Artificial intelligence in banking

A case study of the introduction of a virtual assistant into customer service
Abstract

The usage of artificial intelligence in banking is an important theme within entrepreneurial research. The purpose of the study was to analyse the motivations, challenges and opportunities for Swedish banking institutes to implement artificial intelligence based solutions into their customer service process. The research is based on a case study of the Swedish banking institute Swedbank AB, who introduced an AI based virtual assistant (Nina) to deal with customer requests. For the qualitative study, interviews with Swedish banking customer and experts were conducted. Further, to understand the managerial motivations of Swedbank, a theory of Moore (2008) regarding innovation management was applied. The findings display that Nina improved the service spectrum of Swedbank with the potential of decreasing costs, while maintaining customer satisfaction. Further, the results displayed a high acceptance of new technologies from the customer perspective. This provides the foundation for Swedbank to introduce further artificial intelligence based services. Banking institutes and other service oriented organisations with high customer interaction can use the implications of the thesis when considering to more effectively handle customer requests.
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1. Introduction

The first section of this thesis starts with a brief introduction into the topic of artificial intelligence and banking. Further, the problem definition, the purpose of the thesis and the research questions are stated. The section ends with delimitations of the research and key definitions.

The ongoing era of digitalisation, decentralisation and disruption is shaping industries and consumption on a broad scale (Desai, 2014). Digital technologies are connecting billions of consumers and allow the deployment of low cost connected devices in every business sector. The current generation is adjusted to the digital environment and naturally expects services and products to meet the current digital technology standards. Further, investments into digital technologies and businesses have risen and are rewarded by the public markets (PWC Editorial, 2016). Artificial intelligence (AI) technologies are part of this development and the banking sector is hereby deemed to see a major impact. According to a report by Accenture, a global management consulting and professional services company, four out of five bankers assume that AI is going to revolutionise the way banking is executed. The report suggests that artificial intelligence will affect banking by enhancing the customer experience. Banking products and service may become increasingly personalised giving customers the impression that their banking institutes know their specific habits and needs (Accenture, 2016).

But the introduction of AI technologies comes with potential challenges and risks. Banks are processing highly sensitive data. Thus, privacy and data security concerns are essential elements of the process. Additionally, customers might prefer the contact with persons regarding certain issues, leading to a rejection of AI based interfaces (Kelly, 2017). Hence, the introduction of such technologies into the active process should be executed with consideration of the possible risks.

1.1. Problem definition

The way private customers are interacting with banks is changing. Ashoka and Vinay (2017) are differentiating between millennial generation banking, which is also referred to as digital banking and traditional brick and mortar banking. They described that the banking industry as a whole is making a consistent effort to shift progressively towards
digital channels. This shift is embracing a change from an account based view of a 
banking customer to a perspective, which sees customers as unique individuals with 
different needs. The challenge is to provide digital services that improve the customers 
experience by considering their personalised and specific needs. This is a key factor for 
the creation of banking services and products of the future.
Consumers have already in multiple areas of their lives adapted a digital lifestyle sub-
stituting daily habits with various digital channels. Skinner (2014) states that digital 
social networks have large effects on the digitalisation process of various industries. As 
a result digital solutions are increasingly becoming an extension of traditional social 
interactions. During this conversion consumers are increasingly expecting that financial 
services are continuously digitally available in a customer friendly manner (Cuesta et 
al., 2015). Thus, one field which is supposed to leverage AI technologies are customer 
services. The development of solutions involving artificial intelligence approaches are 
seeing an increase in popularity within research and business (IBM - Watson, 2016). 
According to a report created by Oracle (2016) already eight of the ten investigated 
businesses implemented or are planning to implement artificial intelligence technologies 
into their customer service processes until the year 2020.

The author has identified a knowledge gap regarding the usage of artificial intelligence 
technologies in banking and customer service. The problem is that specific research 
is absent in respect to the motivations and reasons for Swedish banking institutes to 
implement artificial intelligence solutions including the customer perspective. For this 
purpose, the Swedish banking sector with Swedbank as a case is studied.

1.2. Purpose
The purpose of this thesis is to analyse the motivations, challenges and opportunities 
for Swedish banking institutes to implement artificial intelligence based solutions into 
their customer service process.
1.3. Research questions

The intention of the following research questions are to frame the present knowledge gap within the banking sector regarding the usage of artificial intelligence technologies. The first research question addresses specifically the research problem by investigating the case study of Swedbank in detail. The second research question is formulated in a broader scale and intends to address general concerns, challenges and chances regarding the usage of artificial intelligence technologies in banking.

**Research Question 1**

What are the main motivations for banking institutes in Sweden to implement artificial intelligence technology solutions into their customer service?

**Research Question 2**

What are the challenges and opportunities for banking institutes to implement artificial intelligence technology solutions into their customer service?

1.4. Delimitations

The following list includes topics which are out of the scope of this thesis.

**Engineering**

The thesis is not going to provide a description on how named artificial intelligence solutions work in detail. Instead, the thesis will focus on their impacts and functionalities.

**Institutes/Organisations**

Elements from multiple financial sectors are relevant for the thesis but the focus is on banking institutes whose main customer base are private customers.

**Outcome**

The outcome of the study focuses on the Swedish banking sector and the implications are limited to the European market.
1.5. Definitions

The following list of definitions includes key terms used in the thesis, which are described shortly for a better understanding. New terms were added to the list during the period of the creating of this thesis.

**Artificial intelligence**

Artificial intelligence (AI) refers to simulated intelligence in machines. The computer programs of those machines are intended to make decisions in a way comparable to a human being. The goal for AI computer programs is to mimic human behaviour (Barr and Feigenbaum, 1982).

**Artificial neural networks**

The term artificial neural network (ANN) refers to computational modelling tools, which are inspired by the biological neural network of the human brain. ANN’s can be used to address problems with high complexity (Basheer, 2000).

**Brute force search**

Brute force search or *exhaustive search* describes a method in informatics for solving general decision based problems. The main concept is about calculating all possible solution candidates and then select the solution, which best addresses the problem (Robin, 2009).

**Chatbot**

Chatbots are software programs which can interact with human users via written or spoken communication channels using natural language (Shawar and Atwell, 2007).

**Direct contact/Communication**

During the thesis the term *direct contact* or *direct communication* is used multiple times. These terms both refer to communication which addresses a specific human person using channels such as telephone or face-to-face contact.
**Intelligent automation**

Intelligent automation describes software, which is able to make decisions within a specific business unit comparable to a human being. To give an example, an intelligent production robot would not simply redo its manual activities, but it would execute them depending on dynamic information and handle errors and exceptions autonomously (Javed, 2015).

**Keyword spotting**

The term keyword spotting describes a sub field of the speech recognition research field. Its aim is to detect predefined keywords within natural language. This task is important in numerous applications such as voice mail retrieval, voice command detection or when communicating with a chatbot system (Gragier et al, 2009).

**Soft computing**

"Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty, partial truth, and approximation. In effect, the role model for soft computing is the human mind. The guiding principle of soft computing is: Exploit the tolerance for imprecision, uncertainty, partial truth, and approximation to achieve tractability, robustness and low solution cost." (Jin, 2014)
2. Theoretical framework

The following chapter will present the theoretical framework and important topics relevant for the present thesis. The topics are the development of artificial intelligence, an assessment of the popularity of AI, the history of chatbots, an overview on artificial neuronal networks and the two key research fields associated with AI in banking, advanced analysis and customer support. The section ends with an assessment of the prerequisite of Sweden for utilising innovative digital technologies and the introduction of the Core/Context model created by Moore (2008).

2.1. Development of artificial intelligence

Artificial Intelligence also called artificial human intelligence describes an effort to create intelligent machines and computer programs. The unique purpose of AI technologies is to mimic the human brain, mainly within the following categories:

- visual perception,
- speech recognition,
- decision making
- and translation (John, 2007).

AI technologies can be classified into two types:

1. Artificial machine intelligence
   a) Refers to a top down, human engineered approach in which, the computer executes tasks and makes decisions based on predefined rules and requirements.

2. Natural machine intelligence
   a) Implies a bottom-up approach in which the computer uses self-improvement algorithms to increase its performance and abilities for each task handled (Dubinsky and Hawkins, 2016).
Research about artificial intelligence started in the 1950s with scientific articles written by the mathematician Claude E. Shannon about the development and programming of a chess playing machine (Shannon, 1950). His publication lead to a collaboration between Princeton mathematicians Marvin Minsky and John McCarthy. In 1952 they organised a conference together with the subject of automation in order to promote their studies around the topic of artificial intelligence. After the conference Shannon, McCarthy and other scientist approached the Rockefeller Foundation to formally propose a funding, which they were able to receive. They used this fund to form a research team including a well-known industrial researcher from IBM, namely Nathan Rochester (Kline, 2011). Together they created a proposal for a new conference with the main statement:

"Every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it" (McCarthy et al. (1955), Proposal for Rockefeller Foundation. Page 1 of the original proposal)

The conference took place at the Dartmouth College and was the first conference devoted to artificial intelligence. The Conference was very popular and created an atmosphere of discovering and exploring among the research community during the following years. Among the most successful developments at that time were programs based on artificial machine intelligence, which were able to make intelligent decision and programs which were able to understand natural language. Creating machines with these kinds of abilities were not seen as being possible before. From the early 1980s until the 2000s AI saw multiple research boom and winter phases. But the overall interest in AI has constantly risen (McCarthy, 2007).
Figure 1 visualises the patents awarded for technologies regarding AI, displaying a constant rise in patents being placed and approved (National Research Council, 1999). The Dartmouth Conference coined the term artificial intelligence and is often described as the birthplace of AI. The core nature of AI including the named statement has not changed since and is still about designing systems that mimic properties of human intelligence (McCarthy, 2007).

Nowadays AI technologies are again seeing an increase in popularity in research and media. A prominent example is Google’s AI based GO player. GO is a strategy board game which is played since at least 2000 years. The main characteristics of the game is its simple yet deep strategic nature. The most popular version of the game is being played on a 19 x 19 GO board (see figure 2). Each player is assigned either black or white stones. These stones are placed on the board one by one in alternating order. The goal of the game is to cover a larger part of the field then the opponent. GO has been played by a wide range of players from simple farmers to kings and is still the most played game in and around China (Guru, 2008).
What makes GO so interesting for AI research is that in opposite to other board games like chess it is not possible to apply the brute force search method. Chess computers are often superior to humans because they simply calculate all possible moves and combinations and then pick the solution path with the highest winning chance. But using the brute force search for GO is simply impossible. This is because there are more possible combinations of moves in GO then there are atoms in the universe, thus exceeding the capacity of every computer. In order to play the game in a successful way it is important to be creative and pick a good strategy. Remi Coulumn, a computer scientist developed a highly capable GO computer named Crazy Stone. He estimated in 2014 that it would take at least ten more years until a computer would have a reasonable chance against a professional GO player (Wang et al. (2016), Levinovitz (2014)).

In January 2016 Google released a statement in which they described how their own developed system named AlphaGO managed to beat some of the best human GO players (Silver and Hassabis, 2016).

The success of AlphaGO is based on its deep learning technology, which mimics the neurones in a human brain. AlphaGO initially analysed over 30 million moves of top GO players worldwide. Afterwards the system played the game against itself for several weeks utilising server farms. Every game played helped AlphaGO to learn if a certain move leads to a good or worse outcome.

"In comparison to a human player, AlphaGo never forgets a single move"

(Sven Magg, 2017)
This behaviour lead to minimising the total number of possible moves by adjusting the play style depending on earlier failures and successes (Wang et al., 2016). While playing, AlphaGO came up with new moves, which were unjustifiable by top GO players but eventually contributed to a positive outcome. This kind of behaviour started a discussion about machine creativity (McFarland, 2016).

2.2. Current popularity of artificial intelligence

Research and solutions including artificial intelligence are becoming increasingly popular. In the following, two main reasons on why AI is currently popular are described in more detail.

2.2.1. Moores Law

The core statement of Moores Law is that the number of transistors on integrated circuits doubles every 18 months since their invention (Moore, 1998). This is ultimately leading to decreasing computing costs. Moores Law affects the development of artificial intelligence technologies in two ways.

First, as a result of the effect of Moores Law the cost of computing decreased over the past years. This progress benefited the development of artificial machine intelligence because it made it possible to deal with the naturally high computing consumption of AI technologies at an affordable cost level.

Second, a report created by the European Semiconductor Industry Association (2015) called "International Technology Roadmap for Semiconductors (ITRS)" predicts that Moores Law will stop being valid from the year 2021 onwards due to physical limitations. The consequence would be a stagnation in computing power. Scientists and futurists predict that this stagnation of computing power could lead to an increase in research resources towards natural machine intelligence like the deep learning approach used by Googles AlphaGO. Artificial intelligence technologies based on natural machine learning are overall using less computing resources compared to technologies utilising on artificial machine intelligence (Arbesman (2016); Smart (2016)).

2.2.2. Big Data

The foundation for an effective application of AI based technologies is a significant level of data. AI based systems are using input and output data to calculate and determine the underlying function relevant for solving the initial problem.
AI approaches like artificial neural networks provide an alternative to logistic regression methods, which are driven by larger amounts of data (Tu, 1996). Due to the development of data generating technologies such as smartphones, wearables, digital social networks and other information creating elements within the past decade a large amount of data has been accumulated (Lohr, 2012). To fully utilise on this development new methods and technologies are required. A Report by Manyika et al. (2011) concluded that in the United States up to 190,000 data experts with "deep analytical thinking" are going to be needed to cope with the large amounts of data to be analysed. The report also suggests that over a million data science educated managers need to be hired or retrained in order to take full advantage of the opportunities coming with big data analysis. AI assisted machines could take over a key role in analysing large data sets in a meaningful way (Daugherty and Purdy, 2016).

2.3. Development of chatbots

Chatbots refers to a group of computer programs, that are able to interact with humans using natural language such as spoken or written communication. Another term often associated with chatbots is conversational agent (Atwell, 2003). The term "chatbot" was first introduced by Mauldin (1994) within a research paper based on the Turing test in 1994. Alen Turing wrote a paper in 1950, in which he introduce the Turing Test to asses the artificial intelligence capabilities of computers.
"Are there imaginable digital computers which would do well in the imitation game?" (Turing, 1950).

The test describes a game called the *imitation game* which is played with three entities — a human interrogator (player C), a human test person (player B) and an AI assisted computer (player A). Player C has to be in a separate room and is exposed to two digital conversations partners named X and Y (See Figure 3). One of the two conversations is controlled by the human player B and the other is controlled by the AI system player A. Player C is able to ask both conversation partners questions. Based on the responses player C has to identify the real person respectively the computer system. By performing this game Turing (1950) attempted to determine whether a machine is able to win this imitation game. Based on its success rate Turing made assumptions about his initial research questions (Turing, 1950).

"I propose to consider the question can machines think?" (Turing (1950), p. 1)

In the year 1991 a competition was started by Hugh Loebner offering a price of 100.000$ to the person who could create the first program to pass the Touring test. Based on this competition Mauldin (1994) wrote a research paper about the development of a participating Turing system involving the technical performance and the technical design. He thereby used the term *ChatterBot*, which later became chatbot.

Chatbots are human-dialogue systems that are able to receive natural language messages and process them using auditory or textual analysis techniques. Chatbots respond typically with natural language (Shawar and Atwell, 2007). Possible use case scenarios are language education, linguistic research, digital assistance and customer service. The development of a chatbot generally involves that responses are predefined by a human and coded into the system of the chatbot. Consequently, a chatbot is only able to answer predefined questions (Atwell, 2003).

To create chatbots with higher capabilities the Artificial Intelligence Markup Language (AIML) was developed in 2001. It is a XML based programming language to create natural language software agents. AIML enables a system to process human conversations and detect patterns and templates within the dialogues (Atwell, 2003). Since its development a chatbot system named A.L.I.C.E. utilising on the AIML won the Loebner Prize Competion in Artificial Intelligence consecutively three times (Loebner Prize, 2015).
2.4. Artificial neural networks

A complex financial institute like a bank has to have a large variety of skills in order to be successful. Core fields are to make financial products available, make proper predictions regarding financial trends, the simulation of investment behaviour, portfolio management, the prediction of bankruptcies and various other topics (Holsapple et al., 1988).

To cope with the tasks a variety of methods are used. These methods can be divided into three categories:

- **Parametric statistical methods** refer to a sub area of inductive statistics. Its underlying purpose is to evaluate drawn samples and make assumptions over a population. A possible parametric tool is the logistic regression analysis.

- **Nonparametric statistical methods** refers to methods in which the acquired data does not have to fit a normal distribution. The data used usually includes ordinal values like rankings or sorting orders. A possible nonparametric method is a decision tree.

- **Soft-Computing** approaches refer to computer programs, which are tolerant of imprecision and calculate with partial truths and approximation. Soft-computing is key for algorithms based on artificial intelligent algorithms (Jin, 2014).

Artificial neural networks (ANN) are algorithms which are able to learn and mimic some of the functionalities of the human brain. The solution used to develop the previously mentioned AI system AlphaGO is based on an artificial neural network. By using artificial neural networks it is possible to assess complex problems involving decision making processes, information search and analysis. Especially during the past decades, research on neural networks increased heavily amplifying the progress for ANN’s (Lam, 2004). In respect to the future development of artificial intelligence in banking Sven Magg (2017) refereed to neural networks as a key element. The interviewee predicted that progress over the next years is to be expected in data based decision making and customer support. In the following the current and possible usage of ANN’s within the fields of credit evaluation is described.

Credit evaluations is a banking technique first used in the 1950s and deals with the analysis and evaluation of a persons credit worthiness. The problem financial advisors are trying to solve is to classify clients into categories according to their credit risk. The
credit risk describes the risk of a person in debt to fail to make payments. The traditional methods to calculate the credit risks involve algorithms, regression analysis and other mainly parametric statistical methods. Well calculated credit scores are essential for a bank to handle their loans profitably. With the development of new digital technologies, the finance industry is able to evaluate the data increasingly better, leading to more accurate credit scores. Artificial intelligence approaches based on ANN’s are promising in creating credit ratings with higher quality. An analysis tool backed up by an ANN would receive input and output information about clients such as financial information (income, loans, debts, spending behaviour), demographic information (age, gender, marital status) and past decisions made by financial credit advisors. The ANN would then evaluate the information and try to act like an advisor with the objective of providing accurate credit scores. ANN’s are able to make sense out of a large diversity of information. An increase of input and output data would benefit the reliability and accuracy of a system.

The Lloyds banking group provides an example on how to use ANN’s for credit evaluation. The banking group acquired the car financing company Bowmaker whose main business was to provide credits for customers wanting to purchase a new or used car. Lloyds implemented a system for the creation of credit score rankings, which was based on a neural network. The systems main purpose was to improve the decision making process on whether to provide a customer with a credit or not. In comparison to the previous system, the neural network based system improved the success rate by 10% (Treleavan, 1995)

Advanced analysis in banking

The usage of computer assisted systems to analyse financial data is not an invention of the present. The past century has opened up a wide variety of tools to be used in order to analyse and predict financial data (Bhargava et al., 1999). Leigh et al. (2002) conducted a study in which he investigated a technical analysis method for making predictions for stock market price changes by utilising a decision support system. In order to create a forecast, the authors combined various techniques such as machine learning, neural networks, genetic algorithms and soft computing, which represent key artificial intelligence approaches. The results displayed a large potential for new technologies in analysing and recognising patterns in financial stock markets (Leigh et al., 2002). Especially machine learning is described as promising because banks can in most cases use them with their current systems without the need of heavy hardware purchase. The
core job of these systems would be to analyse new information in order to compare it with existing financial data to make better financial decisions. Further, a study about simulated financial trades displayed that non-random price movements and historical data of stock markets can be utilised through machine learning by creating computer algorithms to predict financial developments like price changes (Lebraron et al., 1992). A benefit of AI in finance is that it can redo decision-based labour work at a faster rate and scale and often perform better compared to a human. The possible productivity benefits are immense. An artificial intelligence assistant could review 1,000 legal documents within the course of a few days. On the other hand, a group of human workers would need up to six months for such a task (Sobowale, 2016). To give a use case example, a German real estate company ran a project in which they developed a solution to automatically handle credit proposals. The problem the company was trying to address was that credit proposals were often handed in, in low quality with a decreased readability. This was leading to an increase in time and manpower resources spent trying to correctly identify and classify the documents. In order to solve this problem, the software tool "FaScan" was developed. FaScan combines artificial intelligence technologies with machine learning algorithms to identify and classify financial documents according to their layout and content. The software assistant is able to identify key elements on each page, understand which documents belong together and recognises the specific type of a document (purchase contract, salary statement, loan balance, etc.). When FaScan is done gathering all documents belonging to one case it creates an index. Finally, the sorted and categorised documents are stored into the internal document management system. Overall, FaScan works faster compared to humans and increased the productivity up to 90% with the workload of 30 minutes being done by the software assistant in only 3 minutes. The tool improves its text and graphics recognition abilities with each document read (IT-Magazine, 2016).
Customer support

Personal digital assistants like Siri on Apple’s iPhone or Google Now on Android smartphones are already part of the daily lives of private consumers. A financial digital assistant seems to be the logical continuation of this process. Hereby, artificial intelligence-based services could have a major benefit compared to non-AI tools. This is relevant within the context of future customers who seem to put more value on personalized products. According to Goldsmith (1999) the preference trend of customers is moving towards an increase in individualisation and mass-customisation which is summed up by the author as personalisation. Due to this he proposes that the traditional 4Ps of the marketing mix¹ are going to expand beyond price, product, place and promotion to also include personalisation.

AI-assisted technology can use algorithms in order to make the whole banking experience more simple and aid in discovering new financial products, which suit the customers needs more than its current service catalogue. A modern use case for AI in banking is provided by the virtual cognitive agent Amelia. Amelia is a digital assistant, which is

¹Marketing mix: A planned mix of the controllable elements of a product’s marketing plan commonly termed as 4Ps: product, price, place, and promotion. (Business Dictionary, 2017)
able to provide simple financial advice based on the evaluation of data using AI tools. A global bank made an experiment, in which they integrated Amelia into their mortgage advisory system. The intention was to demonstrate the capabilities of Amelia. Mortgage brokers from all over the world are permanently requesting financial information about banking services and policies. The information needs to be correct in order to ensure a successful approval process (IPsoft - case study, 2016). Furthermore, the answer should be quick because the response time has a significant impact whether the broker is going to sell the financial product of the bank or another product from a competitor. In the beginning of the integration process Amelia received all necessary information about the most common inquires. During a testing period Amelia received questions to challenge its ability to understand the underlying issue of a request:

"My customer is self employed and has land and property income, do you take this into account [when giving advice for a mortgage product]" Amelia:

"Is your mortgage type residential or buy to let?" (IPsoft - case study, 2016)

Within this conversation Amelia understood the intent of the inquiry, which is to provide confirmation if a mortgage application should be approved or not. The only unclear variable in this question for Amelia is the phrase "land and property income". Thus, Amelia’s response includes a question about the rental income of the mortgage. Afterwards, Amelia could provide a reliably answer based on the information given. The final experiment displayed that Amelia was able to understand and answer 120 of 160 question with a high success rate of 89% (IPsoft - case study, 2016).

2.5. Prerequisites within Sweden for utilising innovative digital technologies

Various highly technology oriented innovations which shaped the digital market originate from Sweden. Businesses like the music streaming service Spotify, the voice and video communication tool Skype or the torrent service utorrent were all created in Sweden (Davidson, 2015). According to the world intellectual property organisation, Sweden takes the second place, in a global comparison of the most innovative economies. Hereby it is ranked higher than other countries like the US, the United Kingdom or Germany (World Intellectual Property Organization, 2016).
Further, data collected by entrepreneurial experts of a venture capital firm, displayed that 269 software companies founded since 2003 that had reached at least a value of one billion dollars. Hereby, according to the report Sweden is the largest hub for innovative technologies within Europe (figure 5). Outside of Europe it is only surpassed by the Silicon Valley, which solely placed higher then Sweden. The research compared the ratio of highly profitable technology enterprises with the population of the country (Atomico, 2015).

In the following it is clarified why in respect to the adoption of new technologies Sweden has beneficial conditions supporting the development of innovative digital technologies. The World Economic Forum collected data regarding several technological indicators measuring the digital development of a country. The results were made public and can be accessed freely, displaying a comparison of the countries.
Figure 6 shows that Sweden ranks within the top three countries regarding the number of internet users. This increases the possible customer targets for online banking services, whose services can be accessed more easily by new technology. Further, from the high number of internet users the assumption can be drawn, that the general population within Sweden is open towards the usage of digital tools through the internet.
(a) Sweden ranks first.

(b) Sweden ranks second.

Figure 7: (a) Availability of latest technologies; (b) Firm-level technology absorption.
Excerpt, only the top 25 are shown
(World Economic Forum, 2011)
Regarding the usage of the technology, Sweden tops the availability of latest technologies and ranks second for the absorption of new technologies on firm level (Figure 7). These are indicators for a broad present interest within Sweden regarding new technologies and innovations of businesses. The coupled high ranking in both lists points towards a culture of making new technologies available as fast as possible and implementing them into current business models. This adoption culture within firms may be the reason for Swedish organisations to bring out new successful innovations on a high frequency.

Figure 8: Use of virtual social networks. Sweden ranks second. Excerpt, only the top 25 are shown (World Economic Forum, 2011)

The openness towards digital communication technologies is a major element regarding human-robot interactions. An indicator displaying that Swedes are likely to engage through digital technologies is the usage of digital social media tools like Facebook, Twitter, etc. From figure 8 it can be seen, that Swedes are highly involved in social media, ranking second in the category use of virtual social networks.
2.6. The Core/Context model

Geoffrey Moore analysed the effect of innovations on management decisions and their success on enterprises. Hereby he elaborated various types of innovations such as breakthrough innovations and market changing innovations. His findings were aimed at managers to make better strategy decision (Moore, 2008).

Moore (2008) developed a theoretical model, in which he classified the current state of a business process and its enabling IT applications. He stated that a business constantly needs to innovate in order to stay competitive and relevant on the market. Within his model he differentiates between ‘Core’ and ‘Context’ business activities.

**CORE** "[A core business activity represents] any aspect of a company’s operation that creates differentiation leading to customer preference" (Moore (2008), p. 6)

**CONTEXT** "[A context business activity] represents everything else, all other work performed by the enterprise" (Moore (2008), p. 7)

The main distinctive factor between Core and Context activities are their level of development and their identity adding value.

Core business activities are those which differentiate a company from its competitors. From the viewpoint of a customer, core activities make up the identity of a company and are representative (Moore, 2008).

Context refers simply to all other business activities. An activity is classified as a context activity if it falls within one of the following categories:

- The activity has reached a maturity degree, where it can be standardised and sold to other businesses.

- The activity has become a commodity within the business field.

Thus, Context activities do not add extra value to the products and services, compared to competitors. But Context activities are not less important for an enterprise. According to Moore 90% of a company’s activities can be classified as Context. Yet, he advises to keep focussing on the Core activities (Moore, 2008).
Within the two categories business processes and their enabling IT applications go through four stages:

1. The innovation process starts with an invention, which does not have to be a new technological invention. It can also refer to the utilisation of a technology in an innovative way. The invention is usually kept on a small scale in order to limit the possible risk and provide a trial time.

2. When the invention has successfully managed the trial time and is ready to move up, the second stage begins and it becomes an innovation. The innovation activity is utilised to gain differentiation, which in turn enables customer preferability. The organisation should focus on keeping the innovation for as long as possible by utilising on marketing measures and releases of updated versions of the innovation.
3. When the level of differentiation cannot be maintained anymore, it moves into the third stage. The target in this stage is to manage the business activity in the most profitable way. This can be done by transferring it to sub companies or selling it to other businesses.

4. The fourth and last stage describes that the business activity has become a commodity. Thus, the resources should be redirected into other projects and the business activity should be outsourced to increase productivity (Moore, 2008).
3. Methods

The following section is intended to inform the reader about the research methods used to investigate the research problem.

3.1. Research approach

A differentiating factor regarding the design of a research is the consideration of the relationship between theory and research. The awareness about the theory in the beginning of a research shapes the research approach. This stage defines what research process should be followed. Generally it can be differentiated between inductive and deductive reasoning. The main distinctive factor between the named research approaches is the relevance of hypotheses to the study, making both approaches unique. The deductive process involves the creation of a theory with one or multiple hypotheses and the development of a research strategy to validate the hypotheses. The inductive process on the other side involves the creation of a theory as a result of a data collection process (Saunders et al., 2009).

Deductive research is used to identify causal relationships between variables (Saunders et al., 2009). It is informally also referred to as "top down" approach because it follows a path of conducting the research from a general to a more specific angle. The funnelling of the theory happens in different phases. According to Tochim (2016) the common phases start with the development of a theory. This theory is more precisely framed by the formulation of hypotheses. These hypotheses are investigating through a predefined research strategy. The theory is finally narrowed down further by the collection of data, which address the hypotheses (Tochim, 2016). Within natural science deductive research is the predominant approach used due to the research fields nature of testing physical laws, allowing the prediction and anticipation of phenomena ultimately making them controllable and testable (Collis and Hussey, 2003). Deductive research is executed using a highly structured methodology in order to provide replicable results (Gill and Johnson, 2002).

Inductive research works in comparison to deductive research in a different way. It is informally also referred to as "bottom up" approach because it moves from specific observations to generalisation and theory. The inductive approach involves analysing the present data and looking for patterns throughout the research. The results of the observation can be summarised in the formulation of a theory (Bernard, 2011). Induc-
tive research was developed within social science to cope with the problem of having to state cause-effect links between variables without a clear understanding of how humans interpret their social world (Saunders et al., 2009). The development of that kind of an understanding is the strength of inductive research. In contrast to deductive research inductive research does not involve a highly structured research design and thus is more flexible to alternative explanations (Saunders et al., 2009).

The author has chosen to work with an inductive approach to address the research problem. The reasoning for this choice is going to be explained in the following.

The present thesis focusses on the usage of artificial intelligence in customer service. Existing data and literature for artificial intelligence technologies in use (Kerly et al. (2007), Jia (2009)) and innovative technologies in banking (Sadiq and Shanmugham (2003), Lyons et al. (2007), Devlin (1995)) provide the basis for a possible deductive research. But the combination of the usage of AI and the banking sector provides a knowledge gap, which would not be fully addressed by a deductive research design. Elo and Kyngas (2008) state that deductive approaches are most useful when the aim is to test previous theories within different environments and situations whereas inductive approaches are superior when there is less previous knowledge about a topic. The information gained throughout the data collection are going to be used in order to form an understanding about the main motivations of banking institutes to apply artificial intelligence technologies into their services from both a customer and an expert point of view.

### 3.2. Methods of data collection

**Interviews**

According to Kahn and Cannell (1957) "an interview is a purposeful discussion between two or more people". Interviews may be used in order to gain understanding about a research topic by collecting information. More specifically through the usage of interviews one can gather reliable and valid data that is relevant to specific research questions and objectives. There are three main types of interviews: structured interviews, semi structured interviews and unstructured interviews. Structured interviews involve predefined questions and follow a predefined sequence while asking the questions. Due to this structured interviews are also refereed to as interviewer administrated questionnaires. The main advantage of structured interviews are their
replicable nature as well as an increased comparability of the results (Saunders et al., 2009).

Semi structured interviews involve a set of predefined questions and themes but the sequence and questions might be changed from interview to interview. Further new questions might be added during the process of the interview (Saunders et al., 2009). Unstructured interviews involve no predefined set of questions and promote a more open and free discussion but within a frame of a predetermined research field (Saunders et al., 2009). In-depth interviews are a form of unstructured interviews which offer the opportunity to capture rich, descriptive data about people’s behaviours, attitudes and perceptions, and unfolding complex processes.

**Private banking customers**

For conducting the interviews with the private banking customers, the author has chosen to apply a semi structured approach. Before each interview, the interviewee was asked whether it is allowed to record the interview, for the purpose of creating interview transcripts as a source for the thesis. One interviewee did not want to be recorded thus, in order to capture the answers the author took handwritten notes.

At the beginning of the interview, a set of initial questions was asked in order to understand the kind of relationship the interviewee has with the bank. The following part of the interview was based on the initial answers. An interview guide was used in order to navigate through the conversation. The interviews did not involve preconceived theories or ideas in order to receive unbiased answers from the participators.

The Swedish banking customers were interviewed with the aim to explore their experiences, views, beliefs and motivation about topics relevant for the research. The interviewees were selected randomly with the only criteria of being a Swedish banking customer and belonging to the millennial demographic cohort identified as being born after 1990 and before 2005. The reason for choosing only millennials is that millennials are overall more motivated towards the adoption of new technologies and therefore act as early adopters within the digital financial market (Ashoka and Vinay (2017), Hussain and Wong (2015)). Five interviews were performed (see table 1).
<table>
<thead>
<tr>
<th>Date</th>
<th>Interviewee</th>
<th>Interview type</th>
<th>Duration</th>
<th>Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.03</td>
<td>Karin E.</td>
<td>Skype</td>
<td>20 min</td>
<td>Appendix A: Karin</td>
</tr>
<tr>
<td>02.04</td>
<td>Emma S.</td>
<td>Skype</td>
<td>25 min</td>
<td>Appendix A: Emma</td>
</tr>
<tr>
<td>05.04.</td>
<td>Max C.</td>
<td>Skype</td>
<td>22 min</td>
<td>Appendix A: Max</td>
</tr>
<tr>
<td>07.04.</td>
<td>Rasmus J.</td>
<td>Skype</td>
<td>18 min</td>
<td>Appendix A: Rasmus</td>
</tr>
<tr>
<td>09.04</td>
<td>Felix E.</td>
<td>In Person</td>
<td>20 min</td>
<td>No transcript available</td>
</tr>
</tbody>
</table>

Table 1: Overview of customer interviews

**Expert interview**

An unstructured interview with a post-doctoral teaching associate from the ‘Knowledge Technology Group’ of the University of Hamburg was conducted. The interviewee is specialised in human-robot interaction and artificial neural networks. The interview was conducted using themes to navigate through the conversation. Afterwards, an unstructured conversational interview followed, in order explore different topics raised during the interview. The expert interview defines a method of qualitative empirical research, which is meant to explore the knowledge of an expert within a certain focus area (Meuser, 2009).

The purpose of the interview was to gain expert knowledge about:

- the overall development of artificial intelligence technologies,
- the usage of artificial intelligence within banking,
- the usage of artificial intelligence within customer service and
- the future development of artificial intelligence technologies.

**Secondary data**

The secondary data source used for the thesis is a conference transcript with the marketing channel manager of Swedbank, which can be found in appendix C and usage data of Nina, virtual assistant.
3.3. Data analysis

Content analysis describes different techniques used to systematically analyse qualitative data such as spoken or written communication (Cole, 1988). It can be used to evaluate various types of media such as print media (e.g.: magazines, articles, newspapers), visual media (e.g.: movies, videos or television) or content on the internet. Within research, content analysis is used as a technique to analyse qualitative data in a systematic and objective manner to quantify phenomena (Elo and Kyngas, 2008). It allows researchers to concentrate qualitative data into content related categories with the goal to cluster related statements, phrases or words which share the same meaning (Cavanagh, 1997). The outcome of a content analysis is a summarised and general description of the investigated phenomena. Hereby Elo and Kyngas (2008) differentiate between two types of terms used when describing the outcome – "concept" and "category". The term concept is used in a more specific context when the aim is to built a new theory whereas category describes a broader approach.

For the analysis of the interviews, the author has followed the scheme identified by Elo and Kyngas (2008) for creating a content analysis. Elo and Kyngas (2008) state that conducting a content analysis involves the three phases: preparation, organising and reporting.

Preparation phase

During the preparation phase the author read through the material and derived the core elements from the interviews. These elements or "unit of meanings" can be single words or whole statements and may contain more then one meaning relevant for the topic (Elo and Kyngas, 2008). The choice of the unit of meaning has an impact on the analysis process. Identifying units of meanings with too many meanings may result in making the analysis process too complex (Catanzaro, 1988). However the choice of elements which are defined too narrowly could also negatively impact the analysis process leading to fragmentation (Graneheim and Lundman, 2004). Further Graneheim and Lundman (2004) specified that while conducting a content analysis it is important to state whether latent content such as the notice of non verbal communications, laughter, silence or other types of subtext is to be included into the analysis. The rules regarding the inclusion of latent content for the analysis are specified within the Rules for transcription section below.
**Organisation phase**

During the organisation phase, the author has read through the written material again, and created headings when necessary to describe the content. The identified units of meaning were analysed in greater detail. Afterwards categories were created and abstractions were made (Elo and Kyngas, 2008). According to Dey (1993) the purpose of categorisation should not be to simply group similar elements together. Instead each element should after its assessment belong logically to a category. Each category summarises units of meanings belonging to the same

**Reporting phase**

The results of the analysis are summarised within a report. The report includes a compact overview of the results, the descriptions of the categories in a sufficient level of detail and the core units of meanings classified for each category. The meaning and the relevance of each predefined headline is elaborated. A connection of the data to the results is made to increase the reliability of the analysis (Polit and Beck, 2004).

**Rules for transcription**

In the following the rules used for transcribing the interviews are summarised. The rules contain the choices the author has made regarding the inclusion of latent and manifest content as identified by Elo and Kyngas (2008).

- The only latent content included in the transcription is laughter, which is written as (laughs).
- Further latent content such as silence, pauses, sighs or posture is not included in the transcription.
- Half and broken sentences are left out, if they do not add any value to the conversation.
- Inaudible short pieces below 2 seconds, where it is not clearly understandable what a person said, is written as [inaudible].
- Incorrect grammatical errors such as wrong word choices or faulty sequences of words are not corrected.
- Filler sounds such as "mhh" and "ehmm" are not included in the transcript.
4. Results

The following section is intended to inform the reader about the results from the research investigation. The case of Swedbank and their introduction of the AI system Nina is described. Hereby key information about Swedbank are summarised, the problem of Swedbank is stated and Nina is introduced. Further the customer interviews and the expert interview are summarised.

4.1. Case description

4.1.1. Swedbank

Swedbank is the Swedish banking institute that implemented the AI based customer service assistant Nina. It is one of the largest banking institutes with a Nordic-Baltic origin. Its main target market is Sweden but it also takes leading positions in other countries such as Lithuania, Finland and Latvia. Further, Swedbank is also present within the Chinese and US market. Swedbank was founded in 1820 in Gothenburg and served as a traditional and classic savings bank only.

Key Figures

- Private customers: 4m in Sweden (10m world wide)
- Corporate customers: 263,000
- Branches: 300
- Employees: 6,700

Key Services

- Loans and mortgages
- Savings and investing
- Payment services and private banking
- Insurance (Swedbank, 2016).
Until today, the banking institute has widened its scope offering retail banking, financial advisory and financial asset management, which can be accessed through their branches, by phone or through the internet. Even though Swedbank has grown massively over time, its customer base still mainly consists of private customers. The main objective of Swedbank, as described by themselves as to be close to the customer by valuing long-term customer relationships. For example, one of the products the bank offers is a *Barn och ungdomar* accounts (children and teenager accounts) with extended functionalities, like special saving features, free credit cards which can be individually designed and discounts for theatres, cinemas and other activities (Swedbank, 2016).

Further, Swedbank gradually implemented new technologies into its banking services. Swedbank states, that its motivation is to actively make the banking process easier on an end-to-end basis for their clients. For this purpose Swedbank has already implemented successfully various technologies into their service prospect. The following is a non exhaustive list with examples.

- **Internet banking:** Overall account handling through an online interface (checking balance, money transfer orders,...)
  - 80% of Swedbank customers login at least once a month.
  - Login possibility through Smart-ID smartphone app: A tool, which can be used for authentication and for approval of payments and agreements.

- **Mobile banking:** Mobile banking refers to a smartphone and tablet application, created by Swedbank, which covers all necessary banking functionalities, as well as provide their customers with extra services like *shake for balance*, which displays the real-time account balance of a customer’s bank account, when the smartphone is shook.
  - 39% of Swedbank customers use mobile banking only, with an average of 21 logins per month excluding balance checking.

- **E-invoice:** e-invoices are like regular bills but they do exist digitally. They are accepted as original documents in accounting and can be handled and moved within business software.

- **Swish:** Swish is a mobile payment service that was established in Sweden in 2012. The main usage is to send money between private persons or make payments. For the transaction the mobile phone number, which is linked to the banking account, is used (Swedbank, 2016).
Customer contact happens mainly through three channels – online channels, branches and via telephone. Figure 10 visualises the increase of interactions happening between Swedbank and its customers from the year 2011 to 2015. Telephone banking and branch offices remain stable in their interaction numbers and have not grown significantly. On the other hand the online channel has grown from 350 million digital visits to over 1,000 million (Kedbäck, 2016).

Figure 10: Swedbank: Visits per day and channel (Kedbäck, 2016)

4.1.2. The problem at Swedbank

In the year 2016 overall 4.5 million physical customer interactions (phone or branch contact) happened at Swedbank. Two million of these interaction were transactional, meaning that customers could have executed the request by themselves but chose to engage with Swedbank (Kedbäck, 2016). This indicates that the customers are either not aware of the information being present or that it is more comfortable for the customer to contact the bank.

The problem identified by Swedbank is that customer service staff is spending too much time looking up information. This is done by asking each other or searching the intranet and internet trying to find the information the customer could not find. These interactions are not adding value to Swedbank and are a misuse of available resources. Representatives from Swedbank stated that the company is concerned about new fintech competitors like Trustly or Tink. These pose a threat to Swedbank by providing additional financial services for customers (Hernaes, 2015).

In order to solve this problem, Swedbank approached multiple vendors with their prob-
lem statement. The first intention of Swedbank was to create a Wiki for their own services, in order to help their customers and customer service staff to more comfortably look up information. Various companies including IBM and other high profile organisation, responded stating that they were able to solve their problem (Nuance, 2016). Swedbank chose to go with the software technology cooperation Nuance Communication. Together with Nuance, Swedbank decided that the main objective should be to minimise the number of non value adding customer interaction in order to be able to focus on the value adding interactions (Kedbäck, 2016)

4.1.3. Nina the virtual assistant

Nina is a chatbot which serves as a virtual assistant and is based on artificial machine intelligence. The Nina project started in the year 2015. Nina is accessible through the home page of Swedbank. The main differentiation between Nina and a simple QandA search engine is that in response to a question of a customer Nina prompts the user to ask more questions. The goal behind this approach is to let Nina understand the purpose of a user’s inquiry to a degree in which it can provide an adequate advice. Nina provides an automated conversation around the problem using the answers to make sure that the root cause of the problem has been identified correctly and the solution fits the customer. The appeal of the chat function purposely resembles popular search engines like Google (figure 11). The intent hereby is to present Nina as open and inviting as possible. A typical inquiry from a customer could be: “What are the steps for opening a savings account?”. Afterwards Nina would response either with an answer, or with a counter question to prompt the customer to ask more questions.
Figure 11: Screenshot: Exemplary conversation with Nina web (Swedbank, 2016). Google translate was used to translate the website from Swedish to English.

Nina is created with two layers, an external and an internal layer. The external layer is visible for customers, visiting the Swedbank website. The internal layer is only accessible for Swedbank service staff. The purpose for having two layers is that if the customer is not happy with the answer provided by Nina, they can opt to escalate the inquire to a Swedbank support centre. Afterwards the service staff can choose to access the internal layer, which contains more specific information which might be more useful for the customer (Kedbäck, 2016).
<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. of Conversations</td>
<td>30,000/ month</td>
</tr>
<tr>
<td>First Contact</td>
<td>80%</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
</tr>
<tr>
<td>Deflected</td>
<td>62%</td>
</tr>
<tr>
<td>Channelled</td>
<td>18%</td>
</tr>
<tr>
<td>Attempted</td>
<td>20%</td>
</tr>
<tr>
<td>Abandoned</td>
<td>18%</td>
</tr>
<tr>
<td>Escalated</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 2: Usage data for Nina web (Kedbäck, 2016)

Table 2 displays the usage data of the first months after the introduction of Nina. The results display an immense first contact resolution rate of 80%. 62% of these are deflected, meaning that customers did not have to get in contact with Swedbank at all in order to solve their problem using Nina web. The other 18% are channelled, meaning that Swedbank chose to redirect the users to another channel, e.g. their call centre, a branch or to the internet banking platform. 20% of all interaction are categorised as attempted or unsolved inquires. 18% of those are abandoned, meaning that the user did stop to interact with Swedbank for an unknown reason (Kedbäck, 2016).

The main success of Nina can be attributed to four factors.

1. Nina is customer driven meaning that it only includes information about topics which the customers ask about. For instance, an insurance company, which works together with Swedbank, complained on why its products where not mentioned in Nina’s conversations. The issue hereby was, that the customers did not ask question about the insurance products.

2. Nina is easily accessible through the web browser of Swedbank and according to the results, especially the first contact resolution, performs well and solves the customer’s problems quickly.

3. The facts that Nina is a joint project between Swedbank and Nuance and a cloud based solution, leads to a less complicated and faster implementation process. According to Kedbäck (2016) these factors were key aspects in gaining top level management support.
4. A dedicated staff responsible for the stakeholder management and content management assure that Nina is supported with the right information pipelines. The content management teams main tasks are to monitor conversations, checking if the information used by Nina is up to date and the management of the various stakeholders in order to assure that product owners, legal parties and overall communication about Nina are handled in an appropriate manner (Kedbäck, 2016).

The introduction of Nina web on the website of Swedbank was the first step. The next step for Swedbank is to integrate Nina into the 58 banks which belong to Swedbank but have their own representation and service catalogue. Hereby Nina is supposed to cover the same tasks, but adjusted for each bank (Kedbäck, 2016). The next target is to expand Nina to the mobile channel in the form of a dedicated virtual assistant. This would be a major step since about 40% of the customers use Swedbank’s digital services only through the mobile channel. The ultimate goal hereby is to create an intelligent virtual assistant, which can assist the customer throughout their whole customer experience. A possible banking service named by Kedbäck (2016) which could be addressed via Nina are consumer loans. A user could indicate the intent to make a purchase such as a new computer, through the virtual assistant. Nina would initiate the loan process and guide the user through the necessary steps. The user could have the possibility to continue the loan process when at home.
4.2. Customer interviews summary (Appendix A)

Short profiles of the interviewees

Karin (23): Bachelor student from Jönköping.

Emma (24): Apprentice from Malmö.

Max (27): Final year master student who was on an exchange semester in the Netherlands. Originally from Stockholm.

Rasmus (22): Bachelor student at Lund University.

Felix (24): Inhabit from the area around Vaxjö.

To gain understanding about the experiences, views, beliefs and motivations of Swedes regarding banking and virtual assistance multiple interviews were conducted with private Swedish banking customers. The interviews were conducted through Skype in English. All interviewees were informed that their full names would not be stated within the thesis. The complete transcripts of the interview can be found in Appendix A.

The interviewed Swedish banking customers have banking accounts at Swedbank AB, Svenska Handelsbanken AB, SEB AB and Länsförsäkringar AB. They represent three out of the big four banking institutes in Sweden, with only Nordea Bank AB missing. The interviewees can be divided into two groups, one group being members of Swedbank and the other being members of other banks. This is important due to the studies focus on Swedbank and its virtual assistant Nina. The interviewees all use the digital banking services of their respective banks and would appreciate further digital services. The interviewees also indicated possible changing user habits with changing life circumstances.
4.3. Expert interview summary (Appendix B)

To gain expert knowledge for writing the present master thesis, the author interviewed Sven Magg, who is a postdoctoral teaching Associate of the Knowledge Technology Group at the University of Hamburg. His main research field involves human robot interaction including artificial intelligence based communication. The interview took place within the office of Sven Magg at the department of informatics of the university of Hamburg. The interview was conducted in German language. All quotes in English referencing Sven Magg are translated by the author with an effort to provide the most fitting translation without losing the content of the quotation. The following write up covers the interview subject wise and not chronologically. The complete interview can be found in Appendix B.

The initial subject of the interview was the overall development of artificial intelligence technologies, but the interviewee stated that the field of research is too large to be addressed as a whole within the frame of the interview. That is why, we more specifically discussed the current state of technologies within the human robot interaction field.

The interviewee stated that on one side AI technologies are well-advanced regarding the recognition of natural input such as visual, textual and audio communication and succeed in distinguishing grammatical elements within sentences. Understanding on the other side is mainly obtained through keyword spotting. Hereby requests from human users are best understood if the sentences are short and grammatically correct. If conversations and dialogues are longer and become more complex the system is not able to identify the underlying meaning of the message.

"If the words ‘didn’t got money’ and ‘broken’ appears within a sentence then [the chatbot] assumes that an ATM is broken, but in the end this is just guessing" (Sven Magg, 2017)

The interviewee addressed the issues of what understanding is, what the criteria for understanding are and whether a machine is capable to understand at all. As an example the interviewee stated that at the current level of development it is not possible for a computer to identify sarcasm.

"What is understanding? Does the human brain also follow a keyword spotting principle?" (Sven Magg, 2017)

The interviewee made a statement regarding the future development of the research field of human-robot interaction. He stated that progress over the next years is most likely to be expected in understanding of textual, audio and especially visual content.
The interviewee addressed the opportunities and challenges for artificial intelligence technologies in customer service. As a challenge he elaborated how the perception of an interaction between a human and a computer system is influenced by its appearance. Hereby he differentiated between positive and negative user experience. Users tend to have high expectations when confronted with a communication system with a human-like appearance. If the system fails to meet these expectations the user gets disappointed, thus leading to a negative user experience.

On the other hand, users tend to have lower expectations when confronted with a system, that does not have a human-like appearance. Then the user is less likely to be disappointed. If the system is able to partially achieve the goal, the outcome of the conversation would be a positive user experience. Thus, Sven Magg (2017) argues that one should not attempt to make the appearance of digital chat too human alike, due to the false expectations being set towards the system. As an opportunity the interviewee mentions the availability of chatbots. The availability of customer service centres is affected by office hours and waiting queues. Chatbots are potentially always available for customers to contact.

The interviewee addressed the usage of neural networks in banking. He stated that neural networks could be used within all circumstances, where the main purpose is to recognise patterns. He explained that the main area of usage for a neural network is the analysis of input and output data to search for an underlying function.

"What an AI system does is analysing input and output data and searching for a function in between. If no function exists a machine can’t do anything."

(Sven Magg, 2017)

An example was given on how financial data could be used by neural networks for a credit evaluation system. Data about loans given to customers within the past 30 years could serve as input data. The information whether the loans were payed back appropriately would serve as output data. An underlying neural network would be able to use these input and output data in order to search for a function linking both. The system would then be able to make predictions about new credit applicants based on their financial profiles. The interviewee noted that if the input data does not reflect real conditions, the system is not able to find the underlying function.

Further, the topic of the financial crisis of the year 2008 was addressed. The interviewee stated that computers are able to make decisions solely based on objective reasoning without being influenced by emotions or other motivations. If provided with the nec-
ecessary data, AI based computer systems would have been able to surpass their human counterpart when giving out loans.

“You have to interact with an artificial neural network in order to see what information it has stored. You do not have the option of directly access it and intercept the information. That is why artificial neural networks have a certain level of protection, because they are running within a black box you can’t access” (Sven Magg, 2017).

Regarding data security the interviewee stated that neural networks provide a basic level of protection against abuse of sensitive data. Neural networks are built within black boxes where it is not possible to assess what the system has learned. This makes it difficult for a user to obtain or intercept specific sensitive data. In respect to the future development of neural networks, the interviewee predicted that progress over the next years is to be expected in data based decision making and customer support.
5. Analysis

The following section is intended to inform the reader about the analysis part of the thesis. It begins with the report and the analysis drawn from the results of customer interviews. Afterwards the application of the Core/Context Model on Swedbank is described.

5.1. Customer interviews: Report

In the following the results of the analysis conducted according to the scheme of Elo and Kyngas (2008) are displayed. The first headline describes the identified category. Within each category the identified headlines are listed, with referencing numbers. Below each headline a short description regarding the content is given highlighted in italic. Identified units of meanings are summarized in abstraction keywords for each interviewee. The first category serves as an example.

Example category

[headline reference number]: [headline name]
Description of the identified headline

Interviewee initial: [Abstraction of unit of meaning] ("[unit of meaning]")

Basic banking related information

H1: Bank name
Contains data specifying the name of the current bank of the interviewee.

Karin: Länsförsäkringar ("Länsförsäkringar, should I type it to you maybe?")
Emma: Swedbank ("I'm at Swedbank here in Jönköping")
Max: Handelsbanken, SEB ("Handelsbanken and actually it is two banks and SEB")
Rasmus: Swedbank ("I have my bank account at Swedbank")
Felix: Swedbank
H2: Becoming a customer
Contains data indicating reasons why the interviewee has initially become a customer of its bank.

K: Parents ('I chose to become a member of the bank because my parents were members there (...')
E: Parents ('When I was younger my father opened a Swedbank account with me for me (...')
M: Parents ('Through my parents the one had Handelsbanken the other had SEB (...')
R: Grandparents ('when I was younger my grandmother opened a saving account for me (...')
F: Parents (Interviewee stated that his parents encouraged him to open a bank account)

H3: Reason for staying
Contains reasons stated by the interviewees for staying a customer at the current bank.

K: Convenience ('(...)everything has been fine [so far] and there were no complications (...')
E: Bond, Convenience ('I have some sort of funds saving account', 'I never had problems with my bank (...')
M: Convenience, positive image, bond ('I haven’t checked any [other bank], I haven’t compared anything else its basically just the convenience factor', 'SEB and Handelsbanken feel more professional somehow', 'I also have a fund, well wait you know some stocks like investments.‘)
R: Positive image, convenience ('I like their ads. I mean you hear so much negative stuff happening about banks all over the world. And Swedbank seems to be a bit more more trustable and I didn’t have any big problems yet')
F: Bond, convenience, positive image (First, the interviewee stated to a large savings account, which he does not want to shift to another bank. Next he stated that he never had problems with his banking account. Further, he stated to have multiple automatic orders, which he does not want to shift)
H4: Difference between banks

Contains data describing the general awareness regarding banking institutes in Sweden. The purpose was to assess whether the interviewee perceives any difference between banking institutes in Sweden. The answers are summarised in: Yes: The interviewee described a difference; No: The interviewee did not mention a difference or clearly stated not to perceive a difference.

K: No ("(...) they all handle money so they are the same for me")
E: No ("To me the banks are all kind of the same", "Maybe later when you take big loans there are differences? Else I dont really know.")
M: Yes ("I feel like SEB and Handelsbanken feel more professional", "Between my two banks not much just that I find SEB easier to use online")
R: No ( "I guess they are all kind of the same")
F: No (Interviewee stated to have a preference towards Swedbank but mentioned not to see a qualitative difference between the banks in Sweden)

H5: Way of usage

Contains data regarding the preferred way for accessing and using the banking services. Hereby online banking refers to banking activities conducted through a laptop or desktop computer and mobile banking refers to banking conducted using a mobile device such as a smartphone or tablet.

K: Online banking, mobile banking ("[I use] online banking", 'banking through my phone')
E: Online banking ("I only use online banking")
M: Online banking, mobile banking ("Just basic internet banking", 'I have [used mobile banking], it depends but yes")
R: Mainly mobile banking, online banking ("I'll pretty much do everything using my phone', 'sometimes [I use online banking]")
F: Mainly mobile banking, online banking
H6: Usage behaviour

Contains data describing how often the interviewee uses its banking services. The answers are classified in: Regular usage: The interviewee states to use its banking service at least once a week. Irregular usage: The interviewee states to use its banking service on demand.

K: Irregular usage ("I use it when I need it")
E: Regular usage ("I make transactions sometimes", "nearly every day I login")
M: Regular usage ("I log in like every week (...)")
R: Regular usage ("Quite often" "I'll login like every couple of days")
F: Unknown usage (Interviewee stated to log in 'often')

H7: Used products

Contains data about the banking products and services used by the interviewees.

K: Checking the balance, transfer money, monitor spendings ("for checking my money I have on my account", "when I need to transfer money to a friend or pay something", "[When I] want to see how much money I spent in the last weeks")
E: Transaction, checking the balance, monitoring savings, monitoring spendings ("I check my balance, I make transactions sometimes", "I have some sort of funds saving account")
M: Transaction, Funds ("I need to send money around", "I also have a fund well wait you know some stocks like investments.")
R: Transaction, standing order, checking the balance, gathering tax evidence ("I do payments here and there", "checking my balance, maybe look over my monthly transactions and if that time of the year comes, getting some I'm looking for spending notes for my taxes")
F: Monitoring account, transaction (Interviewee that he mainly logs in to monitor his accounts and place transactions)
H8: Offline usage

Contains data regarding the offline usage of the interviewees. With the term offline usage the author is referring to banking conducted through a branch office of a bank or telephone banking. The answers are classified in Yes: The interviewee stated to go to a branch on a regular basis; No: The interviewee stated not to go to a branch; Occasionally: The interviewee goes to a branch only when having problems with its banking account.

K: occasionally ('Yes, I have done that but only to fix issues.')
E: occasionally ('Yes, I do (...) When I have problems with my banking I go to the bank.')->
M: Yes ('To sending money abroad or handling other things which I cant do online')
R: No ('No, not at all')
F: No (Interviewee stated not to make use of branches of his bank)

H9: Preferred problem solving channel (ranking)

Contains data about the preferred channels the interviewee uses when having a problem with its banking account. The values are ranked according to the information drawn from the interviews.

K: 1. Parents/friends, 2. Self search, 3. E-mail, 4. phone call ('I would ask my mom first', '[I] would search the internet and the homepage of my bank, afterwards if my problem is not yet solved I would probably email them and then maybe call them.')
E: 1. Self search 2. Family/ friends 3. E-mail ('I google it (laughs). When I have problems I search the internet', 'If not I ask my friends or my father 'When I still have the problem I would write a Email')
M: 1. Phone/ selfsearch 2. Branch ('they have like a quick google kind of thing and I look up the things I want to know there as well. It is like a wikipedia-ish thing', 'Basically I just call the customer service. Sometimes I also go to the branch itself.')->
R: 1. Self search 2. Phone ('I'll hit up their site. They got something like an android chat.', 'Only a few things I couldn’t find but i fixed those issues on a phone call.')->
F: 1. Self Search, 2. Phone (Interviewee stated to use use the website of his bank to handle problems. Further he stated to call the call centre for problems he was not able to solve.)
H10: Preferred advisory channel
Contains data regarding the preferred channel to contact the bank for advisory related information.

K: -
E: Phone ("I have a savings account and for that I called with someone from my bank.")
M: Phone ("If I want advice regarding my funds I would just call by.")
R: Self-search ('With most of my questions the website [Nina] was good enough')
F: Phone (Interviewee stated to contact the call centre for advisory services)

H11: Reason to switch
Contains data about the causes which could make the interviewees switch to another bank.

K: Major problems with account ("Maybe if I have troubles with my bank and I search for other banks on the internet, which are easier to handle my issues")
E: High account fees ("If the charges for my bank account get higher")
M: Expensive banking products ("when topics like mortgage start to become important")
R: High account fees, Valuable bonus at other banks ("If the banking handling costs would be too high", 'if other banks would have a really cool offer (...) like when I open an account at their bank that I would get a bonus")
F: High account handling fees (Interviewee stated that he would consider switching to another bank when the account handling fees would be significantly lower at other banks)

H12: Missing feature
Contains data regarding desired banking features mentioned by the interviewees.

K: No ("No, not that I have anything in mind")
E: No ("No not really")
M: No ("No, not at my current using")
R: New online banking layout ('It would be cool if they would update [the online banking layout]")
F: No (Interviewee could not name a desired banking service)
H13: Missing feature regarding customer service
Contains data for desired features regarding the customer service of the specific bank.

K: Nothing ("I’m not using the customer service that often so not really")
E: -
M: Auto identification ("Its just a hassle via phone that you have to identify your self every time")
R: Auto identification (' its just a bit annoying that when I call by and have to authenticate myself every time')
F: Response time (Interviewee stated that he doesn’t like to wait for a response too long)

Virtual Assistant related information

H14: Knowledge regarding chatbots
Contains data whether the interviewee knows about the concept of chatbots.

[The interviewer briefed the interviewees regarding their knowledge about chatbots.]

K: -
E: No ("no I don’t.")
M: No ("A chatbot? no im not sure.")
R: Yes ("You mean that android thing?")
F: Yes (Interviewee stated to have previous knowledge regarding chatbots)

H15: Interest in virtual assistants
Contains data about the interest regarding virtual assistants. Yes: Indicates that the interviewee has a positive attitude towards virtual assistants; No: Indicates that the interviewee would not be willing to use a virtual assistant.

K: Yes ("sure as long as it is convenient for me. The bot idea sounds good because emails are good but it takes too much time and I have used real chats before as well but they are not always there like in the night times")
E: Yes ("Yes if that bot it can help me")
M: No ('I think if i would that it was like a chatbot like I probably wouldn’t use it, no')
R: Yes ("Yea that would be neat.")
F: Yes (Interviewee stated to be interested in the concept of virtual assistant, and would want to have one on its phone)

**H15.2: Desire for a virtual assistant**
*Contains data whether a virtual assistant could be the reason for a client to change banks.*

K: No ("I would say no, because I do not use customer service that much.")
E: Yes ("I don’t have so many problems so probably not maybe if i would have a lot of problems then it could be very handy to have Nina.")
M: –
R: No ("It is pretty sweat I guess, since I am not using it that often im not sure if I would switch my bank just to have this bot to ask question to. I think if it could do more cooler things then maybe.")
F: Yes (Interviewee stated that he might consider switching to another bank depending on the functionalities of the virtual assistant)

**H16: Desire to escalate**
*Contains data about the desire of the interviewee to be able to escalate a problem to a higher instance when problems occur. This higher instance could be a customer service staff, taking over the conversation.*

K: Yes ("I still want to be able to contact real persons always")
E: Yes ("I think it would be good to call someone when there is a problem.")
M: -
R:Yes ("I think that would be good.")
F: Yes (Interviewee stated that he would prefer the option to escalate the problem to a real person if needed)
H17: Trust in virtual assistant [trust limit]

Contains data concerning trust in a virtual assistant. A standard question was asked all interviewees regarding their willingness to take a loan through a virtual assistant. The value in the square brackets indicate the limit for a loan the interviewee would be willing to take through a virtual assistant.

K: Yes [10.000 SEK] (*think I would chose to go to a real person instead of only using the internet or the mobile assistant*, "I would say 10.000 SEK")
E: No (*No I would not take a high loan without talking to a person*)
M: No (*Probably no, no. I would do the traditional thing i think and go to the bank itself*)
R: Yes [20.000 SEK] (*50.000 SEK seems a bit much to take only through an app*, '20.000 maybe')
F: Yes [50.000 SEK] (Interviewee stated that he would be willing to take a loan up to 50.000 SEK through a digital assistant)

H18: Missing elements in virtual assistants

Contains data regarding missing features stated by the interviewees when using a virtual assistant.

K: -
E: Human interaction (*I would think that I don’t chose the best option for the loan I like to ask my advisor what the best option is for the loan*)
M: Human interaction (*I would prefer to speak with a human person*)
R: Human interaction (*If it is a high amount i think I’d like to talk to something with a heartbeat*)
F: -
H19: Awareness of Nina
Contains data whether the interviewees knew about Nina. Three interviewee knew about Nina but were not aware of the name “Nina”.

E: Yes ('Is it that the thing with the green background?’)
R: Yes ('I mean like an automatic chat thing. Its just on their site, one of these things, which just pop up and want to help out somehow.’)
F: Yes (Interviewee stated to use Nina on a regular basis)

H20: Reason for using Nina
Contains data describing why the interviewees chose to interact with Nina.

E: ('I wanted to know how much it costs to send money abroad’)
R: ('I went abroad for longer time to travel some. And there for I had some questions about my banking how I can get money abroad and about fees and stuff' 'And I had a couple of times some questions regarding my bank statements, and yea I got the right answers’)
F: Interviewee stated to use Nina regularly to receive information regarding banking services and products. The last time used was regarding the opening of a savings account for an under aged relative.

H21: Contact resolution
Contains data about the success factor of the interactions mentioned by the interviewees.
E: Most ('[The link provided by Nina] brought me to a website where there was information about how much it costs to send money to other countries', 'yea with most questions it could surprisingly, but not everything.’)
R: Most ('with most of my questions the website was good enough. Only a few things I couldn’t find but i fixed those issues on a phone call.’)
F: Most (Interviewee stated that he could solve most of his problems through Nina. The last problem where Nina could not help was with a specific question regarding his saving account)

H22: Usage experience
Contains data about the usage experience from the interviewees.
E: Positive experience ('I liked it [Nina], it was quick and the right sites.’)
5.2. Customer interviews: Analysis

Within the following the results of the analysis are linked to the case study of Swedbank.

5.2.1. Basic banking related information

The choice for Swedes to pick their first banking institute is mainly influenced by their parents or grandparents (h2). This is expected due to the fact that opening a bank account before the legal age involves the accompany of a legal guardian. Swedes stay at their banks mainly for two reasons (h3). First, the convenience factor. If Swedes don’t encounter major issues with their banking, they do not see a reason to switch to another bank. Further, most clients are engaged into a bond with their banks (savings account, funds), which are usually not easily dissolved. The second reasons is the image of their bank. Banking customers with a positive image of a bank, are likely to stay a customer. Despite having a positive image of their bank Swedes do not see a difference between banking institutes and their services (h4). Customers are taking these services for granted, which is reflected by the data. Only one interviewee distinguishes between the banks in Sweden. Additionally, the interviewees displayed a lack of interest regarding new features for banking services (h12). Within this context, Kedbäck (2016) stated that it becomes more difficult for banks to differentiate themselves from other banks because banking services are increasingly becoming an interchangeable common good.

"we believe that Bank products will become a commodity (...) people expect that the banking business is just normal for them" (Kedbäck, 2016).

Regarding the usage behaviour it can be seen that the online channels and hereby the mobile channel are the favourable choices to conduct banking (h5). Four out of five customers are using banking services on a regular base (h6). All but one customer are using their phones to conduct banking. Further, the offline channels (branch or phone) are only used by one interviewee (h3). The others are either not using offline channels at all or only when encountered with a problem, which is not solvable otherwise.
These results correspond with the usage data of the online/offline channels identified by Swedbank (figure 6). Especially the mobile usage is of significant importance because according to Kedbäck (2016), 39% of Swedbank customers are only on mobile devices. The preferred way for solving issues or searching for information is through conducting self search and phone calling the customer service (h9). When considering customer interactions the main issue for Swedbank to handle customer inquiries through a customer service center, is that these interactions are usually not generating any profit. This is because in most cases the needed information to solve the problem is often already present on the website of the bank.

"It’s not going to be cost-efficient for us to provide advice in physical meetings anymore" (Kedbäck, 2016).

It is more cost efficient for Swedbank to have customers solve their problems and execute banking activities on their own.

5.2.2. Virtual assistant related information

The results of the customer interviews have displayed that four out of five interviewees have a positive attitude towards virtual assistants (h15). To measure the trust in a virtual assistant the interviewees were asked whether they would be willing to take a moderate size loan through a virtual assistant (h17). The willingness to take a loan from a bank involves a mid to long term commitment and thus is a sensitive issue. Three out of five interviewees stated to be willing to take a loan up to a maximum between 10,000 SEK to 50,000 SEK. For loans with a higher value, the interviewees indicated the wish to talk to a real person (h17, h18). As a reason the interviewees stated security beliefs and a lack of trust. The range for loans would fit the planned concept of Swedbank to handle consumer loans though a virtual assistant. Loans with a higher value could be handled by the advisory staff of Swedbank. Further, three out of five the interviewees had previous experiences with Nina. The Swedish banking customers have used Nina in various ways to either assess information regarding specific banking services and products or to solve specific problems related to their banking account (h19). All banking customer expresses an overall positive experience, stating that through Nina they were able to solve most of their problems (h21, h22).

"The perception of a chatbot system will be positive as long as it gets the user closer to a solution" (Sven Magg, 2017)
Sven Magg (2017) stated that users exceptions towards chatbot systems are overall low. Thus, a positive user experience is achieved when a virtual assistant is able to assist a user to reach the desired solution.

5.3. Application of the Core/Context model on Swedbank

The development of the way customers interact with their banks is influenced heavily by the digitalisation processes (Sadiq and Shanmugham, 2003). The results of a study, which investigated the adoption of self service technologies, such as online shopping, self check-in machines and internet banking displayed that self service activities are becoming increasingly popular within Sweden (Bashir and Albarbarawi, 2011).

Martin Kedbäck, responsible for employee and customer facing tools at Swedbank predicts that most of the banking activities, which happen at banks in Sweden in general are highly likely to be performed without the engagement of customer service in the near future (Kedbäck, 2016). His statement is reflected within the outcomes of the conducted customer interviews regarding:

- The preferred way of using banking services (e.g. checking the balance, execute financial transaction or account monitoring) being online and mobile banking (h5),
- The unfavourable choice of using offline channels such as a physical branch (h5, h8) and
- The most preferred problem solving channel being self-service (h9).

As a result customer service activities are increasingly performed using self-service tools. Consequently, according to the Core/Context model, customer service activities can be classified as being a commodity and thus serve as a context activity. These activities are neither cost effective for Swedbank neither do these activities add to the unique identity of Swedbank.

"(...) everything that we can digitalise in banking will be digitalised" (Kedbäck, 2016)

"in the next couple of years probably all banks will let their customers do self service" Kedbäck (2016)
The fourth stage of the Core context model suggest, that context activities, which have become a commodity should be outsources in order to decrease costs. The resources previously spent into a context activity should be redirected into other, more productive activities.

“We will have to introduce a robo advisor when it comes to investments in savings or other other investments (Kedbäck, 2016)

Kedbäck (2016) has stated that it is not cost efficient to conduct customer service through direct contact. Nina can be seen as an entity, which takes over the customer service or respectively customer service is outsourced to Nina. Currently Nina is only providing assistance regarding available information within Swedbank. In the future it is planned to expand Nina to also cover other banking activities, which previously have been executed by customer service staff such as basic advisory services.
6. Conclusion

This section of the thesis is dedicated to conclude the relevant findings and reflect back to the purpose of the thesis.

The study investigated the motivations, challenges and opportunities for Swedish banking institutes to implement artificial intelligence based solutions into their customer service process.

Research Question 1: What are the main motivations for banking institutes in Sweden to implement artificial intelligence technology solutions into their customer service?

The prerequisites of Sweden for utilising innovative digital technologies, were assessed. Sweden provides a solid foundation for introducing digital technologies for both customers as well as enterprises. The population is digitally well-educated and the usage of internet assisted tools is integrated into the daily lives of a large majority of Swedes. Due to this behaviour companies are more likely to successfully introduce new digital technologies into the market. The overall high digital involvement benefits a possible introduction of a virtual AI based assistant as planned by Swedbank.

Online channels are the preferable choice for the interviewed Swedish banking customers to conduct banking compared to offline channels. When the interviewed Swedish banking customers encounter issues they preferably solve them through self service activities. However there are a few services such as taking loans or other types of advisory services, where direct contact with a human is the preferable choice of interaction. This is mainly because of security or trust concerns. Artificial intelligence based services can be utilised by banking institutes to handle user inquiries. The case study of Swedbank displayed that the introduction of Nina resolved in a high resolution rate and that customer have a positive experience after the interaction.

Activities performed by banks in Sweden are moving towards a less and less differentiated competitive landscape. The interviewed Swedish banking customers overall do not distinguish between banks and banking activities are perceived as interchangeable goods. Thus, according to Moore (2008) banking services are becoming context activities classified as commodity. Banking institutes can address these activities by including artificial
intelligence based services into their processes. The case of Swedbank displayed such an utilisation. The introduction of Nina is allowing Swedbank to outsource customer requests in an effective way. In conclusion, the amount of cost ineffective interactions decreased.

Research Question 2: What are the challenges and opportunities for banking institutes to implement artificial intelligence technology solutions into their customer service?

The financial products and services of banks do not differ in the eyes of a customer and thus the customer does not see a value in choosing a specific bank. During this unspecified phase the risk that the customer base might switch to another bank is high. Swedbank already stated that the company is concerned about new digital competitors, which provide additional value through financial services for customers. The usage of artificial intelligence technologies provides an opportunity for banks to stay competitive by differentiating themselves while at the same time save costs.

Online channels are increasingly becoming the preferred way for customers to communicate with their banking institutes. The current experience of communicating through a chatbot could be enhanced by the utilisation of advanced robo advisory services. Sven Magg (2017) pointed out that large progress in AI is expected within the processing of natural voice input. Customer service and advisory could be done utilising a voiced AI based system, which is able to recognize and answer via natural communication. In an ideal scenario, the system could recognise the phone number of the client greet by his or her name.

The low degree of visiting branches indicates a risk for banking institutes. Branches do not only allow customers to make use of banking services but also serve as a direct contact interface between customers and their banks. Positive interactions in branches may add in relationship building and increase loyalty. Not visiting customer branches may affect the customer relationship building process. Banking institutes need to adjust to the customer contact points with the aim to increase customer relationship without direct contact. Hereby the new ways for interacting with customers is especially important for direct banks, which do not provide branches at all.

Multiple privacy and security concerns exist among customers. AI system are required to process large amounts of data in order to function properly. With data sets available online the risk for data theft or data exploitation increases. Additionally, the lawmaking process is lacking behind the technological progress with the consequence that existing
regulations are not addressing all legal aspects of innovative digital technologies, such as AI assistants. This grey area might lead to uncertainty, which in return could restrain the innovative progress. Within the decision making process AI systems have both strong opportunities and challenges. On one hand computer systems are not vulnerable to emotional influences or selfish motivations, thus their decisions are solely based on logical reasoning. On the other hand computer systems operate as they are programmed. This means, that there is a risk that private interests of third parties can be deceived into the software making the computer system biased. Within this matter artificial neural networks provide a security by design approach, due to naturally running within a black box, in which the internal processes are not easily revealed (Sven Magg, 2017).
7. Discussion

The final chapter of the thesis puts the findings and results of the study in context and critically discussed the used methods and the results. Finally, suggestions for further research are stated.

7.1. Results discussion

Previous research has shown that AI based solutions are capable of increasing the productivity of banking services. Bahrammirzaee (2010) conducted a comparative research review about the usage of artificial intelligence based systems such as artificial neural networks and hybrid intelligent systems within banking. He categorised the financial market into three domains — credit evaluation, portfolio management and financial prediction and planning. For each AI technique, he summarised the most famous research with a focus on recent publications. Bahrammirzaee (2010) concluded that the nature of problems which need to be solved by computer systems is changing. This is because current applications display increasingly uncertain and nonlinear behaviour, which changes over time. Within this context the strengths of AI systems such as artificial neural networks seem to be promising. Further the results of the research displayed that AI based solutions performed more accurately compared to traditional statistical methods.

Another study which was conducted by Hui and Jah (2000) investigates techniques on how to extract knowledge from databases in order to support customer service activities. Within his research paper the authors defined a traditional hot-line service centre (see figure 12). Hereby three basic steps become visible. First, the customer is contacting the support centre in order to get advice for a problem he is facing. Second, the service personnel may in order to answer the support request search through an advisory system, which holds the information that is stored within a customer service database. The authors differentiate between two types of service information. On the one side there are unstructured customer service reports, which record machine problems and its corrective actions. On the other side there is data regarding the employees, the day-to-day management operations and sales. Using specific data mining techniques may make it possible to improve support requests and enhance the quality of the results whilst searching through the customer service database.

The combination of the appliance of data mining tools and the introduction of a virtual
customer service agent may have the potential to increase efficiency in customer support. The end-result could be making the defined path from the customer to its required information shorter by setting up the virtual assistant directly on the customer service database.

Figure 12: Schematic hot-line service centre (Hui and Jah, 2000).

The intent of the present study was to address a knowledge gap regarding the usage of artificial intelligence technologies in banking and more specifically the customer service side, with an inclusion of the customer perspective. The results have displayed that the interviewed Swedish banking customers would appreciate an AI based virtual assistant in order to handle their banking activities. Yet, for some services, customers still prefer a human person. Possible security and quality concerns were stated. Further the findings imply that for the introduction of AI tools in banking processes, the acceptance of customers should be considered. AI assisted services have the potential to increase the service spectrum of banking institutes. Further, within Sweden, where wage costs are reasonably high in comparison to other European countries, intelligently automated processes can aid in decreasing cost. But AI services are not yet going to change the whole banking sector and make humans unnecessary. Rather, the main strength of AI assisted tools should be seen in automating transactional and repetitive tasks. By doing so resources are freed up to focus on other knowledge based activities, such as complex
advisory services. Thus, AI assisted services should be seen as a new tool within the existing set of digital tools such as other automation technologies like ERP systems.

7.2. Methods discussion

Swedish banking customers were interviewed to understand their experiences, views, beliefs and motivations regarding banking and virtual assistance. The information gained from the interviews provided essential information to assess the research questions.

Generalisability

Generalisation is the act of reasoning that involves the transfer from particular observations and results to a broad population. Generalisation is widely recognised as a quality measurement standard within quantitative research. In respect to qualitative research generalisation is more difficult due to the nature of data, which usually cannot easily be scaled for a larger population (Polit and Beck, 2010).

The goal of the conducted study was not to create generalisable results but to provide contextualised understanding of aspect related to the topics of the thesis. Thus, the information gained from the interviews provided essential information to assess the research questions. But due to the number of conducted interviews and the qualitative nature of the results, the implications drawn are not generalisable. However, in order to enhance the generalisability, the method for analysing qualitative content developed by Elo and Kyngas (2008) was applied. This ensured more comparable and replicable results.

Data collection

For the customer interviews Swedish banking customers specifically belonging to the millennial generation were chosen, for reasons stated in the methods section. Some of the respondents indicated, that their usage behaviour regarding banking services might differ when facing other standards of living. Hereby, one interviewee stated, that he might differentiate between banking services when topics such as mortgages become relevant, typically encountered when reaching an older age. Thus, the inclusion of additional age groups, might have had provided an enhanced assessment of the topics relevant for the study.
7.3. Further research

Focus group and generalisability

The only criteria for the selection process of the thesis was being within a certain age group and being a Swedish banking customer. The inclusion of other groups such as older generations might create a broader and more comprehensive view of the customer perspective. The study can also be extended to also include other Nordic countries as well as non Nordic countries, with a reasonable developed digital banking market. Additionally, to gain results which are generalisable qualitative data could be collected and analysed.

Data security and legal concerns

Artificial intelligence based technologies have the potential to innovating processes, increase productivity and create new products and services. This process goes along with an increase of interconnectivity as well as an increase of digital data handling. Hereby security concerns must be taken into account. Especially banks process and store large collections of sensitive data. The combination of an increase in digitalisation and the handling of sensitive data, exposes banks to security threat.

The "General Data Protection Regulation" (GDPR) passed in May 2018 by the European Union is going to be an important factor for all businesses including banks, which handle sensitive data. The main objectives of the GDPR are to unify the data protection guidelines within the Euro zone and increase the control of citizens over their personal data. A violation of the law may lead to penalties up to 4% of a company’s annual revenue (eu-gdpr, 2017) and thus, complying with the GDPR has to be a top priority for companies. AI tools of banks are suppose to handle sensitive data. Due to their autonomous nature, they provide a risk to violate data protection policies and need to be designed and set up in a way, that banking institutes may use them without worrying about violating law infringements. To assure that the innovative process undergoes a positive development further investigation regarding security threats and legal concerns coming with artificial intelligence tools need to be conducted.
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Appendices

A. Swedish banking customer interviews

Interview 1: Karin

Date: 25.03.2017
Interviewee: Karin E. (K)
Interviewer: Mehmet Ates (M)

M: First of all what bank customer are you?
Länsförsäkringar
K: I don’t know if my bank is only for private customer, should i say from which bank?
M: yes, please
K: Länsförsäkringar, should i type it to you maybe?
(she send me the name of the bank via E-Mail)
M: Why did you chose to become a customer of your bank?
K: I chose to become a member of the bank because my parents were members there so it was the easiest way.
M: Was it only because of your parents that you have stayed at your bank over the years? Do you see any benefits of that bank?
K: No just that everything has been fine and there were no complications . . . Länsförsäkringar, is basically the only bank that I know, and it has been working fine with me.
M: What digital services of your bank are you mainly using?
K: Online banking and mobile
M: When you say mobile, do you mean mobile banking?
K: Yes, banking through my phone.
M: Could you explain to me how often you use online or mobile banking and what you are doing with it?
K: I use it when I need it. So for checking my money I have on my account or when I need to transfer money to a friend or pay something with Swish or want to see how much money i spent in the last weeks. When i need to make transactions I make it with online banking because it is easier to type things in.
M: Do you also sometimes go to the branch, to the bank itself?
K: Yes, I have done that but only to fix issues I had with pay check that I had because
they came from a different bank, and for that I needed to go to my bank, that were the only times in the recent years that I have went to my bank.

M: While speaking of your problems with your banking if you have a problem with you banking, how do you try to solve it? K: I guess I would ask my mom first, because she knows economy stuff, if she would not be able to help me I would go to the bank and ask a customer service staff.

M: Do you use telephone banking?

K: No not at all.

M: In the case that you would live somewhere, where the next branch is not close, how would you approach to solve your question? would you rather have contact through email, a chat or phone? If no office is there

K: If no office is close first I would search the internet and the homepage of my bank, afterwards if my problem is not yet solved I would probably email them and then maybe call them.

M: Do you see a difference between the banks in Sweden?

K: No, because I don’t know much about the other banks, they all handle money so they are the same for me [laughs]

M: Would you consider your bank to be a younger generation bank or an older generation bank?

K: Maybe older,

M: Why older?

I don’t know, because I find it easy, their webpage is easy to find stuff on and since my parents have it and they are old, thats why I would say it is an older bank.

M: What would be a reason for you to switch to another bank?

K: Maybe if I have troubles with my bank and I search for other banks on the internet, which are easier to handle my issues, or maybe have better options for me as a customer, then I would switch but I think that would be also a lot of effort switching, I am being lazy and comfortable.

M: Is there any feature, you are missing at your bank? can be anything no feature is missing No, not that I have anything in mind or encountered so far.

M: Now, lets say you have mobile banking and there you have a digital assistant, which help you with your banking, you can check your balance you can foresee your spendings and now you want to buy something, which is more expensive exceeding the amount of 50.000 SEK like a TV or a car would you choose to take a loan using only the mobile banking without having contact with a customer service staff at a bank, a real person?
K: I think I would choose to go to a real person instead of only using the internet or the mobile assistant.
M: Why would you choose not to use the mobile service?
K: It is too much money to only use my phone. If I make a mistake I could be in trouble.
M: Would you choose to use your mobile assistant for a lower loan amount?
K: Yes, for lower amount I would use the mobile account, but not for higher loans then I would choose to go to a real person at the bank because it feels more safe.
M: Could you name an amount, for which you would choose to use your mobile assistant in SEK?
K: maximum 5,000 or no I would say 10,000 SEK.
(M explains the concept of chatbots) M: In the beginning you told me that if you have a problem you like to engage with a real person, be it tough personal contact or email contact or phone contact. How would you consider the contact with a chatbot?
K: yea sure as long as it is convenient for me. The bot idea sounds good because emails are good but it takes too much time and I have used real chats before as well but they are not always there like in the night times. But I still want to be able to contact real persons always.
M: So you would want to have the option to escalate the problem from the chatbot to a real person?
K: yes!
M: Nina is a chatbot, it has the appearance of a search engine but when you type in your question it prompts you to ask further questions, having a dialog. At the end it tries to give you the solution for your problem.
K: that sounds cool
K: Would you want your bank to have this as well?
K: Yes
M: Could Nina be a reason for you to switch to another bank?
K: No
M: Lets say if Nina is successful and popular among your friends, would it be an option/reason for you to switch the bank. ()
K: I would say no, because I do not use customer service that much.
M: Regarding the customer service at your bank, what would you wish for in the future?
K: Like I said, I'm not using the customer service that often so not really.
Interview 2: Emma

Date: 02.04.2017
Interviewee: Emma S. (E)
Interviewer: Mehmet Ates (M)

M: What bank customer are you?
E: I’m at Swedbank here in Jönköping
M: How did you become a customer at your bank?
E: When I was younger my father opened a Swedbank account with me for me and I just stayed there until now.
M: Was it only because of your father that you have stayed at your bank over the years?
E: I never had problems with my bank and I don’t do much with my bank.
M: Do you see a difference between the banks in Sweden?
E: No not really. To me the banks are all kind of the same. I mean with my bank card I can get money from everywhere so every ATM and I rarely go to the bank itself. Only if I need to sign something.
M: What is the main difference of the banks in Sweden?
E: Maybe later when you take big loans there are differences? Else I dont really know.
M: What digital services of your bank are you mainly using?
E: What do you mean with digital services?
M: I mean Services like mobile banking, internet banking
E: Oh, I only use online banking
M: How often do you use online banking, like how often do you login? E: I login often. I check my balance very often so nearly every day I login because I often lose the overview of how much I spent (laughs).
M: What else are you doing with you banking account other then checking you balance?
E: I make transactions sometimes. And I have some sort of funds saving account I don’t know how to call them. I check that often too.
M: Could you explain to me, why you don’t you use mobile banking?
E: I feel it is not so secure compared to when I do banking with my macbook. I feel like when I do banking with my phone that someone could somehow steal my pin or so to use it to steal money from me, do I sound paranoid? (laughs)
M: No dont worry
M: Do you also sometimes go to the branch to do banking?
E: What is branch?
M: I mean a building of Swedbank like in Jönköping centrum
E: Yes, I do
M: What are the usual reasons you go to your bank?
E: When I have problems with my banking I go to the bank.
M: Could you describe a problem where you went to a Swedbank store?
E: A few weeks ago I had a problem with my card because I could not pay a macbook with the card. The worker at Swedbank told me that the card has a limit that for spendings and the spending for the macbook was over the limit. He helped me to increase the limit so that I could buy the macbook.
M: While speaking of your problems with your banking if you have a problem with your banking, how do you try to solve it?
E: What kind of problems do you mean?
M: Forexample when you don’t know how to do something or you have question regarding your banking account.
E: I google it (laughs). When I have problems I search the internet because often others already had the problem so then I can find out how they solved it. If not I ask my friends or my father.
M: And if also your friends and your father couldn’t help. What would you do?
E: When I still have the problem I would write a Email to, how do you call it advisor or contact person? It is a woman who also also called me to the bank to give me advice on how I should handle my bank account.
M: And if you would need advice to make a decision such as creating a new savings plane?
E: Well, I have a savings account and for that I called with someone from my bank.
M: In the case that google didn’t help you and you could reach out to your contact person would a digital message based chat also be an option for you?
E: Yes if it can help me.
M: What would you expect from the chat?
E: It should be fast. I would not like to send a message and then wait very long when it is a chat so when I ask something it should not take more then maybe a couple of minutes before I get a response.
M: Would you consider your bank to be up to date to the technological standard?
E: When I was the last times at my bank most of the employees were younger, so I would say younger.
M: What would be a reason for you to switch to another bank?
E: If the charges for my bank account get higher that would be a reason for me to look for another bank. I like to compare things online before I buy it and like to read articles that compare different products. If I would read in a comparison for banks that a other bank has much better banking and is cheaper I would think to switch but I don’t think that a other bank is much better an cheaper then Swedbank because they are popular in Sweden.

M: Is there any feature, you are missing at your bank?
E: No not really.
M: Do you know what a chatbot is?
E: Chatbot, no I don’t.
(M explains the concept of chatbots)
M: Have you every heard of Swedbanks Nina?
E: No.
M: Nina is a chatbot, it appears on the homepage of Swedbank. It has the appearance of a search engine but when you type in your question it prompts you to ask further questions, having a dialog. Meanwhile it gives you possible answers and links to your problem.
E: Oh, is it that the thing with the green background?
M: Yes it is. Have you used it?
E: Yes yes I have.
M: Why did you use it?
E: The last time, it was a couple of days ago I wanted to know how much it costs to send money abroad. I just typed in like money transfer abroad in Swedish and it replied with two suggestions when I clicked one it showed a link which brought me to a website where there was information about how much it costs to send money to other countries, where it is for free where it costs money.
M: Could you tell me your experience with it? Was it for instance more comfortable compared to googling your problem
E: Yes I liked it, it was quick and the right sites. I also just for fun tried out some other questions to see if it could keep up with the things I asked you know I am really good in asking stupid questions (laughs) and I normally prefer not to having to contact others. I like to try to solve a problem alone first. So if this chatbot can help me with my problem then I would use it.
M: Could it keep up with you?
E: yea with most questions it could surprisingly, but not everything.
M: Could you imagine having a virtual assistant on your phone?
E: I don’t know. I would maybe try it a bit.
M: Now, let’s say you have this digital assistant, which helps you with your banking. Now you want to buy something, which is more expensive exceeding the amount of 50,000 SEK like a car, would you choose to take a loan using only the digital banking without having contact with a customer service staff at a bank, a real person?
E: No, I would not take a high loan without talking to a person. And for low amounts I probably don’t need to take a loan. I would just pay with my credit card.
M: Why would you not take a loan through a virtual assistant?
E: I think I would think that I don’t chose the best option for the loan. I like to ask my advisor what the best option is for the loan. And I think if I take a loan I have to sign a contract anyway maybe?
M: Would you choose to use a digital assistant for a lower loan amount?
E: No, like I said, I would just pay with my card.
M: Would you want to have the option to escalate the problem from the chatbot to a real person?
E: I think it would be good to call someone when there is a problem.
M: Let’s say you are at another bank, which does not have this Nina chatbot. Would Nina be a reason for you to switch to Swedbank?
E: I don’t have so many problems, so probably not maybe if I would have a lot of problems then it could be very handy to have Nina.
Interview 3: Max

Date: 05.04.2017
Interviewee: Max C. (Max)
Interviewer: Mehmet Ates (M)

M: What bank customer are you?
Max: Handelsbanken and actually it is two banks and SEB
M: Why did you chose to become a customer of these banks?
Max: Through my parents the one had Handelsbanken the other had SEB so when I was younger so they said you reached the legal age to create a account so yea then we opened an account
M: Was it only because of your parents that you have stayed at your bank over the years?
Max: yea, I haven’t checked any, I haven’t compared anything else its basically just the convenience factor
M: you mentioned that you are a customer at two banks and there are in multiple banks in Sweden. Where do you see differences between your two banks.
Max: Between my two banks not much just that I find SEB easier to use online, because its quicker and thats about it for me.
M: Do you see a difference between the banks in Sweden?
Max: Alright, well I feel like SEB and Handelsbanken feel more professional somehow, well like more traditional. I feel they are more established.
M: What digital services of your bank are you mainly using?
Max: Just basic internet banking like sending money between two different banks, sending it abroad and yea
M: do you also use mobile banking, with your phone?
Max: I have yes, it depends but yes
M: How often do you use online banking, like how often do you login and how often do you use mobile banking in comparison to online banking?
Max: Well lets see, I log in like every week because I need to send money around and about the usage i guess well 50/50 to be fair.
M: You already mentioned a few things you are doing with your banking account. What else are you doing with you banking account other then checking you balance?
Max: thats already the most, I also have a fund well wait you know some stocks like investments.
M: Do you also sometimes go to the branch to do banking?
Max: Yea yes sometimes, just to sending money abroad or handling other things which I cant do online.
M: Do you also do banking by phone?
Max: By phone? no.
M: If you have a problem with you banking, how do you try to solve it?
Max: Basically I just call the customer service. Sometimes I also go to the branch itself but the branch is pretty far from me, so I prefer to do it over the phone. And they are pretty helpful on the phone so in most case that works
M: Do you also sometimes try to search for the problem online on your own, or do you immediately call the bank?
Max: No they have like a quick google kind of thing and I look up the things I want to know there there as well. It is like a wikipedia-ish thing.
M: and if you need advice with your banking what would you do?
Max: If I want advice regarding my funds I would just call by.
M: Would you consider your bank to be up to date to the technological standard?
Yea, if I look into bot of my banking accounts I mean there is not much difference between those banks really, except the looks of the interface.
M: What would be a reason for you to switch to another bank?
Max: I guess im not in that stage yet but when topics like mortgage start to become important then those rates would be of a significant change, and then i would start comparing all the banks to find the best one. and then change banks
M: Is there currently any feature, you are missing at your bank?
Max: No, not at my current using my type of usage is completely fulfilled by my bank
M: Do you know what a chatbot is?
Max: A chatbot? no im not sure.
M: (explains the concept of chatbots)
Max: Oh yea, I have seen that on my bank, and used it a couple of times but im not sure if it is that
M: The chat that you have seen might have been a real chat, with a real person but since you have used both ways to solve your problem, a digital chat and phone calls, what would you prefer?
Max: I think if i would that it was like a chatbot like I probably wouldn’t use it, no. I would prefer to speak with a human person.
M: Would you in general like to have a virtual digital assistant which helps you with
your banking? For instance, if you want to buy something, which is more expensive and exceeds the amount of 50,000 SEK like a car would you choose to take a loan using only the digital banking without having contact with a customer service staff at a bank, a real person?

Max: If I would take that loan from the bank through the digital assistant? Probably no, no. I would do the traditional thing i think and go to the bank itself

M: Regarding the customer service at your bank, what would you wish for in the future?
Max: I think its pretty good i don’t really have anything to complain about really. Its just a hassle via phone that you have to identify your self every time, giving your bank account number name, password, thats annoying
Interview 4: Rasmus

Date: 07.04.2017
Interviewee: Rasmus J. (R)
Interviewer: Mehmet Ates (M)

M: What bank customer are you?
R: I have my bank account at Swedbank.
M: Why did you chose to become a customer of your bank?
R: I think when I was younger my grandmother opened a saving account for me at Swedbank but I couldn’t use it until I was a bit older.
M: Why did you stay over the years at your bank?
R: They seem alright. I like their ads. I mean you hear so much negative stuff happening about banks all over the world. And Swedbank seems to be a bit more more trustable and I didn’t have any big problems yet.
M: Okey you said you like Swedbank, where do you see differences between Swedbank and other banks?
R: Well, I work quite a lot and like the feeling that I can trust my bank you know?
M: Other Swedish banks are less trustworthy to you?
R: No not really, I guess they are all kind of the same, as least in the way that I am using it.
M: What digital services of your bank are you mainly using?
R: Ill pretty much do everything using my phone if you mean that.
M: Do you also use your internet banking?
R: Yea, sometimes. Especially when I get payed I like to see my bank account on a big screen (laughs)
M: How often do you use your phone for banking, like how often do you login?
R: Quite often, I use Swish a lot with my friends, to get money around, split the bills and stuff. And I do payments here and there. I’ll login like every couple of days to check the spendings and incomes.
M: What else are you doing with your banking account?
R: Just checking my balance, maybe look over my monthly transactions and if that time of the year comes, getting some I’m looking for spending notes for my taxes.
M: Why do you prefer to use your phone for banking?
R: Its just quicker, I always have me phone with me and I am used to it now.
M: Do you also sometimes go to the branch to do banking or via telephone?
R: No, not at all. I barely remember when I was the last time at my bank. I trust them but never visit them you know (laughs).
M: How come you never go to the branch?
R: I can do everything I need by myself. If i need help I mostly can find my way to finding a solution.
M: While speaking of your problems with your banking if you have a problem with your banking, how do you try to solve it?
R: I’ll hit up their site. They got something like an android chat.
M: What do you mea by android chat, are you using a google phone?
R: (laughs) No no I mean like an automatic chat thing. Its just on their site, one of these things, which just pop up and want to help out somehow.
M: Do you use it often?
R: Kind of, for a while that android and me were good friends (laughs). I went abroad for longer time to travel some. And there for I had some questions about my banking how I can get money abroad and about fees and stuff. I even though to make like an appointment at my bank because money is an important factor when you are abroad but I wouldn’t even find it I guess (laughs) but with most of my questions the website was good enough and I had a couple of times some questions regarding my bank statements, and yea I got the right answers. Only a few things I couldn’t find but i fixed those issues on a phone call.
M: So if you have a problem you first try out Swedbanks website, if that doesnt help you call by?
R: yea, thats how I did. But its not like im having a lot of problems. It was just then because I was travelling that I had so many questions.
M: Would you consider your bank to be up to date to the technological standard?
R: Overall yea, the internet banking is a bit ugly but that fine. And they have android roboters working for them so they must be up to date right? (laughs)
M: What would be a reason for you to switch to another bank?
R: To switch? If the banking handling costs would be too high or if other banks would have a really cool offer, then maybe.
M: What kind of an offer do you mean?
R: I dont know. something like when I open an account at their bank that I would get a bonus. But I like my bank so far, so I’m not planning on switching any time soon.
M: Is there any feature, you are missing at your bank?
R: I think the internet banking layout is pretty ugly. It would be cool if they would
update it. But maybe I am the only one who doesn’t like it.
M: Do you know what a chatbot is?
R: You mean that android thing?
M: Exactly. A chatbot is basically an automated chat, which tries to give you intelligent answers based on your questions. Would like to have this chatbot to be integrated into your mobile banking?
R: Yea that would be neat. As long as it is not annoying and spams me with messages.
M: Now lets say you have this digital assistant integrated into your mobile banking. Would you be willing to use this assistant to take a loan from your bank which exceeds 50.000 SEK? In order to for instance get bit more money to buy a car.
R: I think 50.000 SEK seems a bit much to take only through an app thats a lot of cash I was planning on taking a small loan when I went abroad but I had enough money so it was fine I think like maybe for a less amount I would but im not sure. If it is transparent enough and the price for the loan is okey.
M: Could you name an amount?
R: 20.000 maybe
M: Why would you chose not to take the loan through the virtual assistant
R: If it is a high amount i think Id like to talk to something with a heartbeat, or even consider checking out loans from other banks as well.
M: We talked before about how you handle problems with the chatbot at Swedbank. Would you want to have the option to escalate the problem from the chatbot to a real person if it doesnt help you?
R: what do you mean by escalate a problem?
M: I mean so when the chatbot cant help you, that it does provide a function to pass the problem to someone else, for instance a customer service employee or a real chat
R: I think that would be good. It that would be sweat, I guess he could see me conversation with that chatbot thing and maybe already know what i want maybe.
M: Lets say you are at a bank which does not have this chatbot. Would that be a reason for you to switch to Swedbank? If you would know helpful it is
R: It is pretty sweat I guess, since I am not using it that often im not sure if I would switch my bank just to have this bot to ask question to. I think if it could do more cooler things then maybe.
M: Regarding the customer service at your bank, what would you wish for in the future?
Nope every things good so far, its just a bit annoying when I call by and have to authenticate myself every time, but I’m not calling the customer service too often anyway
so its fine.
B. Expert interview

B.1. German version (original)

Date 20.04.2017
Interviewee: Sven Magg (Postdoctoral Teaching Associate of the Knowledge Technology Group)
Interviewer: Mehmet Ates

Mehmet Ates (M): Können Sie mir eine kurze Beschreibung ihres Arbeitsbereiches geben?

Sven Magg (S): Der Human Robot Interaction Bereich ist hauptsächlich tätig mit einem physischen gegenüber aber die meisten Methoden die wir verwenden sind auch übertragbar auf künstliche Intelligenz wie Agenten die entweder als Avatar oder als stimme existieren.

M: Ich haben zuletzt einen Artikel gelesen, dass es in Indien einen Roboter in menschlicher gestalt gibt, welcher in Banken eingesetzt wird, um Kunden zu beraten.

S: Ja, und auch in Japan vor allem der Pebber Robot, der berät Menschen, führt Kunden herum jedoch auf niedrigem Niveau.

M: Ich bin während meiner Recherche, auf Artikel gestoßen, die in den kommenden Jahren einen deutlichen Fortschritt in dem Bereich der künstlichen Intelligenz sehen: Wie schätz du den derzeitigen Reifegrad von KI Technologien im Allgemeinen ein?

S:Das ist jetzt eine sehr allgemeine Frage. Es kommt darauf an, welchen Bereich man sich anschaut. Also im KI Feld alles. Mittlerweile in manchen Bereichen sind wir schon ziemlich weit, in anderen Bereichen haben wir noch einen großen Aufholbedarf und stehen sehr am Anfang. Hierbei kommt es sehr darauf an welchen Bereich man genau Betrachtet.

M: Wie ist die der aktuelle stand bezüglich der Interaktion zwischen Roboter und Mensch?
S: In der Richtung der Chattbots sind wir unglaublich gut, um am Telefon die Wörter die gesagt wurden zu erkennen. Siri und Google zeigen das schön auf. Ich kann mit meinem Telefon Reden. Der zeigt mir die Wörter an. Das Funktioniert unglaublich gut. Da sind wir schon unglaublich weit mit verschiedensten Methoden. Jedoch beim verstehen was gesagt wurde, stehen wir noch in den Kinderschuhen. Also wirklich zu sagen ich kann jetzt aus diesem Satz die Bedeutung und die intention des gesagten herauslesen, da wird es sehr schnell schwierig. Dieses Sprachverständnis oder wenn der Satz nicht Korrekt Formuliert wurde, dann noch zu sagen ich weiß was gemeint ist, ist unglaublich schwer.

M: Derzeit wird das Verständnis vorwiegend anhand Keywörtern erledigt, dass problem ist wohl diese Keywörter mit vorhandenen Daten zu verknüpfen, um ein Verständnis aufzubauen?

S: Genau, wenn bestimmte keyword Kombinationen vorkommen, die Assoziiere ich mit irgendwas. Wenn das wort 'geld nicht bekommen' und 'kaputt' auftaucht, dann weißt ich ah der Kunde hat ein Problem mit dem Geldautomat. Aber im Endeffekt ist das nur raten. Denn es ist möglich die selben Keyword in einem Satz zu verwenden der etwas Komplett anderes aussagt. Da wird es dann Problematisch, dem wenn ich ausschließlich Keywordspotting betreibe, dann habe ich genau diese Informationen verloren. Andererseits zu sagen das man den Satzinhalt versteht so wie er gesagt wurde, dass ist etwas was zurzeit ungelöst ist. Bei sehr einfachen Sätzen, wo man weiß welche Art von Sätzen kommt, dann kann ich dieses Verständnis aufbauen, welche Wörter enthalten sind, was die Wörter bedeuten, was ist Objekt was ist Verb, was bedeutet das in semantischen Verhältnissen. Das ist das Themengebiet wo wahrscheinlich in den nächsten Jahren am meisten passieren wird. Wörter zu identifizieren (Spracheingabe) ist relativ zuverlässig.

M: In welchen Bereichen siehst du, dass sich Schnittstellen zwischen KI Lösungen und Menschen in der Zukunft am stärksten entwickeln?

S: In allen. Im Endeffekt sind sämtliche Lösungen irgendwo aus KI entstanden die zurzeit durch Robotik oder als intelligent beschrieben werden.Sobald man sagt es ist intelligent ist es auch KI.
Zum Beispiel waren Bilderkennung, Bildverarbeitungsmethoden früher KI, bis sich das Bildverarbeitungsfeld abgespalten hat und dann ein eigenes Forschungsfeld gebildet hat. Da ist die Frage fasse ich das noch in den Bereich der KI, wenn intelligent ein Gesicht im Bild erkannt wird. Ich denke mal von den großen Bereich sind die Bereiche die mit Bildverstehen, also Sensorverarbeitung für uns wichtig. Wie ziehe ich Informationen aus Bildern, aus was ich gehört hab, aus Text ab, da wird es die meisten Fortschritte geben. Also quasi intelligentes Wissen extrahieren.

Was auch viel passiert im Bereich Wirtschaft z.B. bei Amazon. Ich kann den Text nehmen aus einer Bewertung und anschließend diesen Text auswerten und sagen es war eine positive, negative, neutrale Bewertung allein aus dem was beschrieben wurde ohne andere Merkmale dazu zu nehmen. Studenten haben dies als Masterarbeit verwirklicht mit einer relativ hohen 80Im Endeffekt ist dies aber auch kein Verständnis, sondern nur eine Erkennung von bestimmten vordefinierten Wörtern. "Das Produkt ist unglaublich gut" unglaublich gut deutet auf eine positive Betwertung hinaus. Durch dieses system kann man schon allgemein sagen ob eine Bewertung auf 1-2 Sterne oder 4-5 Sterne hinausläuft. Schwierig wird es bei neutral Die Extremfälle sind leicht zu erkennen.

M: Würdest du also zwischen schwacher und starker KI unterscheiden?


Um schnelle generelle Entscheidungen zu treffen reichen Keywords, Lautstärke, intonation.

M: Finanzkrise 2008: Banken haben Kredite an Menschen verteilt, die sich eigentlich keine Kredite leisten konnten. Hätten KI gestützt Systeme, dort besser reagiert?

M: Ist ein KI System jedoch nicht auch nur eine manipulierbare Maschine, also wenn die Stellschrauben des KI Systems verändert werden, ist man dann nicht bei dem selben Problem wie am Anfang? Zumal die Entscheidungen die von Manager Ebenen getroffen wurden ein Grund für das entstehen der Finanzkrise war.

S: Richtig, der menschliche Faktor ist immer noch da, aber wenn die Rahmenbedin- gungen geschaffen sind, kann eine Maschine besser, rationaler auf den Daten basierend entscheiden.

Selbst im Aktienmarkt, die Entscheidungen der Profis, wenn man es 5 Jahre später be- trachtet, nicht anders sind, vom Erfolg her, wie einer der mit minimalem Wissen zufällig Entscheidung getroffen hätte. Die Erfolgsquoten sind ziemlich zufällig. Da ein Aktien- markt so chaotisch ist kann auch ein künstliches System hierbei nichts lernen. Was ein künstliches System macht ist input und output Daten zu betrachten und zuschreibt es
Eine Funktion zwischen den beiden gibt. Wenn es keine Funktion gibt, kann die Maschine nichts machen, ähnlich wie ein Mensch der meint es gibt eine Funktion aber es gar keine gibt, kann das künstliche System nichts machen, und wirkt wie ein Mensch, der meint es steckt ein System oder eine Funktion dahinter obwohl es gar keine gibt. Das ist genau so wie beim Lotto, es gibt viele die Sagen, dass es ein System dahinter gibt, was jedoch mathematisch nachgewiesen nicht stimmen kann. Hier ist der Unterschied, die KI Maschine würde eine Funktion finden, wenn die Daten gut genug und darauf basierend dann gute Entscheidungen treffen aber wenn es keine Funktion gibt oder diese Funktion zu zufällig ist, dann ist das System auch nicht besser. Das gilt für alle Systeme, die versuchen nichts anderes als zwischen Input und Output eine Funktion zu finden, die manchmal schwer zu finden ist.

M: Bei der Integration von einem KI gestützten System im Bereich customer service, welche Erfolgsfaktoren würdest du als wichtig einstufen?

wartet man automatisch, dass alles was ich sage verstanden wird und das system in meiner Sprache mit mir redet, wenn man aber dann schnell merkt das system antwortet nur auf bestimmte Keywörter, oder antwortet total unsinnig auf das was gesagt wurde. ist die Enttäuschung relativ schnell groß man darf nicht verheimlichen das dass system ein computer ist
Aber wenn das system kontextsensitive reagiert und zum Beispiel die Telefonnummer wieder erkennt und sagt guten tag wir haben doch schonmal gesprochen, dann erhält man eine positive Überraschung und is aktiv in der Interaktion.

M: Da es nun die neue EU Datenschutzgrundverordnung gibt, welche neue regeln für den Umgang mit personenbezogenen Daten definiert, sollte es hierbei deiner Meinung nach eine art code of conduct für Roboter/ KI Maschinen geben?


M: Du hast schon den Bereich neuronale Netze angesprochen. Siehst du besondere Anwendungsgebiet für NN im vergleich zu andern Technologien?

S: Ja es wird schon angewandt auch sehr viel im finance Bereich.

M: Was ich gefunden hatte waren vor allem Kreditevaluationen, sieht du in der Zukunft einen speziellen Bereich der sich gezielt weiterentwickelt wird

S: Überall wo jetzt Muster erkannt werden du hast viele Daten und möchtest Muster erkennen. Da sind zur Zeit die besten Methoden die neuronalen Netze. Die sind da einfach zur Zeit unschlagbar, wenn genug Daten da sind, das heißt wenn ich genügend Daten habe, kann ich ein neuronales Netz trainieren gezielt Muster aus diesen Daten zu erkennen. Sowohl welche Muster interessant sind oder welche nicht interessant sind
bei der Kreditvergabe. Z.B. ich habe die Kreditinformation der letzten 30 Jahre aller meiner Kunden und ich weiß ob sie den Kredit am Ende bedient haben oder nicht diese Entscheidung ob jemand den Kredit am Ende bedienen wird oder nicht steckt irgendwo in diesen input Daten. Dann trainiere ich ein neuronales Netzwerk und gebe ihm die input Daten und sage dem Roboter, dass er ja oder nein sagen muss und trainiere es solange bis die entschieden für die letzten 30 Jahre meistens richtig gewesen ist. Dann kann ich dieses verfahren für neue Kunden anwenden. Dann nehme ich einen von den neuen Kunden und mein Netzwerk sagt mir dann automatisch nein/ ja und genau dieses Muster zu erkennen und das klassifizieren aus mustern, da sind z.Z. neuronale Netze unschlagbar. egal was für Daten. Es werden auch schon in vielen Bereichen angewandt. ZB Gesichter Erkennung von FB oder hinter siri steckt sehr wahrscheinlich ein NN wir wissen es offiziell nicht aber wir sind uns ziemlich sicher. Google verändert sehr sicher NN, um die Sprachregelung durchzuführen.

M: In welchen Themenbereiche werden in Zukunft im Bereich banking KI Lösungen eingesetzt werden

S: Ich denk mal in dem Bereich customer support, wird viel in Richtung chatbots gehen oder im Hintergrund der Entscheidungsfindung bei der Verarbeitung von Daten. das ist auch da wo jetzt die meisten Fortschritte gemacht werden/ wurden. Im Endeffekt ist auch der google Schach/go spieler nicht anderes als ein neuronales Netz. Er hat viele Daten bekommen und musste daraus Entscheidungen treffen. Ich geben ihm eine Milliarde Daten und sage ihm dass er die besten Entscheidungen treffen soll.

M: Wo ist hierbei der Kernunterschied zwischen einem Computer welcher Schach spielt und einem Computer welcher GO spielt?

S: ALphaGO is ein neuronales Netz. GO wurde zu Anfang mit den 5 Milliarden Zügen und die besten Antworten dafür gefüttert. Danach hat GO mit diesem Input gegen sich selbst gespielt und nach und nach Spielzüge ausgetestet und geschaut was passiert und hat gelernt ob es nun ein guter oder ein schlechter Zug war je nachdem wie sich die situation verändert. AlphaGO hat auf Server Farmen Wochen traniert und immer gegen ich selbst gespielt und hat permanent gelernt was gute und schlechte Zuge sind. Das war der unterschied. Vorher hat man ausschließlich menschliche Parteien genommen und daraus gelernt, was zur folge hat, das dass KI system nicht besser sein kann
als die Menschen, die vorher gespielt haben. AlphaGO hat nur das Spiel bekommen und unabhängig davon was menschen machen komplett selber gespielt und hat dadurch komplett neue Spielzüge entwickelt, die ein Mensch niemals gemacht hätte, weil noch keiner auf diese Idee gekommen ist. Aber alphaGO hat gelernt das diese Züge dem Sieg näher bringen in bestimmten Situationen. Dieses Verhalten wurde dann mit Kreativität gleich gesetzt. Weil es einfach neue Spielzüge gespielt hat aber im Endeffekt ist es nur erschlagen des problems durch mehr Daten/ Rechenpower. Aber das system an sich hat das spiel, könnte man sagen, verstanden. Weil es genau weiß, was eine gute/schlechte Antwort auf einen Spielzug ist, auch wenn es ein unbekannte Spielzug ist.
im Endeffekt ist es wie ein mensch, welcher sich 10 Jahre einsperrt, und gegen sich GO spielt und alle möglichen Spielzüge ausprobiert und dabei nichts vergisst. AlphaGO behält auch den ersten schlechte Spielzug der gemacht wurde und vergisst nicht. Darüber hinaus ist AlphaGO nicht beeinflusst von vergangenen Spielen und "ich bin jetzt sauer und mache jetzt etwas unüberlegtes". Genau so ist es bei er Kreditvergabe. Es kommt darauf an die Funktion/ das mapping zwischen input und output zu finden, bin ich auf alle fälle besser als ein Mensch. Wenn es eine Funktion gibt die angewendet werden kann, ist ein Roboter besser in der Anwendung der Funktion.
B.2. English version (translation)

Date 20.04.2017
Interviewee: Sven Magg (Postdoctoral Teaching Associate of the Knowledge Technology Group)
Interviewer: Mehmet Ates

Mehmet Ates (M): Could you give me a brief description of the department, you are working at.

Sven Magg (S): The human robotic interaction department is mainly dealing with (robots with) a physical presence but most of the used methods can also be applied to artificial intelligence based technologies, such as agents which are present as an avatar or as a voice.

M: I have read an article about a robot designed in India with a human like appearance, used within banks to consult clients. Does that suit your area?

S: Yes and especially in Japan there is the Pebber robot, which assists people and guides clients. But this happens on a very low level.

M: During my research I came across multiple articles, which foresee a radical improvement within the area of artificial intelligence. How do you rate the current level of development of AI based technologies as a whole?

S: Well, that is a very generic question. It depends which area of research you look into. Within some areas technology is very advanced but regard a lot of other research fields we still have a lot of catching up to do and are still in the beginning. So does really depend on which area you look into.

M: So what is the current level of development regarding human robot interaction?

S: So looking into chatbots we are very good at recognising words on the telephone. Siri and Google are beautifully displaying this. I can talk to my phone, and it recognises my spoken words in a good way. But regarding the understanding (of the meaning) of the spoken words, we are still in our babyshoes. I mean it is extremely difficult to actu-
ally understand the meaning of a sentence. This is because we still have to learn a lot about speech comprehension especially at sentences which are grammatically not correct.

M: Is it correct that currently speech comprehension is done through the recognition of keywords within a sentence. So the problem is to link those keywords with actual meaning?

S: Exactly, certain keywords are associated with something. If the keyword “money not given” and “broken” is mentioned, then I can draw the conclusion that the ATM is broken. But in the end this is just guessing, because it is possible to use the exact same keywords and create a sentence with a complete different meaning. It gets problematic when I solely do keyword spotting, because a lot of information is then lost. Thus, the understanding of the meaning of spoken words is currently an unsolved problem. Currently we can only create understanding when dealing with short and simple sentences where the context is known. Because then I can spot each component of the sentence and tell the difference between objects, verbs and put them in a semantic context. That is the research field where most probably the most development is expected within the next few years. Recognizing words is working very reliable

M: In what research field do you see the most potention of development regarding human robot interaction within the future?

S: In all fields. In the all of todays solutions which are in anyway described as smart are somehow backed up by AI. If you call it smart, it is based on AI. For example the recognition of pictures used to be part of the AI research field but now it has its own research field. So the question is: what do I categorise into the AI research field. So overall I think that the everything which has to do with processing any kind of sensorial input is relevant for us. How do I extract information from pictures, text, speech or any kind media? So intelligent extraction of information. What also currently happens within the economy world for example at Amazon is the assessment of customer reviews. Just using the review text, machines are able to tell whether it was a positive, negative or neutral review. It is possible to make such a decision without other information sources. But in the end this is also not really understanding, but the recognition of predefined words. If the words “The product is really good” are used it is a good indicator that the review is positive. A machine can quite easily tell if a review is going to be a 1-2 star review
or 4-5 star review. The extremes are easy but it is difficult to tell if it is a neutral review.

M: So would you differentiate between weak and strong AI?

S: The differentiation between weak and strong AI is a gradual development. The main question is how much did the machine understand and how much did it guess? What is understanding? Is the human brain also just using keyword spotting to understand? The human brain is doing a lot of shortcuts, so it can tell the meaning of a sentence really fast. What is the understanding of a sentence? Sarcasm for instance, a machine is not able to understand the concept of sarcasm. It would have to follow the whole dialogue and not only few words in order to analyse the sentence and take emphasis into account. That's very difficult. Even some humans do not understand sarcasm. In order to make quick decisions keyword spotting, the volume, the intonation is enough.

M: Financial Crisis 2008: Banks have been distributing loans to people who could not afford loans. Would have AI supported systems reacted better?

S: Yes, they make better decisions when they're well trained, simply because they're not easily influenced by a variety of factors, especially employees in the credit sector who decide about the distribution of loans to people who should not get loans, for sympathy reasons. If for example hard facts would speak against it or vice versa. Here, an AI system could avoid these kind of subjective factors, focusing only on objective facts. 'What is your [financial] situation? Credit, yes or no.' Rational decisions are better for computer systems to make, especially continuous rational decisions without being influenced by individual cases. Then AI systems would probably have done better a better job. On the other hand, a computer system is only as good as the data it gets to learn. This is the crucial thing. If loans have been given out subjectively over the past few years it becomes difficult to measure how good the loans really were. The system does not have a perfect basis to learn how to give out loans money. For example, there was a study that looked into a system which had to determine the releasing of prison inmates earlier. The system was trained to make those decisions and in the end it was better compared to a human. Machines are better in those kind of decision making processes because a system does not take other factors into account, it can make better rational decisions based on the data.
M: But is an AI system not also just a manipulatable machine? So if the AI systems settings are changed, isn’t it the same problem as in the beginning? Especially since the decisions made by managers were a reason for the emergence of the financial crisis.

S: Right, the human factor is still there, but once the framework is in place, a machine can decide better, more rationally based on the data. Even in the stock market, the decisions of professionals, are not different compared to amateurs who would have done random decisions if you look at it 5 years later. The success rates are quite random. Since a stock market is so chaotic, even an artificial intelligence system can not learn anything here. What an artificial intelligence system does is observing input and output data in order to determine a function connecting both. If there is no function, the machine can not do anything, much like a human who thinks there is a function but there are none. The artificial intelligence system can not do anything and acts like a human thinking there is a system or function behind it although there are none. This is exactly the same as with the lottery, there are many who say that there is a system behind it, but mathematically proven this is not true. Here’s the difference, the AI engine would find a function if the data is good enough and then make good decisions based on that, but if there is no function or this function is too random, then the system is not any better. This is true for all systems that try to find nothing but a function between input and output that is sometimes hard to find.

M: When integrating an AI-based system into customer service, what success factors would you consider important?

S: There is a lot of research about what people accept as 'good', there is a general answer: How smart do I perceive the system. If I know that the system is a computer and I know that the system does not pretend to be intelligent, then I do not expect much and I am pleasantly surprised if it helps me. This is because I do not expect that a computer can help me. On the other hand, if I have an avatar that looks exactly like a human being and has human facial features. Then I implicitly perceive that there is someone smart and expect a perfect solution, as I would expect from a human. In this case the user would be disappointed if the computer differs from the expectation. If the same answers would have been given from a barrel with a loudspeaker, I would have been pleasantly surprised. Because I would not have dared such capabilities to a machine. So
it depends on the perception of the people and the error rate of the system. We once supervised a master project with humanoid robots that made stupid mistakes, like not recognising speech several times because it misunderstands a word. In this case it is very disappointing, because you think ah I was so positively surprised by its appearance but the results are bad. Otherwise, if the system does not pretend to be intelligent, then I have no great expectations and look forward to any answer. When you enter natural language, you automatically expect that everything I say is understood and the system speaks to me in my language, but then you quickly realise that the system only responds to certain key words, or totally nonsensical to what was said. The disappointment is big. One must not hide the fact that system is a computer. Especially within short dialogues. Usually one does not talk for a long time with such a machine. The cases are usually relatively simple and the systems usually redirects to a human as soon as it is confronted with complex cases. But what it offers me is to have a nice interaction point available 24 hours a day. I can always write or call the machine if necessary and within seconds it responds. I do not have to wait in a line and all these factors are positive for the user. As soon as the system brings me closer to my solution, the experience has been positive for me, that is why chatbots are very helpful and in the research field of chats have the potentials to become very large, especially the understanding can be developed further.

However, one must be careful that one does not roll over everything on the chatbots too fast, because people might get disappointed that the bot does not always help you or always answers in the exact the same way. E.g. you call 5 times and always get the same conversation. But if the system reacts context-sensitive and, for example, recognises the phone number and says hello XY we have already spoken, then you get a positive surprise and are active in the interaction.

M: Now that the new EU Data Protection Regulation is in place, which defines new rules regarding the handling of personal data, should there be a kind of code of conduct for robot / AI machines in your opinion?

S: We are already working on such a code of conduct because in the end, this is a big problem. The transfer of personal data is currently a big issue, because it is in the area [inaudible 21:09]. The real problem is an ethical one, which has to be solved by society, that has nothing to do with the robots. It’s just about what data is stored and who has access. In neuronal network for example with which we work, the data is no longer
directly accessible when the neural network learns something [inaudible]. I do not see it anymore. I have to interact with the neural network to see what it knows. I no longer have the opportunity to tap it directly. From this point of view, neural network based systems already have a certain level protection built in because they are integrated into a blackbox that I do not have access to. Then the robotic system comes into play and then the question is how do I interact with it. Typical examples that are applied at conferences is the accidental disclosure of data to others because the robot has no social awareness or no one taught it about social context. For example, The robot is at someone’s home and gets all lot of personal information about the persons life, it has access to its media consumption and medications. Then an acquaintance comes to visit and the robot asks, in front of the acquaintance, if you want to take your medicine now. The robot does not understand that he is not allowed to dispose private information when someone else is in the room. Because the robot has learned that. Maybe the robot did not even realised that there was someone else in the room. Another example: if you would ask Amazons “Alexa” call my girlfriend, Alexa could reply “which of the three” because Alexa has found three names in the contact list with stars at the end of the name. robots can not understand the context. The more robots I put into my social context the more I have to realise that the robot does not understand the social context and never will. For us [Human Robot Interaction Area] it is the task to explore how to teach such a thing to a robot. On the other hand, the task of the people is to change the context so that nothing bad can happen.

M: You have already addressed the area of neural networks. Do you see any special application for neural networks compared to other technologies?

S: Yes, it is already applied very much in finance.

M: What I found was mainly regarding credit evaluations. Do you see a specific area which will be developed further in the future?

S: Everywhere, where patterns are detected. You have a lot of data and want to recognise patterns. Currently, the best methods are the neural networks. They are simply unbeatable at the moment, if there is enough data, that means if I have enough data, I can train a neural network to recognise patterns from data. Within credit lending it could detect which patterns are interesting and which are not interesting. For example,
if I have the credit information of the last 30 years of all of my clients. Then I know if you have payed the loan back at the end or not. This answer if somebody will end up paying back a loan or not is hidden somewhere within the input data. Then I can train a neural network and give it the input data and tell the robot that it has to make a decision by saying “yes” or “no” until the decision making has been correct for most of the past 30 years. Then I can apply this procedure for new customers. Then I take one of the new customers and my network can give me automatically an “yes” or “no” answer. These kind of neural networks are already applied in many areas. For example the face recognition of Facebook or behind Siri there is most likely a neural network. We do not know officially, but we are pretty sure. Google as well very certainly uses neural networks to perform its language control.

M: In what areas topics regarding banking are AI solutions going to be used in the future?

S: Well, I think in terms of customer support, it’s going to be chatbots or background-decision-making when it comes to processing data. This is also one area where a lot of progress is being made. In the end, the google chess / GO player is no different to a neural network. It got a lot of data and had to make decisions from it. I give it access to a large amount of data and tell it to make the best decisions.

M: Where is the core difference between a computer system which playes chess compared to a system playing GO?

S: AlphaGO is a neural network. GO was initially fed with 5 billion moves and the best answers against them. After that, GO played against itself using this input. Afterwards it was testing moves, analysed what happened and learning whether it was a good or a bad move depending on how the situation changed. AlphaGO has been training on large server farms for weeks and always played against itself and has learned the difference beween good and bad moves. That was the key difference. Previous attempts only used human games and moves to learned from them, with the result that the AI system can not be better than the people who played before. AlphaGO has just got the game and regardless of what people would have done, played its own game and developed new moves which a person would never have made. Because no one has come up with such moves before. But alphaGO has learned that these moves get it closer to victory.
in certain situations. This behaviour was then compared with creativity. Because the fact that it was developing new moves. But in the end, it was just solving the problem using more data / computing power. But, you could say that the system has understood the game. Because it knows the difference between good and bad moves even if it is an unknown move. In the end, it is like a human being who is imprisoned for 10 years, playing GO against himself and trying all sorts of moves without forgetting anything. AlphaGO does remember every move even bad moves. In addition, AlphaGO is not affected by past games and emotions like 'I’m angry and do something rash'. That is exactly how it is with giving out loans. It depends on finding the function or mapping between input and output. In that case a machine is better than a human being. If there is a function that can be applied, a robot is better at finding the function.
C. Conference presentation transcript

Event: Intelligent Assistants Conference organised by Opusresearch
Presenter: Martin Kedbäck

My name is Martin and I look after a channel that we call digital customer service which is a retail distribution channel that we have in Swedbank. So I am responsible for development of customer facing and employee facing tools such as chat virtual assistants phone calls whatever it may be such as things that start in our digital channels and end up in a retail branch office or in a contact center.

I’m going to talk you through our implementation of Nina web which is a Nuance product that we have implemented about a year and a half ago. I’m going to start just by setting the scene a bit to talk to you how we think why we think we need to change given factors that affect us in the financial industry and take a look at how we will position a virtual assistant in that context.

Alright first though just because you love it I’m going to start with a corporate slide just to tell you a bit about Swedbank.

So Swedbank is a fairly big retail bank in Sweden and the Baltic region I’m not going to go through all the stats on this slide but I think as you can see we have a big chunk of the population in our customer base and that is intentional of course we like having a lot of customers but it’s also stating that is a bank that’s all including so everyone’s welcome we’re not a niche bank in any way we don’t specialise in the private bankers or corporates or everyone’s welcome we do a bit of everything and that says something about how our customers interact with us and I’ll come back to that again a bit later.

So financial industry is going through a quite a big disruption I’m sure you’ve heard it a couple of times before I’m not going to go through all of it to you but it’s an important thing to keep in mind when we talk about our digital strategy and again the virtual assistant.

A lot of really really good competitors are out there in the financial industry and they are disrupting our business. They’re taking a good business from us by being better that’s what’s really happening so that’s happening in the savings part of our business or in the payments part for example we need to make sure that we do something different in order to to stay alive and stay relevant in this environment.

what we see is happening right now and will happen in the next year or a couple of years is that everything that we can digitalise in banking will be digitalised, so today
tip all of your banks will probably let you do your transfer money between one account to another digitally for example.

we want to make sure that everything can be done digitally so a mortgage or consumer loan for example. we also think that we will have to introduce a robo advisor when it comes to investments in savings or other other investments that you want to do and this is not only driven by technology technology is an enabler in that sense but it’s also driven by legal regulations that we are facing in the European Union we have to do something different because it’s not going to be cost-efficient for us to provide advice in physical meetings anymore. we believe that bank products like someone else was mentioning this morning will become a commodity people expect that the banking business is just normal for them we need to do so something specific to show that we can add value to our customers by differentiating service and again finally we think that customer experience is crucial.

so if you think about all these points or at least some of them is relevant for us when we think about how we will introduce a virtual assistant in here for example robot voice is a really good example of where we want to position a virtual assistant in there somewhere to help our customers to make better investments automatic.

again then just showing what’s happening in our business so these numbers is the increase in digital visits that we’ve had from 2011 to 2015 so we had 350 million in 2011 and now we’re up to over a billion digital visits in our channels online channels you can also see on this slide that the telephone bank and the branch offices they remain quite stable there’s not that much difference.

so what’s happening due to technology and things that are changing people are just contacting us a lot more than what they used to that that’s what we’re seeing engaging us a lot more and if we take that down and look at the contact center purely we had this year we will have about four and a half million people calling us or getting in touch with us somehow.

we know that out of those four and a half million two million will be transactional and by transactional we mean that that’s something that you could have done in another channel you could have done that by self serving you in our online channel but you still choose to engage with us somehow.

eighty percent of our customers will have logged into our online channel at least once a month and thirty-nine percent of our customers are only on our mobile device they’re never ever anywhere else which is pretty cool and we need to think about that when we develop new features and if you are on the mobile device you tend to spend quite a lot
of time there 21 for average logins a month and that’s excluding checking your balance so people spend a lot of time in our mobile apps.

and if we think just a bit ahead we believe that our customers will do this even more so primarily they will contact us through digital channels and again like I said before everything should be done by self service and a key driver for us then is to make sure that we take all of these transactions transactional calls or contacts that we have and turn them into relationship building complex instead which is banking for saying selling stuff more or less that’s what we want to do we want to spend more time with our customers making them feel better and making sure that we make a bit more money in the process.

okay so looking at the Nina web project and that started about a year and a half ago we we had a problem statement in our business we realised that our agents in the call center and the people who work in the branch offices spent far too much time searching for information they were talking to each other or browsing our internet page trying to find stuff in the customer meetings that they couldn’t so in a process perspective there was a lot of waste so that was our problem statement. so we sent out an RFI to a lot of vendors regarding that problem statement and a lot of people came back to us saying that we can fix that problem for you but then the guys that were that we’ve chosen to work with now from from new ones came back and said that that’s we think that you were doing this in the wrong way you it’s good that you want to create the Wikipedia but you should start by actually taking out all those transactional calls that you don’t want to have in the first place so do that first and then make sure that your day-to-day business becomes more effective and when I say that now it sounds like we were just a bit stupid not realizing that in the beginning but it’s it’s sometimes you become quite silo-ed and forget the bigger picture I do work in a bank.

so we decided to implement our virtual assistant since you are all here I’m quite confident that you know what a virtual assistant is but just in case if anyone stumbled into the wrong session or so it’s like an automated chat that we have and the key thing I think for us in this project it’s that it’s not a QA.

it’s something that actually has an automated conversation with our customers and the point there being that we try to get to the root cause of the problem to make sure that we actually solve the question of the customer had in the first place.

so there’s a key difference this is what it looks like at Swedbank you’ll notice that we don’t have an avatar we have chosen to go for another another look and feel which is more we try to make it feel a bit more like Google.
and again going back to the statement of our bank being all including this is the intent here is to be open inviting please contact us we can help you with all kinds of questions I don’t know yeah you can probably read it here it’s it’s a google translated but basically it prompts our customers to to go ahead and ask as many questions as you can and the more questions you ask to this function the better it will become so what happens if a customer decides to type in a question in this case someone has asked about a amount under account that has been reserved and they don’t know why so don’t they they won’t ask us about that a new window will pop up and the agent will provide an answer in this case telling them that don’t don’t worry about it this is a reserved amount and you will be happy in a couple of days you will know what it was you purchased which is all good and then if so we have two layers of our agent sorry I forgot to tell you that so this is the external layer this is the customer facing layer that we have then we have an internal version as well so if you imagine an example where a customer has gone into our virtual assistant and they asked the question about the reserved amount and they weren’t happy with the answer for whatever reason so they decide to call the call center or visit the branch office instead our employees can then type in the same question in the assistant get the same answer as the customer did for transparency reasons but then they also get an option to get internal information and if you hit that you will see that you get prompted to get a more efficient customer meeting so this is kind of like a next best action feature that we have.

Ok I’m going to show you some stats that we have so we’ve had this again then going for about a year and a half we average on about 30,000 conversations a month and out of those conversations we have a first contact resolutions of about eighty percent so that means that our sorry our customers questions are taking care of eighty percent of 30,000 each month.

And out of those if you break that down even further there are sixty percent that are deflected and deflected means that these people do not have to get in touch with us at all they’re happy enough with the automated answer that they got from the Nina web. the other eighteen percent is channel so that means that we choose to direct the customers to another channel please call the call center or login to your internet bank for example.

On the other side the conversations that we can’t handle are either abandoned so we can’t do anything with them at all or escalated so that means that we we try to capture that information anyway by making sure that the customer reaches out to us in another channel so it’s more customer driven channel movement if you like. so if you look at
what’s been good with this project I think the key thing for us here is that it’s all customer driven that’s been a crucial part of this project success. so the functionality is works in the way that we don’t put anything in there that our customers aren’t asking us about the only time we update the the answers in Nina is when our customers are starting to ask questions about things that we don’t have there already which is brilliant. and we have a couple of examples where product owners at Swedbank for example someone owns the product for insurance have come to us and tried to ask questions about insurance in Nina and they were very unhappy with the answers and they come to us and say that hey there’s nothing in there about insurances this is crap you got to do something with the product.
we can just turn that around and say that sorry not any single one of our customers are asking anything about insurances so it’s not our problem it’s your problem you need to think about your product and what and why it’s not more visible out there.
so that’s a very good thing and again then as you saw on our stats we got really good results really quickly which which made it easy enough to sell to top management which you need to do to get investments so that was really good.
we had a project we I think six months maybe I’m exaggerating slightly I think it was seven months in reality from when we decided that we want this until we had it in production which again I work in a bank so I don’t know how what it’s like in other businesses but for us that’s just exceptional in terms of speed.
and I think that was much the reason for that was a there was a cloud solution which made it a bit more easy to implement and be that it was a joint project between us and Nuance in this case that made it very very quick and easy to deploy.
another key thing or two key things I can put them together is the dedicated team that we have and the stakeholder management that that team does.
so this is not a self learning tool it’s it’s actually manned by people behind so it’s an automated chat but for it to work we need to make sure that we fill it with the right type of information so we have three people working as content management content managers now one of them’s right there Emma and they do the work so they monitor everything that’s happening out there with Nina and they make sure that the conversations are up to date so that we can continue to have these nice numbers.
that we have that’s also done in cooperation with with Nuance and also as a Content Manager you need to make sure that you manage all the stakeholders that are out there communications and product owners and whatever it may be legal everything needs to be okay because this is presented to customers so that’s that’s a key thing to think about
when you do this as well.

all right next up for us we are so we have a bit of a weird organization at Swedbank we have a Swedbank which is a retail organization with a lot of branch offices and then we also have a lot of what we call savings banks which are like regional banks there is 58 of them and they will they’re all part of sweat bank but they’re uniquely branded so they have a name that’s unique to them and they may have some products that are unique to them and they also want to have our Nina web implementation so that’s what we’re doing right now so we’re going to have 58 implementations of Nina when this year is over

which is pretty cool and they all look a bit look a bit different it’s a different look and feel to it but the engine and the content it so it’s it’s almost the same we’re also going to make sure that we move Nina into our digital channels so sorry for the typos in this slide but but what we’re going to do is that we move Nina into the mobile channel and the secure channel that we have.

which will for us create the foundation for what we really want to do so what we’ve done here what I’ve shown you here is the step a in what we want to achieve moving Nina into our secure channel and our mobile channel is step B.

when we’ve done that we can actually get to the point where some of the other guys we’re talking about here before i think this is the foundation for us to actually have a a proper intelligent assistant that can help our customers all the way with their day-to-day banking.

so you could for example imagine a case where you could start asking for a consumer loan or maybe stating i want to buy a car at Swedbank dot SE and then you would actually help the customer all the way through move them into the internet bank follow along in that conversation and make sure that you close the deal and everyone would be happy.

what we’re also going to do is to make sure that we connect our nina implementation which will then be in the mobile app with a live chat so that you should be able to move when if you remember on the stats i had a couple of channeled questions so people that need to go somewhere else we want to capture that in a bit better way so we’re going to move from automated chat to a year normal assisted chat.

Okay that’s it from me unless you have any questions my question is whether the customers have authenticated before they go into Nina or not or mixture if they’re authenticated? they’re not now but they will be as we move it into to the next step so this is all unauthenticated customers right now.

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Audience question:
You said interactions are being handled via Nina has that translated into large operational savings or reinvested to provide better customer service what is the success criteria? is it excellent customer service or the operational saving?

Martin: Okay yeah it’s a good question i think it’s switched so this was driven purely by cost-saving interest from us from the beginning going back to all those transactional calls that we had and we have saved a lot of money by implementing this tool but we’ve also seen then the the things we can do in the future the potential that we have our now which is going to switch it to being a much more customer friendly driven project in the future absolutely but driven by cost saving yes and it works.

Audience question:
other questions like I have a good question you mentioned as far as having that kind of a unlimited scope but like in terms of understanding that the banking products that people are asking then you’re going to move into 58 written you know products how did you prioritize what what banking information it was going to be first or from a customer standpoint?

Martin: Okay if from the idea that the very beginning of the project we threw in the 100 most commonly asked questions on our website that was a starting point but then we just threw it out there we put it out there and let the customers decide what questions were important so that’s regardless of the savings banks which was and that was a big eye-opener for us because we were pretty clear on what we thought our customers were going to ask us and it was completely different from what from what they were asking us and the same thing with the savings banks now the savings banks are using the 58 different ones they’re using the same databases we have as the basis and now we’re going to have to see I think it’s going to take some time before we know if questions are going to be radically different from the savings banks but we don’t know that yet.

Audience question:
Last one hi you talked about having an internal version of Nina as well as an external how’s that being received by your employees?
Martin: It’s been a bit of both to be honest I think the intention that we had is too well if I put it like this for it to work we need to make sure that our employees talk in the same way as our customers do and we found out pretty quickly that they don’t. It’s a lot of internal jargon going on which means that Nina isn’t working the way our employee is expected to so we’re looking into that now I think we’re going to have to rethink it maybe create the database which is completely internal yeah so right now if we look at usage is not at all where we want it to be internally but it’s okay but it could be a lot better all right.