

Fostering a Model for an Effective Cognitive Virtual Assistants aka “Chatbots” for the Banking Customer Service Experience

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1 An Overview:

The use of automated virtual assistants (chatbots) has been increasing exponentially over the years. Companies deploy them for many reasons ranging from improving and bettering customer experience, decreasing cost, generating leads, providing basic answers to customer’s questions, etc. While this conversational software has gained a lot of traction and use case scenarios they have often not been optimal in performance. According to (3) some of these tools still fall short on realizing their full potential especially the rule-based virtual assistants, and as a result many efforts have been directed towards improving these systems. In-fact recent advancements in computing technologies has led to the introduction of cognitive capabilities into the chatbots in a bid to improve their operations. Despite this, a recent study (4) shows that a lot of the systems incorporating this new technology such as Facebook’s messenger chatbot failed to solve 70 percent of customer’s inquiry. Hence, our goal is to consider the impact of these developments in cognitive computing for virtual assistants and their consequences on customer service especially in the banking industry. In this study our aim is to assess the effectiveness of these cognitive systems in satisfying customers’ needs and where necessary to develop a prototypical cognitive architecture/model for these agents which will enable them generate, process, intelligently analyze customers’ data and provide feedback to customer in a way that shows significant improvement in correctly addressing customers’ request. The outcome of this study shall be useful not only for the banking enterprises but also every other company and business which require virtual assistant systems for customer support. For the purpose of this study chatbots and virtual assistants are used interchangeably.

2 Background – Literature Review:

Cognitive Computing (CC) which can be attributed to an evolution of Artificial Intelligence (AI) has been gaining traction and attention in both academic and industrial circles in recent years. Often used interchangeably, cognitive computing (CC) is however quite different from artificial intelligence (AI). Russel S.J., et al in (8) defined AI “as the designing and building of intelligent agents that receive percepts from the environment and take actions that affect that environment” John McCarthy popularly known as the father of AI in (9) referred to AI as the science of making intelligent machines such as computer programs. In other words, it is the ability for expert agents to intelligently carry out the type of activities normally associated with human beings. These computers when scaled, can outperform human intelligence usually without human input. Cognitive Computing on the other hand follows a different approach but goes even further, it strives to replicate the human thought process and the way a human brain logically goes about solving given problems. It does this while analyzing humongous data, learning from the data and then presenting useful knowledge to a human agent for final decision. In other words, it strives to augment

the human intelligence. For example, when faced with a case of opening an account with a bank, cognitive agent wouldn't just process best accounts class to open based on customer known activity pattern and present the best fit situation, it would rather strive to approach the query in such a manner that a human would, trying first to understand, then reason and learn while interacting with a human by providing valuable insight that enables the human make the best decision in such a situation. It is this quality of the cognitive computing that has made it very attractive for development in virtual assistant systems which require high degree of conversation modelling for optimal human interaction.

The banking industry has not been immune to these technologies but have in-fact embraced them as opportunities to better enhance their service offerings to customer. According to a paper by the European Banking federation (10) Banks have increasingly adopted a wide range of applications in their operations and are actively investing in research and development of AI application as an integral part of their operation with the expectation that it would significantly improve its customers experience and ensure better efficiency in compliance management. A research by (11) shows that four of five bankers believe that AI would completely revolutionize how banking has been done in the past. Ashoka and Vinay in (13) asserted that the banking sector is gradually moving towards digital banking this is largely due to competition from modern digital banks who do not run at similar cost as these traditional banks yet meet them on equal playing fields in the open markets. Customers themselves are increasingly demanding innovative way to improve their banking experience and the banks who pioneer this and similar technology have a lot to gain as more consumers will switch to them. (14) goes further to affirm that customers want their finally activities and transaction to be available to them 24 hours through digital channels. One way banks can achieve this is through integration of AI in their services via tools such as chatbots.

The EBF (10) in its paper reached the same conclusion and identified three main categories of immense opportunity to the banking industry namely: 1) by enhancing customer interaction and experience in areas such as chatbots, robo-advice, voice banking etc. 2) by enhancing the efficiency of banking processes in areas such as process automation and document classification and finally 3) by enhancing security and risk control and compliance monitoring. For the purpose of this study we shall be concentrating on the first category which is identifying ways of enhancing customer interaction and experience and we shall be looking at the role chatbots has played towards this and whether the application of AI's cognitive computing capabilities has and can significantly scale up and improve this process. We shall also look at some developing improved cognitive architecture and models that can help support the research and provide some sort of roadmap for future developers.

3 Proposed Work:

Aim and Objectives: The main aim of this research work is to determine the effectiveness of cognitive computing enabled chatbots in delivering quality customer service and developing a model based on findings.

- Determine if the introduction of cognitive abilities in chatbots is indeed fit for the purpose intended and if the technology makes any significant difference on how the software/chatbots handles and processes data.
- Build a virtual assistant chatbot and design algorithms including a conversational model for customer interaction.
- To determine if there is any material difference and/or benefits from chatbots running CC and if they can yield optimization of customer experience by using a second untrained chatbot as a control experiment.
- Develop a prototypical architectural frame for the program as well as the conversational model it would be built on.
- Develop an assessment plan for the project, to be tested by both customers and bank employee.
- Conclude the research project findings in a manner consistent with a Ph.D. thesis.

3.1 Rationale:

Chatbot represents a technology that has huge potential to bring about high benefits in terms of cost reduction, customer service improvement and general personal assistance if it can be built very well with the right algorithms and AI technology. It has the potential to permeate every aspect of our life ranging from small task such as obtaining weather report, ordering our favorite burger, booking a hotel reservation or even doing more complex things like helping with booking a bank loan or providing investment advice. However, the underlying AI platform supporting these chatbots, the NLP capabilities, the conversational design built into it, etc., all play an important role in determining the degree of effectiveness of a chatbot and indeed if the chatbot can meet desired expectation both for the organization deploying them as well their customer who make use of these smart systems. Gartner in (6) predicted 70percent of Organizations will integrate AI to Assist Employees Productivity by 2022, up from 15percent in 2018 and virtual assistant systems (chatbots) feature very prominently in that list. IBM backed this up in (7) that industries where these chatbots operate such as healthcare, retail, ecommerce and of course banking, could save up to USD 8Billion annually in cost by 2022, up from USD 20Million in 2017. Which is an exponential rise. Obviously the future looks good for the chatbots but at the moment they are facing a difficult time and almost even neglect except in some small quarters. The reason being simply that they haven't gotten smart enough yet to handle customers' complex queries. There are also not much researches into these chatbots carried out by academics, research where done are largely performed by private organizations who may decide to keep their findings proprietary and as a result knowledge isn't shared nor is it widely available to enable the chatbot technology develop as the faster pace it could and should have. However, with the introduction of cognitive capability in this systems and the newly discovered potential of these systems with their ability of autonomous learning, lots of interests are returning to chatbots once again and that is what this study is trying to contribute towards.

Finally, despite the numerous challenges and benefits. It is possible to build chatbots that do work, but it has to be done the right way. This study therefore seeks to add to the body of exiting knowledge in the AI community and try to reproduce in clear terms the impact these virtual assistant can provide customers satisfaction if cognitive capabilities are correctly built into them by developing a model that exemplifies same.

3.2 Methodology:

Here the method for carrying out the research is described and grouped into work packages. These work packages will be described in details in the next section but we will give them shape here. The research seeks to determine the effects of cognitive enabled virtual assistance usage on bank customer's user experience. In order to achieve this analysis the candidate must first of all carry out an extensive review of related literature in this domain to attain a broad background knowledge. He must then carry out an analysis of the research variables to determine fitness of purpose and validate them accordingly. Next he must determine a bank who he/she wishes to partner with in carrying out this research. Some terms and condition should be agreed with ahead some of time like availability of resources both, human (experts in the field who will provide support during the research such as repeatedly querying the chatbots as customers would and providing feedback on observations), time, hardware and software, etc. A sample of 20 customers would be selected for the study. The selection would be purposeful rather than random because we will need loyal customers of the bank that would provide time and honest feedback from their interaction with the chatbots. A framework for the model would be developed and perfected later. Two chatbots built one would be used as a control and while the second would be enhanced, with new algorithm and cognitive computing capability based on feedback from testing. Both will continuously be feed the same amount of data but the algorithm of the first will not be modified. At the end of the testing period both software would be presented to study sample in turns and feedback taken in terms of how the bots performed in providing solutions to queries. A qualitative approach to data collection will be conducted and will include some interviews. Following a satisfactory outcome of the study the final version of the software would be validated by the bank experts and deployed, a completed model developed, a reevaluation plan and final report prepared for the study.

3.3 Work Packages:

WORK package 1: Here the candidate is to read up major publication on the domains of research which includes AI, Cognitive Computing, Virtual Assistance development and Customer Service relations in the banking sector. He must understand the use case scenario of virtual assistants especially in banking industry and how cognitive

ability can be deployed to make them better execute their task. There after he must now undergo the task of assess the fitness of purpose of the research variable for the study at hand, the objectives, questions and other individual tasks to be performed. The PhD dissertation advisor will guide him in the right direction when necessary.

WORK Package 2: Here he must decide on the organization he would be working and agree on such terms as duration of the study, support he will be getting from the organization in terms of resources needs and as the value he will be creating for the organization by insight provided from the study. He should select his study sample of 20 customers at this stage.

WORK Package 3: An initial framework for the model that the candidate would be using for the model shall be written and the chatbot designed and developed at this stage. Two of the chatbots are to be created here, the first one being the control experiment and the second one being the actual program that will be augmented with Cognitive algorithms though out the development of the study. Data and customer queries records would continue to be fed to both systems, maintained and observed but only the second one would receive cognitive capabilities.

WORK Package 4: At this stage both software would be prepared for presentation to the sample study, the first chatbot at first and the second next without them knowing of the control experiment. They will be given the same set of questions for both bots and allowed to make up some additional questions of theirs afterwards their feedback as well as ratings on which of the bots where able to answer their query's satisfactory obtained for further analysis.

WORK Package 5: final feedback is obtained from the bank experts and other stakeholders and recommendation where necessary made. A preliminary report on the finding throughout the research would be submitted to the research stakeholders for the approval and validation of the prototype.

WORK Package 6: Developing of the final version of the virtual assistant would be done at this stage as well as the final version of the framework for the model. Also a revaluation plan and feedback would be designed at this stage to ensure the continuous efficiency of the virtual assistance.

WORK Package 7: The Final report on the findings of the research and the framework adopted would be done at this which brings the research study to a close. The report will further be published in an appropriate journal that will ensure that the new information is added to body of knowledge in the AI and chatbot domain and that it is available and accessible to all researchers and knowledge seeks in the field.

4 Professional, Legal and Ethical Issues:

The primary issues concerned with this study and the deployment of this cognitive agents would arise in the area of security and privacy. A 2020 survey carried out by the Tech vision giant Accenture in (12) says that two out of three consumers they sampled were worried about how their personal data and online identity for personalization purposes would be used for commercial purposes in much the same way they were about security threats and hackers. Also there were concerns raised about safety of chatbots as they might be compromised by third parties to carry out phishing activities for unsuspecting customers. This and data protection laws such as GDPR would be of immense concern to banks and the study will provide recommendation in its final report on how some of these challenges could be addressed securely.

5 Relevance to Beneficiary:

The research work would be of major benefits to banks and other financial institutions who are in the business of providing services to the customer. However, beyond banks and financial houses this ECC framework could be deployed to other companies and/or industries that deal with a lot of customer data and are looking for ways to exploit their dataset for improvement in their service offerings and customer experience. This would save cost in both time and money as they don't have to undergo the process themselves but instead draw from the available knowledge of an already tested and proven system.

The outcome of this research can also benefit AI tech consumers in their everyday lives such as those who own an Amazon Alexa, or those who simply wish to book a doctor's appointment through intelligent bots on their mobile phones, etc. Since they all operate on the same underlying technologies, this study would develop useful models that will improve existential knowledge in the field.

As the model would adopt underlying technologies such as NLP, ML, etc., shared by many other cognitive computing projects, the framework will be of value to the AI research community who are involved in similar projects. Finally, academically this work would yield doors to future research and provide reference point for students of De Montfort University and other institutions around the world who pursue knowledge in similar subjects of interest.

6 Justification of Resources:

Organizations invest a lot of money in trying to develop a computer technologies that meets their growth needs, so it is only necessary that in deploying resources we use some of the best available tools for the research to ensure optimum results.

People: This is a highly skilled and very challenging field, so I recommend that the candidate for this research should be a PhD candidate with a Computer Science background with a strong knowledge in Artificial intelligence and huge passion for machine learning and cognitive computing. He should have good programming skills and familiar with cognitive computing tools currently available in the market. The PhD researcher would need an experienced researcher from the same computer science field who will serve as his PhD dissertation advisor.

Hardware and software: A windows 10 computer should for the researcher with a minimum of 8G RAM and 1T HDD. A cognitive computing software tool such as IBM Watson, Microsoft Azure cognitive services, etc., would be crucial to the study so the researcher should pick a bank that runs any one of the cognitive computing tools to study e.g. Citigroup, Royal Bank of Scotland, etc. Where this is not available an open source cognitive computing toolkit can be used.

Access to Subject/Facility: A meeting should hold in advance with the bank's representatives discussing the purpose of the research and the expected returns to the organization in order to facilitate mutually beneficial collaboration between both parties. Two data scientist at the organization should be seconded to the research to provide him with support and guidance in accessing the company's datasets and necessary tool.

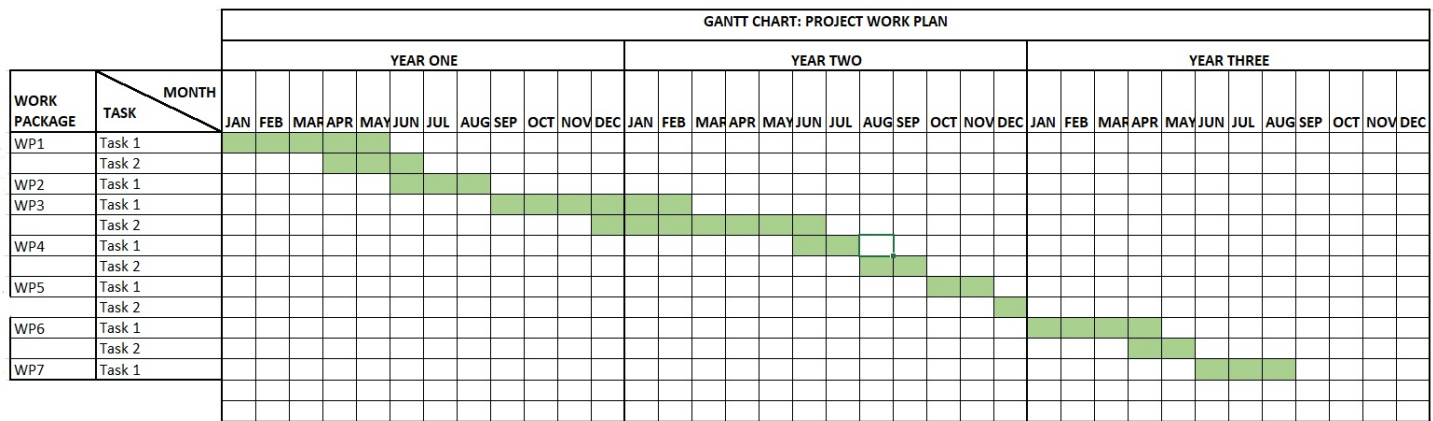
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8 GANTT CHART:

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Work Package	Task Description	Task Period (Month)
Work Package 1	Task 1 - Literature Review	5
	Task 2 - Research Work Assessment	3
Work Package 2	Task 1 - Organization and sample selection.	3
Work Package 3	Task 1 - Develop Initial architectural model	6
	Task 2 - Build chatbots, algorithms and apply data	7
Work Package 4	Task 1 - Preparation of chatbots for first time testing by sample	2
	Task 2 - Actual deployment and testing by customers	2
Work Package 5	Task 1 - Collection of final feedback from expert users and stakeholders	2
	Task 2 - Preparation of preliminary report on findings	1
Work Package 6	Task 1 - Development of final version of chatbot	4
	Task 2 - Development of final Architecture and Model	2
Work Package 7	Task 1 - Final research report and thesis and its publication.	3



N/B: Time is represented in monthly units

Figure 1: Gantt Chart