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Chatbot as Islamic Finance Expert (CaIFE): When Finance Meets Artificial Intelligence

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ABSTRACT

Artificial intelligence (AI) is the key technology in the new disruptive technological innovation and industrial transformation. AI has very wide application in finance and banking. The financial institutions not only answer the queries of the customers, but they should also clarify the complaints the customer face and provide the solution. For this purpose, many banks and financial institutions are using Chatbot to provide solution to customer complaints and queries. Chatbots are very efficient in providing solution to customers queries and are available 24 hours to give solution to customer's complaints. Finally, we propose an artificial Intelligence based interactive Chatbot called 'Chatbot as Islamic Finance Expert' (CaIFE). Our interactive Chatbot CaIFE receives automatic robot support related to Islamic finance and banking by having users communicate with a robot having knowledge accumulated by machine learning. It answers any query related to Islamic finance and banking on real time basis. It then presents a case study of CaIFE and explains its characteristics and limitations.

CCS Concepts

•Computing methodologies → Artificial intelligence → Distributed artificial intelligence → Intelligent agents

Keywords

Artificial Intelligence; Chatbot; Financial Expert; Islamic finance; machine learning; NLP; Sharia.

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1. INTRODUCTION

In the last decade we witnessed a sea of technological innovations in financial services sector like never seen before. The financial technology (FinTech) sector has seen most of these innovations [1]. As the nature of services provided by the financial institutions is

complex and it's not easy for a common man to understand easily. The customers face many queries and complaints on daily basis and tries to contact bank branches to get their complaints answered [2]. Many financial institutions and banks are turning to the financial innovation called Chatbot for customer support and sales purpose. The word 'bot' in the Chatbot is derived from the word 'Robot' which means a computer program based on the machine learning and natural language processing (NLP) to communicate with the people like human being [3][4].

Introducing Chatbot in the Islamic Financial Institutions (IFI's) will help these organizations to respond to customers queries on 24/7 basis. For example, applying Chatbot technology in the sales and customer support will not only help the IFI's to save cost on salary and wages but also can make its operations more efficient. 80% of the customer who use Chatbot for financial services are very positive about it [5]. Though in some countries it was revealed that perceptions about the Chatbot is positive among the users, but they prefer to communicate with the human being [5]. Chatbot is the technology to look forward to save cost and give customer a better experience [6]. Using the Chatbot is the fruitful way of communicating with the customers in comparison to the conventional search engines. The number of exploration session for a Chatbot is 25% lower than the google search engine [2]. The Chatbot can help in Personal Financial management and wealth management [6]. If user is not able to type properly and don't know how to ask questions, then they can use voice command for asking questions [7]. It allows multiple threads facility where it is possible processing of multiple incoming and outgoing messages. We can use interesting graphical user interface and animation, so users feel that they are chatting with another human being [1].

Fintech means the techno finance or financial technology to provide the financial services in the most innovative way with the use of technology. On the other hand, Islamic FinTech is the use of technology in financial services that does not violate the sharia principles [8]. Islam accepts all the innovation with open arms as long as it does not violate the sharia principles. Islamic FinTech is very close to the ethos and principles of sharia as it removes two major risk in banking industry, uneven maturity and leverage [9]. Islamic Fintech is different from the conventional Fintech as it is transparent, compatible with sharia and beneficial for the all the parties concerned. Fintech can provide a number of opportunities to Islamic banks [10]. As Islamic banks are still lagging the conventional banks by a long margin. FinTech can provide a level playing field for the Islamic banks as it provides new and innovative services or old services wrapped in the new way [31]. In the aftermath of the financial crisis, NextGen Islamic finance is the use of FinTech for providing financial services in a safer, better and at lower cost [11], [12].

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2. ARTIFICIAL INTELLIGENCE AND CHATBOT

The use of Artificial Intelligence (AI) is not uncommon nowadays, it can be seen almost everywhere from general purpose applications such as photo or image processing to very sophisticated application such autonomous driving or self-driving vehicles. The use of Natural Language Processing (NLP), a subfield of AI, is also increasing day by day such as in Machine Translation Systems [13], [14] Question Answering, Sentiment Analysis [15], and Chatbots etc. Chatbots uses AI and NLP to communicate with the users. Different NLP approaches such statistical [14][16], case-based reasoning [17], [18] and artificial neural network [19] has been used in building NLP based applications and for handling language issues such as translation divergences [18] and case markers [16] etc.

The earliest development of chatbot (ELIZA) was in 1960s by Joseph Weizenbaum [20], MIT professor, however, the term 'chatterbot' was first coined in 1994 by Michael Mauldin [21], [21]. However, the use of the chatbot has been seen a tremendous growth in the last decade [22].

Most common use of chatbot has been observed as customer care service agent. However, there are several researches which has used chatbot in different-different application areas such as in library [23], [24] and financial service agent [7], [25]. This paper discusses the utilization of chatbot as Islamic Finance Expert. CalFE [26], [24] has been built on the IBM Watson framework and consists of around 45 entities, 70 intents and around 1100 of possible training examples currently and growing continuously. Entities are the information which user has entered while conversing with the chatbot and has a specific purpose in the conversation. Entities are usually represented as noun such as the object of something or information for a context such as Date and Time mentioned in the conversation like New Year will imply 01-01-2020. Intents are more like the verbs or the actions which user

want to perform, for example, if user says during the conversation that he wants to cancel the something or buy something or open account, so the relevant intents can be #cancel something, #buy something or #open account etc. The context of the intents and entities are another important criterion while developing the knowledge base for the chatbot. Islamic Fintech is the new and growing research area [27] and many disruptive technologies is being used in developing Fintech solution for providing Islamic Financial Services [4], [28].

Multiple Bot frameworks such as Microsoft Bot Framework, Rasa NLU, Dialogflow and IBM Watson are available for developing chatbot, each framework has its own advantages and disadvantages. There are several other bot building frameworks available as well such as Facebook WIT.AI, Botkit [29], [26] and Amazon Lex etc. We have considered some of the major frameworks to review which are Microsoft Bot Framework, Rasa NLU, Dialogflow and IBM Watson. All the frameworks which we have reviewed have certain advantages and limitation of use. Choosing which framework to develop CalFE with, was also the challenging task for the authors. For example, Microsoft Bot framework services are easy to use, it is open source and can be integrated with other messaging platforms but it depends mainly on Microsoft services such as .NET, Rasa NLU supports enterprise platforms and is open source but require coding and development experience. Dialogflow is one of the most popular frameworks for virtual assistant specially on mobile platforms and provides one of the most comprehensive toolkits for building bots but organizing and managing high number of intents is complex and difficult and requires a lot of manual and admin work. IBM Watson APIs are easy to use and comes with prebuilt graphical user interface. After reviewing multiple frameworks, the authors adopted IBM Watson because of their familiarity with the framework among some other reasons. The following table 1 describes the advantages and drawbacks for these (Microsoft Bot Framework, Rasa NLU, IBM Watson and Dialogflow) major frameworks [30], [31].

Table 1. Advantages and Drawbacks for Multiple Bot Frameworks.

Bot Frameworks	Advantages	Drawbacks
Microsoft Bot Framework	<ul style="list-style-type: none">• Open Source and available for free on GitHub• Services are easy to use• Adds NLP support and integration with messaging platform is easy	<ul style="list-style-type: none">• Some services are paid such as Azure and Lex• Require coding experience and simple logic require complex• Relies heavily on the Microsoft's service and in compliant with non-Microsoft platforms
Rasa NLU	<ul style="list-style-type: none">• Open source• Supports enterprise platform• On-premise hosting is possible	<ul style="list-style-type: none">• Require coding and development experience• No possibility to integrate with other messaging clients• User information management is not supported directly

Dialogflow	<ul style="list-style-type: none"> Can be integrated with most popular communication platforms such as Skype, Facebook Messenger and Google Assistant Bot building comprehensive toolkit and NLP support is available for developers <p>Available and supported by multiple platforms such as iOS, Android and Windows Mobile.</p>	<ul style="list-style-type: none"> Organizing and managing high number of intents is complex and difficult Requires a lot of manual and admin work in managing intents <p>However, free trial is available, but you need to pay to use the service for longer time</p>
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The following figure 1 represents the architecture of the Chatbot as Islamic Finance Expert *(CaIFE). CaIFE has been developed using IBM Watson framework. It consists of around 45 entities, 70 intents and around 1100 of possible training examples related to

Islamic finance and banking currently and growing continuously. CaIFE is still at its evolving stage and the authors are continuously trying to improve it on the basis of comments and suggestions received from the users.

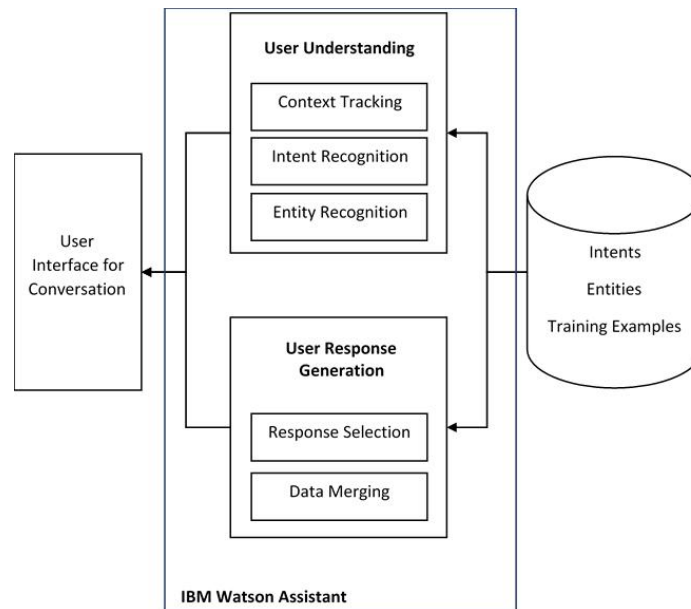


Figure 1. CaIFE architecture.

3. RESULTS

The following figure 2 displays a user's interaction with CaIFE. CaIFE is still in its infancy and continuously improving and growing. As has been discussed in the research [22], [3] one of the challenging tasks in chatbot assistant is to understand the complex

sentence structures and provide appropriate response [32], [33]. CaIFE is an initiative to solve this problem and to be one of the best Islamic Finance Expert chatbot. As discussed, and presented in the following figure, CaIFE is able to understand complex sentence structure and respond direct and unambiguous responses to the user.

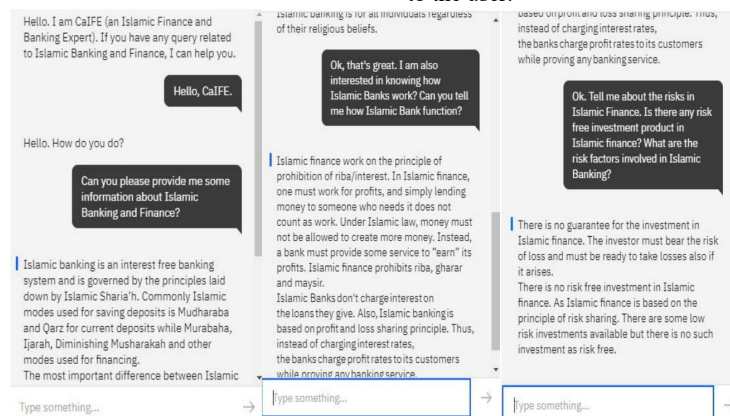


Figure 2. A conversation with CaIFE.

4. CONCLUSION AND FUTURE WORK

From the all above we can conclude that technological innovations are at the peak of its prowess and financial services sector has already witnessed most of it. Now financial services organisations have adopted to the changes brought in by the FinTech companies. FinTech organisations are more like working as a partner to the banks and financial institutions. Though Islamic financial institutions (IFIs) are late to adopt the technological advancement but its better late than never. Now, IFIs have already adopted to these innovations and competing with their conventional counterpart. Chatbot has been very popular among the conventional financial institutions to interact with the customers and solve their queries. CalFE is the chatbot designed primarily designed to interact with the Islamic bank customers and answer their queries. CalFE can handle almost all the questions posed to it related to the basic concepts, rule and regulations, types of services, sharia compliance and all other queries related to Islamic finance. One of the limitations of CalFE is that it cannot solve the numerical questions. The authors are working to make CalFE compatible to solve numerical questions related to Islamic Finance.

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