IS 601

Term Research Paper

Topic: <u>Machine Learning in Intelligent Virtual Assistant</u>

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1. Introduction

WWW (World Wide Web) is working on a large scale; it is constantly growing and searching for relevant information and it cannot be done manually. Machine learning is a part of artificial intelligence. To be an intelligent, a machine which is in a changing world should be capable of learning by itself. If is possible for the system to learn and adapt to these changes, it is not necessary for the system designer to anticipate and provide solution for any problem.

Machine learning also help to find solutions to many problems in vision, speech recognition and robotics. Machine learning is programming computers to optimize a performance criterion using example data or experience. Learning is the execution of a computer program to optimize the parameters of the machine using experience and the data. The model may be predictive to make predictions in the future, or descriptive to gain knowledge from data. Machine learning uses the theory of statistic in building mathematical models, because the core task is making inference from a sample. (Alpaydin, 2020) The process of learning begins with observation of the data, such as examples, direct experience, or instruction, in order to look for a pattern in data. Machine learning helped to automate repetitive activities that also reduced manual labor requirements. Machine Learning provides a variety of methods for making sense of this knowledge and for providing clear and reliable tests result. Most data can be managed with an accurate prediction generation by machine learning models such as Deep Learning.

Virtual Assistant is a new software class that works on behalf of the user to locate and filter information, negotiate for services, easily automate complex tasks or collaborate with other software agents to solve complex problems. (Mane, Sonone, Gaikwad, & Ramteke, 2017) An Intelligent Virtual Assistant is an artificial intelligence device that emulates human interaction, including customer service, to perform specific tasks. If a user asks a personal assistant to perform a function, the natural language audio signal will be translated into digital data which the software will analyze. Then this data is compared to a software database which uses an advanced algorithm to find an appropriate response. This database is hosted in cloud networks, on distributed servers.

How machine learning used in intelligent virtual assistant?

The Google Assistant can tell the user's car location. This feature works on the machine learning with using of GPS tracker. Location-based reminders display notifications when user enters the user's specified geographical area. The area will be saved by the Google Assistant according to the location. And when the user asks the Google Assistant where the car and assistant is simply replies with car's location. (Mane, Sonone, Gaikwad, & Ramteke, 2017) Other example is the playing music. Just say play the music in YouTube and assistant will play the recommended music. The assistant plays according to the user's search area and the history of the YouTube. These all work has been done by assistant with help of the machine learning.

A broad variety of applications in companies, education, government, healthcare and entertainment are enabled by dialog systems or conversation systems.

2. Literature Review

2.1 History

Most of the world was dependent on each other from their daily activities during the recent years before the advent of the intelligent virtual assistant. Work takes a lot of time to do manually; also, the user's choice, privacy and related data were compromised.

The first voice assistant was introduced by the IBM in 1961. IBM introduced the IBM shoebox, the first digital speech recognition tool. It recognized 16 words and digits. The Julie doll from the Worlds of Wonder toy company came out in 1987 and could recognize a child's voice and respond to it. Throughout the 1990s, companies like IBM, Apple, and others created items that used voice recognition. Apple began building speech recognition features into its Macintosh computers with Plain Talk in 1993. In April 1997, Dragon came out with Dragon NaturallySpeaking, which was the first continuous dictation product. It could understand about 100 words per minute and turn it into text. Later with advancement and enhancement in the technologies, Siri was the first voice assistant to reach a wide audience and soon followed other people such as Google Now and Cortana from Microsoft. Then the Alexa voice aid and Echo smart speaker were launched by Amazon in 2014.

Such organizations have adopted numerous methods for developing and improving their existing systems. Virtual Assistant is based on the application and its complexity are developed by several techniques. For example, Google has improved the Google Assistant by using the Deep Neural Networks (DNN) method which highlights the main components of dialogue systems and new deep learning architectures used for these components. Also, Microsoft used the Microsoft Azure Machine Learning Studio with other Azure components to improve the Cortana dialogue system. Facebook has launched its own personal assistant, Messenger M, which is working to combine machine-learning algorithms with contextual memory. Facebook is training Facebook's new virtual assistant for Messenger with supervised learning. All these companies are trying to develop the competences in several of the core technologies for their dialogue systems, such as automatic speech recognition, text-to-speech, synthetic talking face, and dialog management. (Kepuska & Bohouta, 2018).

The global intelligent virtual assistant market size is expected to reach USD 45.1 billion by 2027, expanding at a CAGR of 34.0%, according to a new report by Grand View Research, Inc.

2.2 Associated Field of Technology

Natural Language Processing is the field of artificial intelligence is which deals with the interaction of computing to human languages such as English. Natural language processing applications include text mining, query analysis, and linguistic translation. (Khan, Tripathi, Dixit, & Dixit, 2019)

Speech Recognition is a field of computer linguistics which allows the system to use efficient algorithms and methodologies to interpret the user's speech command in the executable text commands. (Khan, Tripathi, Dixit, & Dixit, 2019)

Artificial Intelligence allows electronic devices to see the world around them and take some sophisticated actions to achieve a specific target. In the simple word the machine thinks and behave like a human and can take its own decision.

Neural Network allows the assistant to learn from vast quantities of analytical knowledge using the program. It is a network that has an input layer, an output layer and at least one hidden layer in between. Artificial Neural Networks are a related community of nodes that is like our neurons

nervous systems. These are types of models that interpret as a human system and that can benefit from the data. (Khan, Tripathi, Dixit, & Dixit, 2019)

2.3 Related Work in the Intelligent Virtual Assistant

Intelligent virtual assistants are extremely important in today's life. Intelligent personal assistants have access to a large amount of information on a device or online, which enables them to perform simple tasks. It can only happen in a few seconds, by giving verbal commands to the assistant for call, message someone, weather control or traffic and so on. The primary aim of intelligent assistant is to help users accomplish their tasks. Numerous such applications are built to discover user behaviors, capabilities, interests and priorities, to anticipate the behavior of the user even more effectively and to carry them out without user intervention. Based on previous experiences, the assistant must continuously develop its conduct using machine learning algorithms and other AI approaches. (Mane, Sonone, Gaikwad, & Ramteke, 2017). Supervised learning is the best option to predict personality of the user. The other main task of the assistant is to communicate with the user efficiently. Much of this is achieved by machine learning and Natural Language Processing (NLP) subset of Artificial Intelligence (AI), that helps machine to understand speech and the user's habits, as well as developing its own personality that the assistant has to do be an intelligent. The assistant translates the languages also tackles the human errors like lexical ambiguity, syntactic and structural ambiguity, synonym by using machine translation which is worked on Deep Neural Network (DNN) and machine learning algorithms. (Satpathy, Mishra, & Nayak, 2019). The proper learning helps the intelligent virtual assistant to do task accordingly after analyzing the system and by performing certain learning algorithms, proper outcome can be achieved.

3. <u>Technical Details</u>

The parts discuss about the algorithm used in the virtual assistant to process the vast quantities of instructions. Thus, the use of machine learning algorithms in the assistant is used to look at the needs of the consumer in making important decisions.

3.1 Types of Machine Learning

Supervised learning

The developer names sample data corpus in this case and sets strict boundaries under which the algorithm operates. Supervised learning mainly has the aim to scale the data size to provide predictions on the basis to defined sample data, of unveiled, potential or unknown data. (Nawrocka, Kot, & Nawrocki, 2018).

Unsupervised Learning

If the main aim of controlled machine learning is to know the results and to sort the data, then the desired results are still unknown and still to be determined in cases of unsupervised machine learning algorithms. Unattended machine learning explains knowledge by scrutinizing and recognizing it. (Nawrocka, Kot, & Nawrocki, 2018).

Semi-supervised Learning Algorithm

Semi-supervised learning algorithms are the basis between supervised and unattended algorithms. The semi-monitored model essentially blends certain elements of both into one. Uses the classification process to classify and divide data properties into separate sections. (Nawrocka, Kot, & Nawrocki, 2018).

Reinforcement Learning Algorithm

Reinforcement learning is about creating an autonomous system that develops itself, based on combination labelled data and interactions with the receiving datum, during contiguous sequences of trials and failures. It uses an exploration/operation approach. Mechanics are clear-the action is taken, the consequences are recorded, and the next action considers the effects of the first action. (Nawrocka, Kot, & Nawrocki, 2018).

3.2 Machine Learning Problems

There are several subclasses of ML problem based on what the prediction task looks like.

Classification is the method in which incoming information is labelled using past data samples and manually trains the algorithm to identify and categorize those types of objects.

Regression describes the mechanism by which trends are defined and continuous outcome predictions determined. The program must know the numbers, values, and groupings and so on.

Clustering it consists of an analysis of the data used in order to classify the data into meaningfully relevant classes (i.e. clustering). The credentials are characterized by the similarities between individual data objects and their differences with the rest (which can also be used to detect anomalies).

Reduction of dimensionality the entry data are very noisy. Machine learning algorithms reduce the size by distilling information to eliminate this noise.

Ranking is responsible for sorting items according to a specific criterion. The most popular task of this type is the search engine returning websites that satisfy the query sent by the user. (Nawrocka, Kot, & Nawrocki, 2018).

3.3 Methodology

Methodology has been divided into two parts: data abstraction or mining and response generation. Data abstraction or mining will do the analysis of the data. Response generation is depending on the characteristics of the data generated in the process of abstraction, also depends on the algorithm, tools, techniques used in the data integration.

Data abstraction or Mining

This include the data gathering, data mining process to calculate the proper outcome of the user's given task.

The data can be gathered from the user's search history, application setting, and privacy selected by the user. The search history came from the Google search, social media activity and other day-to-day activity of the user with the machine. Data mining of the dataset can be achieved by the machine learning regression and classification algorithm.

The widely used regression algorithms- Linear regression, Support Vector Machine, Multiple Regression algorithms are used to predict financial, forecasting, traffic analysis, and classification of images, text, hypertext categorization, and behavioral analysis, social science search respectively. The classification algorithms- K-nearest, decision tree, Random Forest are used to robust noisy training data and to handle numeric, categorial data and to reduce overfitting, respectively.

The Data mining improved the outcomes of the input. It refines the items from the large dataset according to the input and mining techniques and suggests some outputs of the given task or input. Then the final decision will be taken for the reply.

Response Generation

In the machine learning, it is difficult to say one technique is suitable for all dataset. The output cannot be explained and does not guarantees the accuracy of the output as per the user's prediction. Response or output generates on the technique used in the mining. It is precisely same as the user's prediction. All the response will be saved for further task and will help to improve human-machine interaction. The response introduces the need of content adaption, the process of finding media to reply back to the user's request. For an example, the user asks for the machine learning algorithm, then assistant will reply by- here is the machine learning algorithm, and then shows the page that containing the list of machine learning algorithm.

3.4 Machine Learning Software

Apache Mahout is open source Machine Learning focused on collaborative filtering as well as classification. This is an extension of Apache Hadoop platform. Since it is implemented on top of Hadoop, it makes use of the Map/ Reduce paradigms. It provides expressive Scala DSL and distributed linear algebra framework for deep learning computation. Provides native solvers for CPUs, GPUs as well as CUDA accelerators.

Apache Spark MLlib data streaming platform, also provides advance machine learning feature with its several APIs that allow users to implement machine learning on real-time data. It supports classification, regression, gradient boosting, decision trees, random forests and so on.

Shogun Supports various language like Python, R, Scala, C#, Ruby etc. Supports support vector machine, dimensionality reduction, clustering, hidden markov, linear discriminant analysis algorithms.

4. <u>Risk, Limitation, Strategies</u>

4.1 Security and Privacy Risk

Voice replication risk "The addition of voice absolutely increases the risk level for technology users," said Nathan Wenzler, chief security strategist at AsTech Consulting. It can be easy to hack into and compromise voice enabled IoT apps, which opens up several issues regarding the privacy and the other confidential data.

Unintentional voice recording Voices within the context of the system Intelligent Virtual Assistant allowed can be unintentionally captured and transmitted to a server that permits private

conversations to be eavesdrop by other parties and hackers that might break into the data base. (Chung, Lorga, Voas, & Lee, 2017).

Wiretapping an Intelligent Virtual Assistant ecosystem HTTPS encrypts most of the communication between Intelligent Virtual Assistant enabled device and Intelligent Virtual Assistant. However, various network classification methods of machine learning that still reveal in encrypted circulation payload sizes, data speeds and other patterns that can be used for the determination of the device status. (Chung, Lorga, Voas, & Lee, 2017).

Personal Data The assistant has access to read all data of the user from the device. But the user generally not aware of this grant.

4.2 Limitation

Automation is a metric that is more specific to chatbot and Intelligent Virtual Assistant. It indicates the ability to understand user queries and provide relevant answers. The basic rule is greater automation, the better performance. It has a limitation in that it assumes that the developer has mentioned for all possible user queries and the fullest scope of the solution. There are lots of false cases which affects the user experience.

Data A good Machine Learning systems needs lots of data to understand the user and to predict. The answer becomes ambiguous when the answer is not according to the user's expectation.

Accuracy The virtual assistant is software. Voice assistants do not always understand what the user is asking. Sometimes, it is how the user speak. Other times, it is simply because the artificial intelligence has not yet learned how to do something. The machine cannot understand the user's emotion. There are so many words those pronunciation is same, but the meaning is different. So, it might be difficult for the machine to understand in some situation.

Enabled Device The assistants are limited to the devices. As Siri can not be use in the android phone. As the same the Alexa supports only Amazon devices- Echo and Echo dot.

4.3 Strategies/Solution

The mobile device should be protected through the password or PIN number. So, before accessing the assistant the user needs to unlock the mobile device. (Burbach, et al., 2019) From this way, can avoid the unwanted interaction with the assistant. Ensure that password is strong and ideally 2-factor authentication protecting all the accounts associated with the assistant. The user should be more focus on the device privacy and the installed application's settings. By deleting saved command, words, and recordings. Since these items are usually stored in cloud, there is the possibility of accessible by someone else.

5. <u>Implication on Society</u>

5.1 Impact on human lifestyle

This assistant has implications for the society, especially those with limitations in eyesight can be so much more productive and independent. This can reduce the social burden in society. Also has a good impact on the day-to-day life. The lives have become an intelligent by using the virtual assistant.

The Google Home is a perfect intelligent assistant to improve the lifestyle at home and at affordable price. Once activated by the phrase "OK Google" or "Hey Google", Home them listens for a command. In most cases, Home responds to the user's query or command by voice within a second or two. Help of Google Home can control the smart tv and another electronics device. Try "Hey Google, turn on the tv", will start the tv without using the remote of the tv. Also turn off and on the lights and can set the temperature of the house using the Google Home. Smart electronics and Google Home make the home and life smarter. (Kepuska & Bohouta, 2018)

5.2 Impact on Industry

Whether it is car, heavy or unused aerial vehicle industry, artificial intelligence and machine learning is everywhere. Systems that enable the industry's robotic arms to operate efficiently and under all conditions and constraints or those systems that enable self-driving cars avoid all the obstacles and find the best route to the destination or that can avoid the aircraft from crashing if the pilot goes out due to the high-G power. The Lockheed Martin F-16 Ground Collision Avoidance Program is a clear example of such smart systems. (Khan, Tripathi, Dixit & Dixit, 2019)

Intelligent agents' techniques were used by Procter & Gamble (P&G) to develop the supply chains. The chain was organized as a group of semi-autonomous agents representing individual components of the supply chain, for example trucks and production plants, dealers, and retail stores. Simulated simulations of the agents allow the company to conduct what-if analysis on inventory levels, stock in stores and transportation costs. The enforcement of each agent is programmed to obey rules that evoke actual actions, including "ordering an item when it is out of shop."

Intelligent virtual assistant increases the sales of the business by growing customer service efforts. It decreases the amount of live chat, provides quick reactions and saves time. Furthermore, it gathers information from consumers and analyzes customer satisfaction survey responses, which help companies enhance contact between consumers and businesses. NOVA uses the learning machine to write custom emails. It knows which emails have been more successful in the past and thus recommend improvements to sending emails.

Virtual assistant in the healthcare industry assists in transforming various health process and improve healthcare delivery. It helps in improve quality, patient care, and patient outcome at lower costs. It can easily automate the task of patient engagement by automating patient interactions through the use of chatbots or smart speaker.

6. Suggested Course of Action

Most of the machine learning developers use atomic models to perform all kind of unit tasks. These models are inefficient and computationally expensive, and more effort is required to achieve good result. The intelligent virtual assistant works on the particular dataset like the user's search history and the privacy of the user device. But this approach is not giving the desired output all the time.

6.1 The Holy Grail of ML

ML lies on a great big model, a multi-functioning model that can do plenty of things. This uber model will eliminate the need to create models that do specific tasks and instead train this one

large model with different pieces of expertise. The model operates by sparsely activating different pieces of model that is required. The model will be 99% idle of most of the time and only must call upon the right fragment of expertise when needed.

6.2 Back Propagation Algorithm for Neural Network

Neural Network is a computational machine learning and pattern recognition technique inspired by the human neurons. Many companies are using the Neural Network in their intelligent assistant to improve speech recognition of the assistant. Back Propagation Algorithm encounters the moving target problem which impacts its efficiency. Back Propagation is the practice of the fine-tuning the weights of a neural net based on the error rate obtained in the previous iteration. Proper tuning of the weights ensures lower error rates, making the model reliable by the increasing its generalization. Neural networking allows the assistant to learn about the user and become increasingly personalized, eventually carrying out tasks before the user must ask. This Back-Propagation Algorithm in Neural Network will help the assistant to reach proper output of the given task by doing data warehousing.

7. <u>Conclusion</u>

Machine Learning is used to identify patterns in vary large databases without explicit programming although with significant human training. The arrival of the era of machine learning provides new opportunities and challenges to the applications of the intelligent virtual assistant. The development involves machine learning accomplished by neural networks, deep learning networks, with the focus on finding pattern in data and classifying data inputs into known outputs. The helped organization to know better in the recommendation system, intelligent voice control assistant, to identify pattern of fraud, for prediction. The machine learning algorithm and tools help to get various trends and based on the database, it helps the assistant to better visualize to data and it helps them to enhance the knowledge of the user's choice and to predict the output. In spite, of many positive sides, there are many negative drawbacks of the assistant that cannot be overshadowed. The main concern is the assistant's privacy issues and the data, automation. The above suggested steps may help to reduce the risk of the security. Also, it helps to get better communication, recommendation, calculation and so on. It might help the user, as well as the intelligent industries who are largely depends on the system's integration.

8. <u>Annotated Bibliography</u>

Alpaydin, E. (2020). Introduction to machine learning. Cambridge, MA: The MIT Press.

The book gives the brief information of the machine learning. Book briefly explain the learning's history, algorithm, applications, method and other statistic approach of the machine learning. Explained design and analysis of the learning experiments. Also mentioned the deep learning and Bayesian Decision theory with using machine learning algorithm.

The book gives theoretical and practical knowledge of the applications of machine learning. The detail of this book was used to write the introduction and technical section of this paper, also helped to understand how machine learning is used in mathematical calculation-probability and linear algebra.

Burbach, L., Halbach, P., Plettenberg, N., Nakayama, J., Ziefle, M., & Valdez, A. C. (2019). "Hey, Siri", "Ok, Google", "Alexa". Acceptance-Relevant Factors of Virtual Voice-Assistants. 2019 IEEE International Professional Communication Conference (ProComm). doi: 10.1109/procomm.2019.00025

> This article provides information about how the virtual voice assistant records the data and the privacy of it. Shows a choice-based-conjoint analysis with three attributes by relating the well-known privacy utility trade-off. Found out that not the price of a voice assistant is the most important factor for its acceptance. Acceptance of the voice assistance and the decision to use a voice assistant always depends on a combination of different factors, of which privacy is the most important. The current use of voice assistant and the technology are briefly explained.

> The information of the paper helps how the voice command of the assistant is accepted with the considering of the privacy of the machine. Also helps to understand NLP performance and the privacy regarding related work and the techniques used to understand it.

Chung, H., Iorga, M., Voas, J., & Lee, S. (2017). "Alexa, Can I Trust You?" Computer, 50(9), 100–104. doi: 10.1109/mc.2017.3571053

> This paper describes the common risk of using the intelligent virtual assistant. Briefly explained the information regarding the assistant's echo system. Its security and privacy risk contains the malicious voice command, unintentional voice recording, compromise in the assistant enable device, and the encryption of the network during the communication.

> The paper summarizes the privacy issue with suitable examples and the related architecture figure. The paper helped to understand the risks and how they are important to secure the data. Several recent incidents forced the companies to focus on the assistant's privacy issue. Described the system's diagnosis test can help to lead more trustworthy system.

Flikkema, P. G., & Cambou, B. (2017). When things are sensors for cloud AI: Protecting privacy through data collection transparency in the age of digital assistants. 2017 Global Internet of Things Summit (GIoTS). doi: 10.1109/giots.2017.8016284

> This paper describes the privacy of the could connected devices. The assistant transmits the sensitive data to the cloud to provide authentication and protection using the TLS. Describes the encryption and decryption using Diffe-Helman to initialize the communication because of its high computational complexity. To achieve the goal of privacy while using cloud connected device, the data collection privacy is used.

Hapsari, I., Surjandari, I., & Komarudin. (2018). Visiting Time Prediction Using Machine Learning Regression Algorithm. 2018 6th International Conference on Information and Communication Technology (ICoICT). doi: 10.1109/icoict.2018.8528810

> The paper shows the calculation of the visiting time using machine learning regression algorithm. This shows the how the regression algorithm calculates the time of the journey by using the dependent and independent variables and using clustering algorithm

The paper helped to understand how the intelligent assistant shows the road when user told the assistant "take to the Costco mall" according to the timings to reach to the destination.

Kepuska, V., & Bohouta, G. (2018). Next-generation of virtual personal assistants (Microsoft Cortana, Apple Siri, Amazon Alexa and Google Home). 2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC). doi: 10.1109/ccwc.2018.8301638

This paper describes the goal of artificial intelligence is the realization of the natural dialogues between humans and machines. The paper different technologies are used by the companies to make their intelligent assistant best. The paper includes information on gesture recognition, image/video recognition, speech recognition, conversational knowledge base and the general knowledge base. Moreover, describes the how the system is able to do lengthy communication with the user.

This paper helped to learn the use of the intelligent assistant in the different sectors like education, robotics, home automation, security access control and so on. The information used in effect of intelligent assistant on human lives and on the industry.

Khan, M. A., Tripathi, A., Dixit, A., & Dixit, M. (2019). Correlative Analysis and Impact of Intelligent Virtual Assistants on Machine Learning. 2019 11th International Conference on Computational Intelligence and Communication Networks (CICN). doi: 10.1109/cicn.2019.8902424

The reason to study this paper to enhance the knowledge of Artificial Intelligence (AI) technologies are used, their applications and inexpediencies and how they can be improved in the intelligent virtual assistant. Briefly explained the difference between artificial intelligence and the machine learning. Also, presented a comparative analysis of the intelligent virtual assistants available in the market.

The information from this paper is used to identify the different AI technologies and how help the assistant to be an intelligent. The information used in the literature section to write related field of technology.

Kunte, A. V., & Panicker, S. (2019). Using textual data for Personality Prediction:A Machine Learning Approach. 2019 4th International Conference on Information Systems and Computer Networks (ISCON). doi: 10.1109/iscon47742.2019.9036220

This paper provides the information of user's personality prediction using machine learning approach. Personality prediction with the help of data through social media is a promising approach as this method does not require any questionnaires to be filled by user thus reducing time and increasing credibility. This research uses Linear discriminate analysis, multinomial naive bayes and adaboost over twitter standard database. In this work the researchers used Big Five model of personality prediction which contributes to five categories of personality.

The information helped to understand how to predict the user's personality using some algorithm using dataset.

Lugano, G. (2017). Virtual assistants and self-driving cars. 2017 15th International Conference on ITS Telecommunications (ITST). doi: 10.1109/itst.2017.7972192

> This article provides the information of automotive car using the intelligent assistant. Focuses on virtual assistant, the personification of the car intelligence incorporating, an algorithmic "brain", a synthetic human "voice" and powerful sensor-based "senses".

> This paper helped to learn more about the application of the intelligent assistant in the automotive industry. Concerning IoT access, personalization and infotainment, proprietary systems are created. Fully explained the different intelligent assistant used in the cars for car navigation, IoT applications, Generalist, virtual companion.

Mane, P., Sonone, S., Gaikwad, N., & Ramteke, J. (2017). Smart personal assistant using machine learning. 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS). doi: 10.1109/icecds.2017.8390128

> The paper describes the how the machine learning is used in the intelligent virtual assistant for different task. Helps to understand conceptual model of the assistant. This paper uses the Support Vector Machine a supervised machine learning algorithm to describe the working of the intelligent assistant. Describes how the system adapt the behavior of the user by accessing the database and performing the certain algorithm.

> The information helped to write many sections of this paper. Also, learned the how the system is working in some task like call, time, location based by using the intelligent assistant.

Nawrocka, A., Kot, A., & Nawrocki, M. (2018). Application of machine learning in recommendation systems. 2018 19th International Carpathian Control Conference (ICCC). doi: 10.1109/carpathiancc.2018.8399650

> The paper includes basic information about the machine learning and recommender systems with their example. The paper explained how the machine learning algorithm is used in the recommendation system via practical implementation. The paper mainly focused on filtering algorithms based on the neighborhood of users or objects and based on content. The description includes similarities, advantages, disadvantages, measures of evaluating the algorithm.

> From this paper, got information of recommendation system. How the intelligent assistant plays the song using recommended song list. Helped to write the technical and suggested part of this paper.

Page, L. C., & Gehlbach, H. (2017). How an Artificially Intelligent Virtual Assistant Helps Students Navigate the Road to College. SSRN Electronic Journal. doi: 10.2139/ssrn.2940297

> The paper describes how the students uses the map to reach the particular destination and how the machine learning technology is used to calculate the time of the journey. Also, mentioned how the virtual assistant helps in education by increasing in efficiency.

The paper helped to understand the calculation of the navigation of the road.

Ray, S. (2019). A Quick Review of Machine Learning Algorithms. 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon). doi: 10.1109/comitcon.2019.8862451

> The paper explained all machine learning algorithm. It gives brief explanation of it. The algorithms are used to solve classification, regression and clustering problems using these algorithms. The advantages, disadvantages of these algorithms have been explained along with comparison in terms of performance, learning rate etc. Types of machine learning techniques have been mentioned in this paper.

> It gives insight information of the machine learning algorithm and helped to understand the algorithm for the certain problems. Helped to write the technical section of this paper.

Roper, M. (2019). Using Machine Learning to Classify Test Outcomes. 2019 IEEE International Conference On Artificial Intelligence Testing (AITest). doi: 10.1109/aitest.2019.00009

> The paper shows how the output is derived using machine learning algorithm. This paper represents a strategy to support the process of identifying which tests have passed or failed by combining clustering and semi-supervised learning. It is possible to cluster test cases in such a way that those corresponding to failures concentrate into smaller cluster.

> From this information, able to understand the outcomes of the assistant using machine learning.

Sam, A. P., Singh, B., & Das, A. S. (2019). A Robust Methodology for Building an Artificial Intelligent (AI) Virtual Assistant for Payment Processing. 2019 IEEE Technology & Engineering Management Conference (TEMSCON). doi: 10.1109/temscon.2019.8813584

> The paper shows the payment processing using the robust methodology. The machine starts interacting with human by applying NLP, NLU, NLG techniques that are used to process, understand and generate. The work has been done by using data collection and treatment, algorithm, and evaluating. Also mentioned k-clustering, greedy algorithm. Used the support vector machine is used to classify the assistant's utterance.

> The paper helped to learn the technique behind the payment processing using the intelligent assistant.

Satpathy, S., Mishra, S. P., & Nayak, A. K. (2019). Analysis of Learning Approaches for Machine Translation Systems. 2019 International Conference on Applied Machine Learning (ICAML). doi: 10.1109/icaml48257.2019.00038

> This article helps to understand how the machine translate the user input as voice into machine language in the virtual assistant. Machine translation is the part of Natural Language Processing (NLP). It translates source language text into target language. This article

represents the various approaches of machine translation system. It shows how neural machine translates by using different Deep neural network techniques and machine learning algorithms.

Article helps into determine the application of the machine learning in natural language processing (NLP).