ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

AI Going Wrong Reasons behind Wrong Responses

Akash Ghosh[1], Rizwan Chandarki[2]

P.G. Student, Department of Computer Studies & IT, Symbiosis International (Deemed University), India[1]

P.G. Student, Department of Computer Studies & IT, Symbiosis International (Deemed University), India[2]

ABSTRACT: Artificial intelligence (AI) is the simulation of human intelligence processes by machines and more specifically computer systems.There are various AI driven digital assistants available in the market for the public to use in their daily lives. AI powered digital assistants are on the rise but are still prone to wrong responses which make them inaccurate and not 100% reliable. The primary aim of this paper is to discover the reasons behind wrong responses generated by these AI powered digital assistants. We have taken four digital assistants namely, Google Assistant, Microsoft's Cortana, Amazon's Alexa and Apple's Siri for gathering the required information for this study. Our study has revealed five major causes for wrong responses which are User base, Speech recognition, Background noise, Permissions and Network issues and how they affect performance have also been mentioned. Finally, some recommendations have been drawn based on our analysis which can help in eliminating the reasons behind wrong responses.

KEYWORDS: Artificial Intelligence (AI), digital assistant, Google Assistant, Cortana, Alexa, Siri, user base, speech recognition, background noise, permissions, network issues.

OBJECTIVES

The common objectives of our study are:

- To collect responses from various AI powered digital assistants
- To analyze the responses collected from the digital assistants
- To discover the major causes behind wrong responses generated by the AI powered assistants
- To provide solutions to overcome the reasons behind wrong responses

I. INTRODUCTION

AI can be categorizedintoWeak AI or Strong AI. Weak AI or narrow AI, is an AI system which is designed and trained for a particular set of tasks. AI powered virtual personal assistants, like Google's Assistant, Amazon's Alexa, Microsoft's Cortana, Apple's Siri, etc. are some examples of weak AI. Strong AI which is also referred to as artificial general intelligence, is an AI system which has generalized human cognitive abilities. A strong AI system when presented with an unfamiliar task can find a solution without human intervention.

AI-driven digital assistants are rapidly becoming our way to interfacing with everything. We largely got them in our phones first, then in our homes, but now they are coming in our carsand are also appearing in our offices.Each of these virtual assistants are learning with increasing efficiency our likes, our wants, how to anticipate our needsand eventually, how to effectively make us happy. Digital assistants in todays world are capable of a two-way conversation with its user across a range of devices for a conversational experience.

In this paper we will be making a comparative analysis on the following digital assistants:

1. **Google Assistant Smartphone**
2. **Cortana**

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

3. **Alexa**
4. **Siri**

We will be analyzing responses for each device and find the reasons for wrong responses based on our findings.

1. Google Assistant Smartphone

Google Assistantis an AIpowered virtual assistant which was developed by Google, a successor to Google Now and is mainly available on smartphones and smart home devices. With Google Assistant, one can perform tasks like controlling smart home devices, make phone calls, set calendar events, set reminders, ask questions to be searched online and much more.Google Assistant was revealed to the world during Google's developer conference on May 18, 2016. In 2017, Google Assistant was installed on more than 400 million devices and has been downloaded over 10 million times on smartphones till 2018 through the Play Store.

2. Cortana

Cortana is a virtual assistant created by Microsoft for Windows 10, Windows 10 Mobile, Windows Phone 8.1, Microsoft Band, Surface Headphones, Xbox One, Invoke smart speaker, Android, iOS and Windows Mixed Reality. Cortana can perform tasks like setting reminders, alarms, recognizing natural voice without the requirement of keyboard input and is capable of answering questions using information from the Bing search engine. Cortana is named after a synthetic intelligence character in Microsoft's Halo video game franchise. Cortana for Android is officially Unreleased but still available for download from the Play Store as a test version. It has crossed over 5 Lakh downloads as of June 2018 on the Play Store.

3. Alexa

Amazon Alexa, simply called Alexa, is anAI powered virtual assistant developed by Amazon Lab126. It is used to power the Amazon Echo and the Amazon Echo Dot smart speakers. It is capable of handling voice interactions, streaming music, streaming audiobooks,creating to-do lists, setting alarms, streaming podcasts, providing weather, traffic,other real-time information, etc. Alexa's namewas inspired from the name of the computer voice for the conversational system on board the Starship Enterprise depicted in the hit science fiction TV series and movies by the name of Star Trek: The Original Series and Star Trek: The Next Generation. In January 2019, Amazon's devices team announced that over 100 million Alexa-enabled devices had been sold. As of December 2018, the Alexa app for smartphones had been downloaded over 10 million times through the Play Store.

4. Siri

Siri,an AI powered virtual assistant which ispart of Apple Inc.'s iOS, watchOS, macOS, tvOS and HomePod operating systems uses a natural-language user interface and voice queries to answer questions, make recommendations and performs actions by assigning requests to a set of Internet services. The assistant adapts to a user's individual language usages, searchesand preferences, with continued usage. Since its inception in 2011, Siri has become an integral part of Apple's products over the years, including latest iPhone models, iPad, Mac, iPod Touch, Apple TV, AirPods and HomePod. Siri currently is not available to Android users.

II. RELATED WORK

In order to take a decision, AI depends on inbuilt algorithms and massive amounts of data which it processes to reach certain conclusions. Erik Brynjolfsson and Tom Mitchell [8] in their paper mention that to provide AI with a solid ground for proper decision making, well-defined inputs and outputs must be set, goals and metrics should be clearly defined, short and precise instructions should be given and long chains of reasoning relying on common sense must be eliminated. So, the creation of an environment which is straightforward and predictable is required.
The most frequent cause of AI's foolish mistakes is 'Bad reasoning'. The worst part is that, the machine cannot explain why it took a particular decision, so making it really difficult to discover what and at what stage things went wrong.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

Recently, scientists have found a solution to this problem by creating a software that can debug AI systems by reverse engineering their learning process.

III. METHODOLOGY

This section discusses the chosen research methodology. In this research paper we have taken 50 questions across 10 categories each, making a total of 500 questionsto collect responses from each digital assistant. Responses were recorded from each assistant one at a time across a period of 4 days.

For the purpose of this study we have tested the queries on the following devices:

1) Google Assistant on a Smartphone
2) Cortana on a Laptop
3) Alexa on an Amazon Echo
4) Siri on an iPad

This approach provided us with the opportunity to record responses for each digital assistant separately and carry out our analysis. The basic aim of collecting responses from each digital assistant is to discover the reasons or causes of incorrect responses generated by these digital assistants.

IV. FINDINGS

The following are the responses collected from each of the digital assistants. The data has been represented in a tabular form as given below:

Queries	Google Assistant Smart Phone	Cortana	Alexa	Siri
Online Search	42	40	32	23
Calls	39	25	23	19
Inbuilt Games	36	34	18	9
Online Quiz	35	21	22	17
Memo	38	33	24	15
Stream Videos	32	23	19	12
Messages	38	26	20	20
Stream Music	37	32	22	27
Opening Apps	38	35	20	11
Reminders	44	38	28	21

Table 1: Correct Response received from each assistant by categories

The following Table shows us the percentage of correct responses for each digital assistant based on the total questions asked and correctly answered questions:

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

Digital Assistant	Total Questions	Correct Answers	Percentage
Google Assistant	500	379	75.8
Cortana	500	307	61.4
Alexa	500	228	45.6
Siri	500	174	34.8

Table 2: Percentage of correct responses by assistants

V. ANALYSIS

In this research paper, we have observed the performances of four AI driven digital assistants which are Google Assistant, Microsoft's Cortana, Amazon's Alexa and Apple's Siri respectively. From the observations we can clearly see that Google Assistant is in the lead with most correct answers against the commands given followed closely by Cortana while Alexa and Siri showcase a quite poor performance respectively.

Based on the data collected a graphical representation is given below for an overview of the entire outcome:

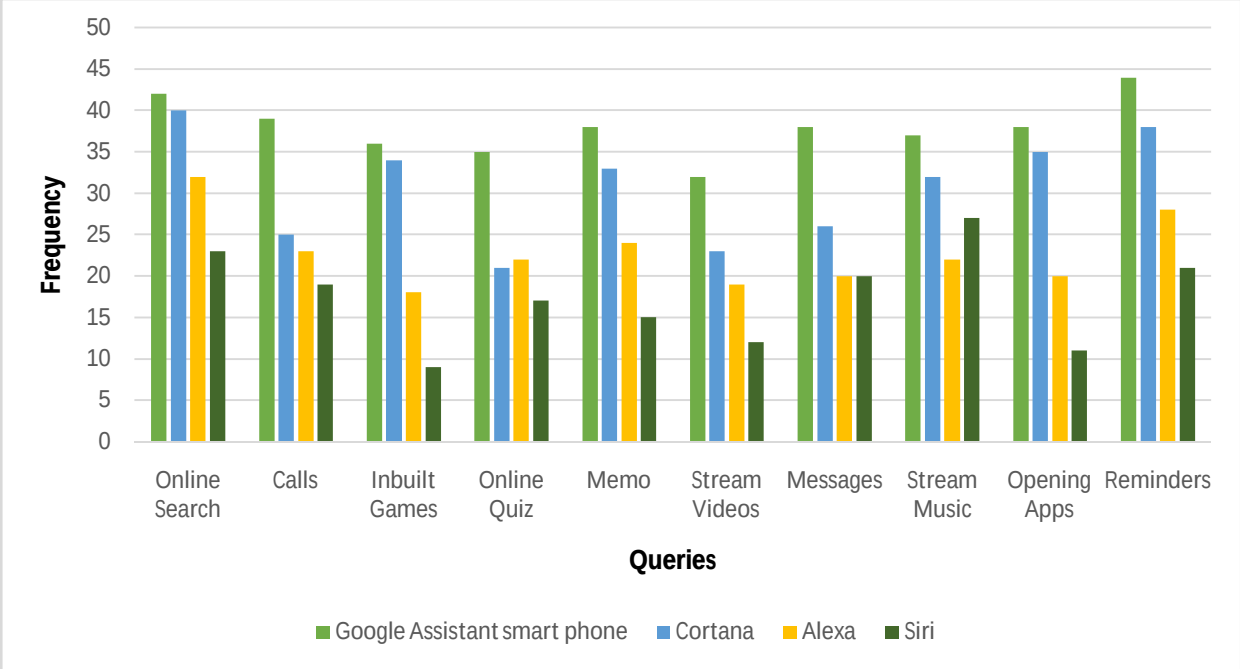

Fig 1: Comparison of correct responses from each digital assistant by categories

As per our observations we can say that most of the wrong responses generated were due to the assistant not understanding the query or when it tried to answer a query but got it entirely wrong. Now we will discuss the causes which we think are behind the wrong responses of AI driven digital assistants in today's world.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

1) **User Base –** According to our research we see that Google Assistant Smartphone which operates on Android OS has the leastincorrect responses. If we see the android user base until December 2018, we find it to be almost around 75%, making Android the market leader for smartphones. So, due to this Google has ample amount of user data to analyze, study user behavior and make its digital assistant far more efficient day by day.
On the other hand, Siri with the most incorrect responses operates on the iOS which has a user base of around 22% until December 2018. Now, due to this Apple does not have a large amount of user data from around the world which it can study and analyze to make its digital assistant more reliable.

   If we see the performance of Microsoft's Cortana which operates on Windows OS, it comes as the second most accurate but has its share of issues. Windows is the market leader with around 76% user base until December 2018. So, Microsoft should work on improving its assistant further by making use of the user data available with them in order to make Cortana the assistant for life as it claims.

   Now, coming to Alexa which operates majorly on Amazon's devices such as Echo which is a smart speaker and majorly in countries like USA, UK and China is the market leader in smart speakers with around 75% share fares just a bit better than Siri in our findings. This poor performance can be due to the fact that the market for smart speakers is on a growing phase, not many people are using it and it is not available worldwide in all countries at present. Thus, this is not enough for Amazon to understand user behavior patterns effectively in order to make its digital assistant more efficient and accurate.

2) **Speech Recognition –** Understanding correctly what command is being given is quite tricky for a digital assistant with so many languages and people speaking in so many different accents. Digital assistants on many occasions fail to understand what is being said and thus provide incorrect or no results. If we take the case of Siri, it is efficient in understanding English spoken in the US accent but does not perform at the same rate when English in the Indian accent is being spoken. Google, on the contrary has been able to bridge this gap to a great extent with its Assistant because of its large presence in almost all the countries around the world and being able to study users accents more effectively to give better results. While Cortana is good at speech recognition, Amazon's Alexa is still not so accurate and needs to listen correctly in order to avoid wrong responses.

3) **Background Noise –** This is a recurring problem with all the digital assistants, meaning any noise from the background other than the users voice is also detected by the digital assistant and leads to wrong responses being generated. Background noise can be in any form ranging from conversations between people, Television, sound from rainfall, etc. which can result in digital assistants to collect incorrect inputs. According to our observations Siri and Alexa turned out be the most sensitive to ambient noise and misunderstood commands on multiple occasions resulting in poor performance.

4) **Permissions –** It has been noticed in our observations that not allowing all permissions for each of the digital assistant'sdecreases its output capabilities. Like not giving access to contacts will not allow the digital assistant to call one of the contacts resulting in failed outputs for such commands. Same goes for the permissions related to calendars, apps, voice and app activity which will provide better speech recognition and web and app activity which will provide personalized experiences for the user. Thus, it can be said that not giving full access to digital assistants will result in increased number of wrong responses and errors.

5) **Network Issues –** Finally one of the major causes for wrong responses has to be network failures for any digital assistant considered. Network issues can arise from anywhere either the companies end or the users end. Being dependent on cloud computing for their processing, any problems in the central services will render the digital assistant app or device completely useless. Further any network issues at the users end like

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

slow internet connectivity or disruptive internet connections can hamper the smooth performance of such digital assistants giving way to wrong responses while executing commands. Some digital assistants like Google Assistant can perform few offline commands without the need for internet connectivity but other assistants completely rely on the internet to perform tasks.

VI. RECOMMENDATIONS

- In order to overcome poor performance due toUser Base, digital assistants need to penetrate more market and gather more user data to study user behavior patterns. This will help digital assistants in providing a more seamless and personalized experience to users, thereby reducing the number of wrong responses.
- Speech recognition for digital assistants can be improved by taking into consideration different accents spoken for a particular language at the time of training the speech recognition systems for such assistants.
- Background noise problems can be eliminated by implementing machine learning techniques and algorithms which can separate and detect human voice over other sounds. This will allow the digital assistants to hear what is necessary and provide a more accurate performance.
- It is recommended to allow all permissions required by digital assistants for their consistent performance and prevent any unnecessary errors. It must be remembered that allowing full access can also become a security threat and so users must be aware at all times regarding what the assistant can see and access.
- Network issues from the company side can be tackled by having better cloud servers to handle increasing requests, this will prevent unnecessary outages. The user can only ensure a stable and fast internet connection at all times to enjoy an uninterrupted experience of the digital assistant. Further, it can be said that with the advent of 5G internet technology in the coming future AI powered assistants will get a huge boost in performance and become more accurate.

VII. CONCLUSION

We have studied some AI powered digital assistants in order to understand the reasons behind wrong responses generated by these systems. There can be multiple reasons for inaccuracy but we have narrowed it down to 5 major causes which are User base, Speech recognition, Background noise, Permissions and Network issues.
In this paper we have discussed and analyzed the following AI powered digital assistants:

1. Google Assistant on Smartphone
2. Cortana
3. Alexa
4. Siri

Based on our observations the following inference can be made:

- At present no one particular digital assistant can be said to be perfect.
- Any number of wrong responses generated by the digital assistants studied are very much due to the mentioned reasons in our analysis.
- All wrong responses generated by the digital assistants were very obvious i.e. the user can understand that he/she has got an incorrect response for their query when they see it.
- Google Assistant answered the greatestnumber of questions and had the highest percentage of responses which were answered fully and correctly.

Our study shows the reasons for wrong responses generated by AI powered digital assistants and how to tackle them. Thus, it can be concluded from this study that if all the mentioned reasons for wrong responses are worked upon and eliminated, then the future of AI will become seamless, accurate and more efficient.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 12, December 2018

REFERENCES

1. https://www.forbes.com/sites/kevinmurnane/2018/05/03/dumb-and-dumber-comparing-alexa-siri-cortana-and-the-google-assistant/amp/
2. https://www.popsci.com/digital-assistant-showdown#page-6
3. https://www.businessnewsdaily.com/10315-siri-cortana-google-assistant-amazon-alexa-face-off.html
4. https://www.macworld.co.uk/feature/iosapps/siri-vs-google-assistant-3659249/?amp
5. http://gs.statcounter.com/os-market-share/mobile/worldwide
6. http://gs.statcounter.com/os-market-share/desktop/worldwide
7. https://www.linkedin.com/pulse/how-we-improve-ai-better-voice-assistants-malo-grisard/
8. Erik Brynjolfsson and Tom Mitchell, "What can machine learning do? Workforce implications", Science 22 Dec 2017, Vol. 358, Issue 6370, pp. 1530-1534.
9. http://science.sciencemag.org/content/358/6370/1530
10. https://stfalcon.com/en/blog/post/why-AI-makes-mistakes
11. https://searchcio.techtarget.com/opinion/What-technical-challenges-face-voice-AI-technology-There-are-many

BIOGRAPHY

Akash Ghosh, Bachelor of Business Administration (BBA) from Jagannath International Management School (Guru Gobind Singh Indraprastha University), currently pursuing Master of Business Administration in IT (MBA-IT) from Symbiosis Institute of Computer Studies and Research (Symbiosis International University).

Muhammed Rizwan Abdul Saleem Chandarki, Bachelor of Computer Application (BCA)from Abeda Inamdar Senior College Azam Campus (University of Pune), currently pursuing Master of Business Administration in IT (MBA-IT) from Symbiosis Institute of Computer Studies and Research (Symbiosis International University).