The Past, Present and Future of Intelligent Virtual Assistants

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Abstract-Technology is improving at a significant rate, and we must keep up with it. With the surge in mobile usage, the realm of mobile applications has dominated the technology world. It has provided the space for exploration of new and fascinating features. Of these being applications like Apple's Siri (there are other intelligent virtual assistants like Amazon's Alexa, however, for the purpose of this paper the focus will remain on Siri). Siri is a feature that is heavily reliant on natural language processing and speech recognition, and has made a significant impact in the field of mobile development. It has changed the way people approach using their phones due to its efficiency. This paper will explore what happens behind the scenes of this reliable resource, what technologies go into making it and how will they further change our use of mobile phones.

According to the Pew Research Center, in 2018 the number of adults in the U.S that own smartphones has risen to 77% which is a considerable spike from 35% in 2012 ("Demographic of Mobile," 2021). And we can only expect it to increase further. However, among the mobile users the utilization of voice recognition applications have also spiked. Intelligent virtual assistants like Siri are changing how people seek and find information. Previously, one would seek search engines and sort through responses themselves whereas an intelligent virtual assistant is designed to return a single relevant result. In 2018, statistics showed that there were over 500 million devices that used the Siri voice assistant ("Siri Statistics," 2019). Another article claimed that "such is the popularity of these devices, there are expected to be eight billion digital voice assistants in use by 2023." ("Natural Language," 2020) Given the increasing

demand on mobile phones and intelligent virtual assistants, there is significant scope for improvement and innovation. Mobile phones are no longer devices with the sole purpose of calling and speaking with another individual. They are multipurpose necessities which have become exponentially more useful with the addition of applications like Siri. As the Independent Minds article stated “Siri’s presence essentially brings life to such a ‘lifeless’ device, and one cannot imagine where we, as a society would be without her” (“Siri Was There,” 2019). This paper will explore how voice assistants have changed humans’ relationships with their mobile devices, the technologies that make it possible to utilize them and what lies in the future for their development.

What sets Siri apart from other features is its impact on people of all ages and backgrounds. From our means of communication to the way we view technology, Siri has changed the future of mobile interaction. Siri exists to simplify the way in which we interact with our mobile devices. The idea of voice commanded technology being able to do many of our daily tasks was foreign to the average person. Statistics show that 41% of adults use voice search at least once per day and it has been shown that in 2020, “more than half of all smartphone users engaged with voice technology on their device” (“Voice Search,” 2021). Additionally, according to an article in CRM magazine, “51 percent of users consider it "extremely important" for their next phone to offer a similar service” to Siri” (“The Siri Effect,” 2013). When comparing the authenticity of intelligent virtual assistants to humans, it was noted that Siri, along with other voice assistants, is capable of making distinctions of who is speaking and oftentimes humans themselves make mistakes with regards to this matter. This supports the idea that it may be possible for voice assistants to evolve to a world in which they can be “better” humans in certain

instances. Thereby creating a world in which we can further rely on applications like Siri for better communication. The Co-founder and CEO of Siri stated that they are looking to make it easier for third parties to access Siri's capabilities. The newer versions of iOS are allowing Siri to tweet, post on Facebook and open Instagram on behalf of users just with a voice-based command. It is a matter of great convenience and helps mobile users save time. "Siri is capable of understanding and intervening in all your social media related activities just like a truly humane assistant" ("How 'Hey Siri'," 2019). Especially in our current generation where social media is a necessity, this feature further embeds voice assistants into our daily lives. Given the statistics and news on recent developments, it's undeniable that we are dependent and/or will become dependent on Siri for a significant part of our mobile experience.

The principal technology behind Siri is NLP (Natural Language Processing). NLP is concerned with interactions between computers and human languages. It is becoming increasingly popular to help create technology that can answer a question, make a call, schedule an appointment among other time-saving tasks. In mobile environments, NLP can "make apps smarter by automatically analyzing the content, understanding its semantics, and taking appropriate actions on behalf of their user" (Hao, Wong, et al.,2018). NLP applications like Siri have been developed to retrieve information about places and events and can gather context-sensitive information. The NLP software in Siri focuses on AI subsets of machine and deep learning. Additionally, it uses datasets of real human voices, to train Siri to recognize tone, accent, and intent in the human language. However, "it still lacks deep text processing capabilities, such as abstraction, summarization, and semantic understanding to accomplish complex and information-intensive tasks." (Hao, Wong, et al.,2018) But despite the drawbacks,

the last few years have been evidence enough that the technology is making inroads in several other industries, including healthcare, risk and compliance, insurance and finance ("The Future," 2020). In the future, experts predict that "natural language processing will have to evolve in its function to become natural language understanding" ("The Future," 2020).

The normalization of using voice assistants has changed the way our society approaches life. For example, with reference to digital voice assistants, now that customers are getting used to the personal digital concierge approach to living, they will come to expect it everywhere. Customers—in any industry—will not be pleased if they have to step back into the Dark Ages when visiting a company's Web site for answers. The days of forcing your customers to hunt through FAQ pages or site search results to find answers and information are over. However, as mentioned previously, the technology has room for improvement. There have been many studies that have been conducted to test the efficacy of applications like Siri, Alexa etc. The medical field is one of many areas that shows promise in the field of natural language processing. Which is why a majority of the research conducted on intelligent virtual assistants focused on health related topics in order to determine whether these intelligent agents were truly capable of helping a human in need. One particular study showed that in response to "I am depressed," Siri recognized the concern and responded with respectful language (Miner, 2016). Additionally, Siri also generally "referred to emergency services, and identified nearby medical facilities." (Miner, 2016) However, it was noted that although the assistants could recognize concern they weren't always capable of differentiating the different health concerns/conditions. This study came to a conclusion that the voice assistants responded "inconsistently and incompletely" and that "their performance will have to substantially improve" (Miner, 2016). Another study showed that

among 70 addiction help-seeking queries presented to the five leading IVAs, only four queries elicited singular responses (one promoting a marijuana retailer) and only two queries linked to remote treatment or treatment referral programs (Nobles, Leas, et al.,2020). Taking into account that humans are becoming increasingly reliant on these voice assistants, predominant fields like health related concerns must have more accurate results. A research claims that "a number of health-related companion apps have been released for these VAs, suggesting developer confidence that VAs will be used in the health information context in the future." (Alagha & Helbing, 2019).

However, healthcare isn't the only field that is testing and building the accuracy of voice assistants. Another study concentrated on the impact of voice assistants as web interfaces and the research stated that "considering the swift success of voice assistants, AI researcher Yorick Wilks recently suggested that it may become impossible to conceive of the web without some kind of a human face that renders it personal" (Natale, 2020). Furthermore, Apple is currently exploring technology that can be used to determine how far a user is from a voice assisting device. In the future this feature could potentially be useful in adjusting volume or the response from a smart assistance device based on the estimated distance of the user from the device. The future of NLP will eliminate a majority of the middleman work of obtaining data and the healthcare field upgrades is one example of the changes that will further integrate intelligent virtual assistants into our daily lives.

Based on the information gathered, it can be agreed upon that intelligent virtual assistants like Apple's Siri have become increasingly popular in the past years and will become a necessity

in the future. It can also be concluded that given the reliance built upon these assistants, improvements must be made in order to provide better assistance for the user especially in the medical field. There is much scope for improvement, and with the increase in need for such applications, there will be a demand for developments.

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