**CASE STUDY: USE OF AI IN GOOGLE**

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1. **Introduction**

The goal of this case study is to learn more about the various AI technologies used in Google. Google Assistant is the centerpiece of all AI technologies in Google, here we discuss all the AI technologies leading to the betterment of Google Assistant.

Google Assistant is an artificial intelligence-powered virtual assistant developed by Google that is primarily available on mobile and smart home devices. Unlike the company's previous virtual assistant, Google Now, the Google Assistant can engage in two-way convers conversations.

1. **Similar Methodologies**

* **Google Brain**

Google Brain is a deep learning artificial intelligence research team at Google. Formed in the early 2010s, Google Brain combines open-ended machine learning research with systems engineering and large-scale computing resources.

In June 2012, the New York Times reported that a cluster of 16,000 computers dedicated to mimicking some aspects of human brain activity had successfully trained itself to recognize a cat based on 10 million digital images taken from YouTube videos. The story was also covered by National Public Radio and SmartPlanet.

In March 2013, Google hired Geoffrey Hinton, a leading researcher in the deep learning field, and acquired the company DNNResearch Inc. headed by Hinton. Hinton said that he would be dividing his future time between his university research and his work at Google.

* **Google Translate**

The Google Brain project contributed to Google Translate. In September 2016, Google Neural Machine Translation (GNMT) was launched, an end-to-end learning framework, able to learn from a large number of examples. While its introduction has increased the quality of Google Translate's translations for the pilot languages, it was very difficult to create such improvements for all of its 103 languages. Addressing this problem, the Google Brain Team was able to develop a Multilingual GNMT system, which extended the previous one by enabling translations between multiple languages. Furthermore, it allows for Zero-Shot Translations, which are translations between two languages that the system has never explicitly seen before. Google announced that Google Translate can now also translate without transcribing, using neural networks. This means that it is possible to translate speech in one language directly into text in another language, without first transcribing it to text. According to the Researchers at Google Brain, this intermediate step can be avoided using neural networks. In order for the system to learn this, they exposed it to many hours of Spanish audio together with the corresponding English text. The different layers of neural networks, replicating the human brain, were able to link the corresponding parts and subsequently manipulate the audio waveform until it was transformed to English text.

* **AI devised encryption**

In October 2016, the Google Brain ran an experiment concerning the encrypting of communications. In it, two sets of AI's devised their own cryptographic algorithms to protect their communications from another AI, which at the same time aimed at evolving its own system to crack the AI-generated encryption.

In this experiment, three AIs were created: Alice, Bob and Eve. The goal of the experiment was for Alice to send a message to Bob, which would decrypt it, while in the meantime Eve would try to intercept the message. In it, the AIs were not given specific instructions on how to encrypt their messages, they were solely given a loss function. The consequence was that during the experiment, if communications between Alice and Bob were not successful, with Bob misinterpreting Alice's message or Eve intercepting the communications, the following rounds would show an evolution in the cryptography so that Alice and Bob could communicate safely. Indeed, this study allowed for concluding that it is possible for AIs to devise their own encryption system without having any cryptographic algorithms prescribed beforehand, which would reveal a breakthrough for message encryption in the future.

1. **Summarization of above methods in Google Assistant**

Assistant initially debuted in May 2016 as part of Google's messaging app Allo, and its voice-activated speaker Google Home. After a period of exclusivity on the Pixel and Pixel XL smartphones, it began to be deployed on other Android devices in February 2017, including third-party smartphones and Android Wear (now Wear OS), and was released as a standalone app on the iOS operating system in May 2017. Alongside the announcement of a software development kit in April 2017, the Assistant has been further extended to support a large variety of devices, including cars and third-party smart home appliances. The functionality of the Assistant can also be enhanced by third-party developers.

Users primarily interact with the Google Assistant through natural voice, though keyboard input is also supported. In the same nature and manner as Google Now, the Assistant is able to search the Internet, schedule events and alarms, adjust hardware settings on the user's device, and show information from the user's Google account. Google has also announced that the Assistant will be able to identify objects and gather visual information through the device's camera, and support purchasing products and sending money, as well as identifying songs.

1. **Use of the concept**

* **Smart displays are one of the uses of Google Assistant**

In January 2018 at the Consumer Electronics Show, the first Assistant-powered "smart displays" were released. Smart displays were shown at the event from Lenovo, Sony, JBL and LG. These devices have support for Google Duo video calls, YouTube videos, Google Maps directions, a Google Calendar agenda, viewing of smart camera footage, in addition to services which work with Google Home devices.

These devices are based on Android Things and Google-developed software. Google unveiled its own smart display, Google Home Hub, in October 2018, which utilizes a different system platform.

1. **Conclusion**

Google Assistant, in the nature and manner of Google Now, can search the Internet, schedule events and alarms, adjust hardware settings on the user's device, and show information from the user's Google account. Unlike Google Now, however, the Assistant can engage in a two-way conversation, using Google's natural language processing algorithm. Search results are presented in a card format that users can tap to open the page. In February 2017, Google announced that users of Google Home would be able to shop entirely by voice for products through its Google Express shopping service, with products available from Whole Foods Market, Costco, Walgreens, PetSmart, and Bed Bath & Beyond at launch, and other retailers added in the following months as new partnerships were formed. Google Assistant can maintain a shopping list; this was previously done within the notetaking service Google Keep, but the feature was moved to Google Express and the Google Home app in April 2017, resulting in a severe loss of functionality.

1. **Reference.**

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* <https://en.wikipedia.org/wiki/Applications_of_artificial_intelligence>
* <https://blog.aimultiple.com/ai-is-already-at-the-heart-of-google/>