



A Study on Google's AI in Prediction of Cardiovascular Events

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Abstract

The artificial intelligence (AI) has the potential to revolutionize health care industry, in fields as clinical trials, personalize medicine, precision medicine, and disease predictions. In this paper, we provide a study of the applications of Google AI in the prediction of cardiovascular events. The Google has launched new AI technology which is helpful in prediction of cardiovascular events. However, the adoption of AI in the healthcare sector faces many challenges, such as lack of clear guidance, standards, data privacy and security concerns, good information and issues, and ethical considerations. Despite these challenges, we continue to develop and invest. Artificial intelligence has the potential to increase the efficiency and accuracy of disease prediction and improve patient outcomes.

Keywords: Artificial Intelligence, Google AI, Cardiovascular Events Predictions, Health Care.

1. Introduction

1.1. Basics of AI

The AI (Artificial Intelligence) is a computer technology which enables machine to work smarter and take decisions like a human [1] with its subfields such as deep learning [2],

machine learning [3]. The AI is a computational program that duplicate the human intelligence [4] things like problem solving & learning [5]. The AI can be defined as intelligent machine. The AI is simplifying the human work [6]. AI is majorly works on the algorithms; an artificial neural network (ANN) [7] is a framework for the execution of AI algorithms. Where the Artificial intelligence algorithms are guided by the structure and function of the human brain. Artificial neural networks train themselves first from received sample data and recognise the patterns among data then predict the outcome by applying their intelligence. The network consists of many layers of neurons, which are the main layers of the network. The first is the input process, which takes the input, the output process completes the final output, and the hidden layer perform computational process required by the neural network.

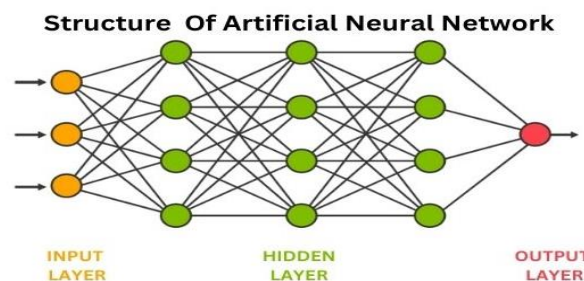


Figure.1. Structure of Artificial Neural Network

Some of the common applications of neural network are facial recognition, rain and stock market forecasting. Neural networks can analyse the pattern and predict the stock market future possibilities. Machine Learning is sub field of AI, itself discovers the data patterns automatically without any human instructions. In Machine learning, the system learns from data and generates the algorithms to perform the tasks on learned models. Whereas regular computer programs work according to preset rules created by humans, from experience and knowledge. Although the learning can be categorised in supervised, unsupervised, and reinforcement learning.

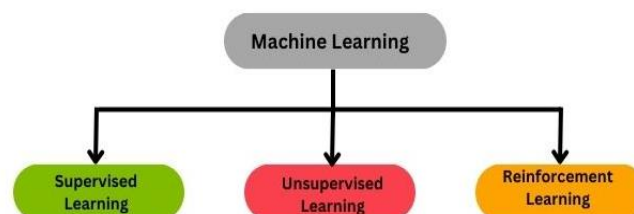


Figure.2. Different Learning Method used in Machine Learning

The supervised learning is used for predictions, and unsupervised learning results in discussing hidden data patterns. Reinforcement learning is different way of learning where machine learns from best actions based on consequences.

1.2. AI in Healthcare

Health care is most promising industry which AI is going to revolutionise [8]. Health care industry has huge amount of data [9], this data can be processed using this AI technology for better performance and decision making. There are several research studies has done and it says that AI can perform as well as and better than humans at healthcare task, such as disease diagnosing [10]. AI is getting a huge attention from the researchers and health care professionals [11]. The Artificial intelligence is involved in medicine since the 1950s, when physicians made the first attempts to improve their diagnoses using computer assisted programs [12]. But unfortunately, medicine industry including cardiology has not fully embraced by this revolutionising technology. There are only a limited number of AI-based clinical applications are available currently. However, AI has shown promising development in this field from the last decade. These methods have proved important results in various complex areas, such as echocardiogram, diastolic dysfunction, & grade stratification. Current projections estimate the healthcare artificial intelligence (AI) market will expand from USD 26.6 billion in 2024 to USD 187.7 billion by 2030[31].

1.3. Difference Between AI and Traditional Medicine Research:

Using statistics is the standard method for medical research to reveal the benefits of new treatments, predict prognosis, identify risk factors, and uncover disease mechanisms. Surprisingly, in the traditional statistical domain and the AI domain, there is considerable overlap in techniques and methods. For example, logistic and linear regression [13] models used in statistical methods are also machine learning techniques, most medical researchers are familiar with these. Although there is difference in their opinions and philosophies that is statistics is the science that explains data, estimates and can model the solutions, whereas AI with Machine Learning ability has more focus is to achieve practical predictions from available data. Another important thing for medicine is that AI techniques are not only statistical analysis, but it is also suggested that causal inferences should not be made for the medicine research. In fact, there is a need of integrating machine learning for this motive. However, this evolving technological trend should be carefully evaluated and validated with

current valid domain knowledge about pathophysiology and health Issues to support the results of AI analysis and AI based solutions. An important strength of AI compared to traditional research is its ability to work on different data structures, discussed below.

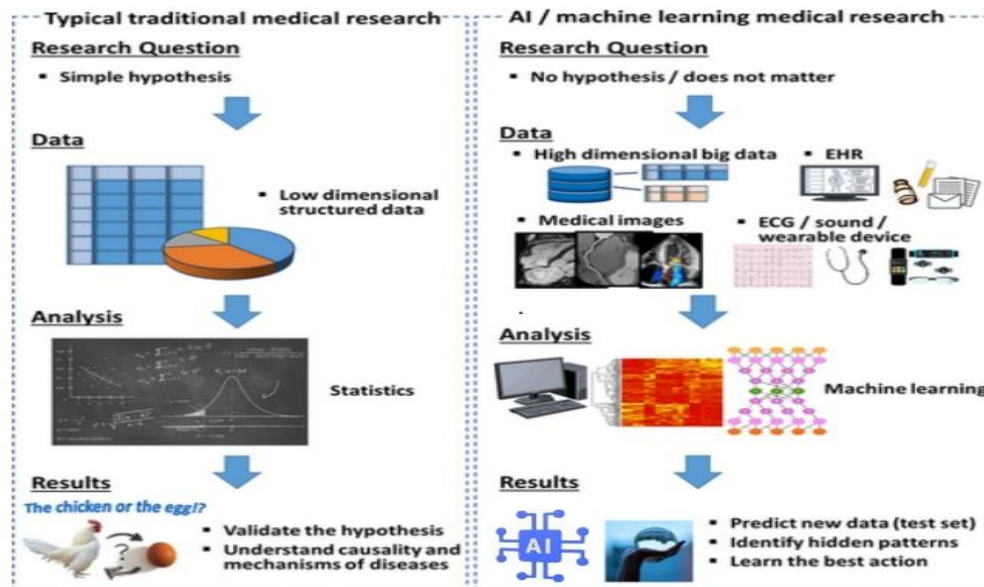


Figure.3. Differences between uses of AI in Traditional Medical Research with Statistics

2. Google AI in Healthcare

The two brilliant research students at Stanford University named Larry Page and Sergey Brin, founded Google on 4th September 1998.[14] Google is an Internet-related service and product company, majorly known for its popular search engine and now a days capable with generative AI. It offers a variety of services and products. Google developed health-related products and services with its healthcare division which is formerly known as Google Health.[15] Google is using artificial intelligence (AI) to improve healthcare in diagnosis, treatment, and research.[16] Google AI Health is continuously growing and expanding its work in healthcare. In 2018, google launched new initiative “AI for health” focused on improving healthcare using AI for everyone. Google has partnered with several healthcare institutes for develop and deploy AI-powered healthcare solutions.

3. Google AI Research Initiative

Google AI, Research initiative in healthcare is still in its beginner stage, but the potential to revolutionize the way the systems diagnoses, treats, and manage the diseases. [17] The Google is committed to using AI, and it is working worldwide with their partners to make this vision a reality to improve healthcare. It is working on a variety of projects, which are;

- **AI in diagnosis:** Google has developed AI tools that can help to diagnose diseases more accurately and quickly. For example, AI tool that can detect diabetic retinopathy, a leading cause of blindness, from images of the retina. These same retinal images can guide to predict the cardiovascular events. [18]
- **AI in treatment:** Google has developed AI tools that can help to make personalize treatment plans for patients based on their individual medical history. For example, AI can predict which patients are most likely to respond or react to a particular drug or treatment. These AI algorithms can design personalised medication planes for the patients that will help to recover quickly. [19]
- **AI in research:** Google has developed AI tools that can help medical researchers to identify new patterns and insights in medical data. This information is helpful to develop new treatments and improve existing treatments. AI is very helpful in research because of its ability of high amount data processing and analysing.[20]

Specific initiatives taken by google to work in healthcare is diabetic retinopathy diagnosis, Google AI has developed an AI tool in partnership with the University of California San Francisco, that can help doctors diagnose diabetic retinopathy more accurately.

4. Applications of AI in Cardiovascular Predictions

The Artificial Intelligence can be used in cardiovascular disease prediction in variety of ways, some of them are given below.

- **Analysis Electrocardiogram (ECG):** AI can analyse ECGs to detect early signs of cardiovascular disease (CVD), such as atrial fibrillation and heart failure. This can help to identify patients with high risk for developing CVD and to prevent serious complications early. [21]
- **Image analysis:** AI can analyse medical images, such as CT scans, MRIs, and chest X-rays to detect CVDs such as coronary artery disease and stroke. This can help to make more accurate diagnoses and provide more effective treatment.
- **Individual Risk analysis:** Based on their individual risk factors, such as age, sex, race, family history, and lifestyle habits AI can assess a patient's risk of developing CVD. This information can help patients to make informed decisions about their health and to develop personalized healthy lifestyle plans.

5. Google AI in Cardiovascular Prediction

Healthcare is one of the fields that AI is going to change. Previously Google announced their work on diabetic retinopathy. [22] which is a one of the causes of blindness, and for this Google used deep learning algorithm to help doctors to diagnose the same in earlier stage. A running field trials performed at Aravind and Sankara hospitals in India, and the trials proved well. Currently doctors are dependent on blood tests.[23] To diagnose cardiovascular diseases. The Google has introduced expert AI diagnosis to places where trained doctors are scarce. By using retinal scans, these systems can offer more meaningful information which helps in prediction of risk for 5years about having an adverse cardiovascular event stroke or heart attack. [24] The most interesting fact here is that these systems offered newer information that more than what doctors could find in these eye scans of a patient. This could be a new, non-invasive technique to detect cardiovascular risks. The Google is working with this technique on field trials with partner hospitals. Another area where AI can help doctors is to predict medical events. doctors have needs to make difficult decisions, and for them, getting advanced notice before 24-48 hours a patient is likely to get very sick, is a tremendous difference in the outcome. Google using de-identified medical records and analysed more than 100,000 data points per patient more than any single doctor could analyse, AI can quantitatively predict the outcome of readmission of patient, 24-48 hours before than traditional methods. It gives doctors more time to react. Google looking forward to partnering with hospitals and medical institutions.

**Drawing blood for blood test****Retinal exam**

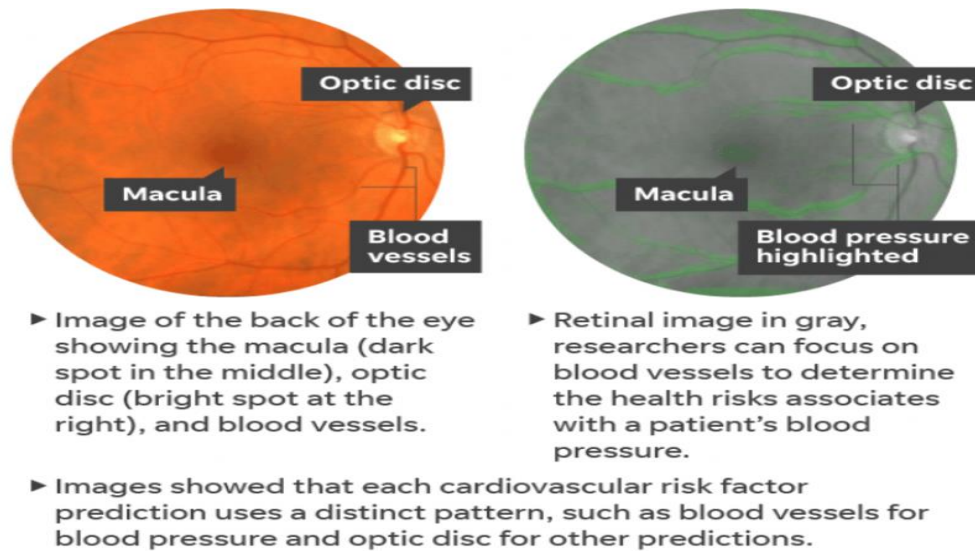
Source (left): "Blood Test May Predict Post-Surgery Recovery Time". 2018. *Gephardt Daily*. <https://gephardtaily.com/health/blood-test-may-predict-post-surgery-recovery-time/>.
Source (right): "Medical Eye Center | What Is A Retinal Eye Exam? | Medford". 2018. *Medford Retina Care*. <https://www.medfordretinacare.com/2017/04/retinal-eye-exam/>.

Figure.4.1. Blood Sample Collection**Figure.4.2. Eye Scanning**

However, it is significant step in the non-traditional methods for predicting heart diseases, thereby opening new doors for researchers and healthcare professionals. The motive behind this research is grounded by the fact that the retina, has a thin layer at the back of the eye, is rich in blood vessels. the condition of this reflects the overall cardiovascular health of an individual person. AI algorithms can predict an individual's likelihood of developing cardiovascular diseases, by analysing the details such as their width and how they branch of these vessels. [24] Google has showcased how AI can be successfully integrated into healthcare through their project: ARDA know as Automated Retinal Disease Assessment which AI-powered diabetic retinopathy screening system is developed by Google.[25]

6. Breakthrough Research

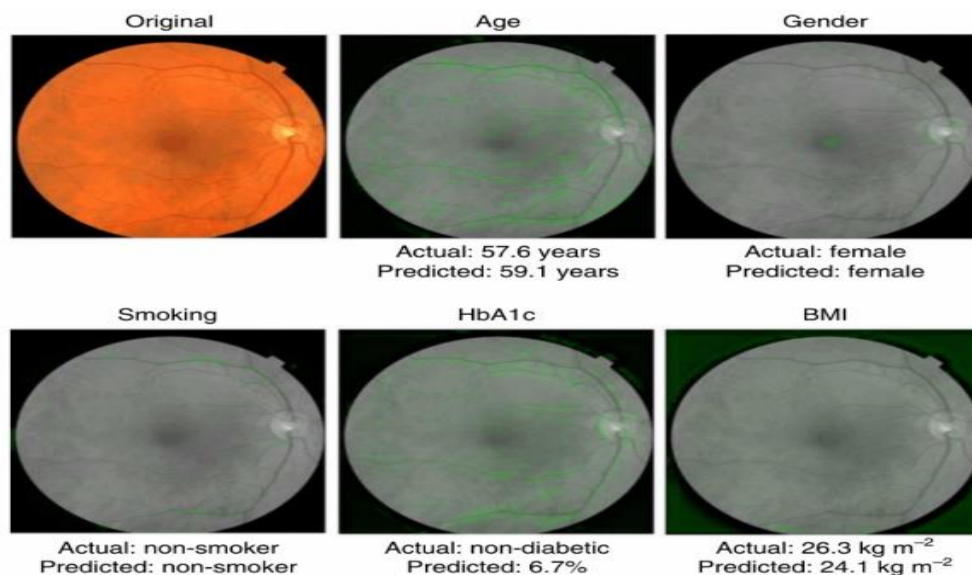
ARDA system uses retinal Scan images, it shows blood vessels at the back of the eye, to predict the risk factors of cardiac events, the system analyses the gender, their age, blood pressure level, and smoking and drinking habits, that influence or considered as factors of the cardiac activities and events. These factors or data are used as inputs to an AI algorithm to predict the risk of a cardiovascular activity or event of person. [26] This technology can provide results of the heart's health condition after matching the eye scans with a matrix of available data for cardiovascular risks. Until the now 70% test results of predictions made by the algorithms are true. This new AI technique is eliminated the need for the long series of tests and scans typically required to detect cardiovascular risk. With validated dataset of 13,000 records this deep learning model studied anatomical features in eye as optic disc or blood vessel to generate the prediction outcomes such as age, gender, smoking habits and blood pressure.[27] This AI system identified the correlation between pathology in retinal (Eyes) changes in patient's heart. Ones the system learns the image patterns. The system can estimate the size and pumping efficiency from retinal scans. Combined this data with basic demographic data of patient, such as their age and sex, the AI system can predict the risk of heart attack over the subsequent 12 months. Google researchers also used deep learning. It is a specialized branch of machine learning. A technology that enables one to "learn computational models composed of multi-layered abstractions.



Source: Baig, Edward C. "Google Hopes AI Can Predict Heart Disease by Looking at Retinas." *USA Today*, Gannett Satellite Information Network, 19 Feb. 2018, www.usatoday.com/story/tech/2018/02/19/google-ai-can-predict-heart-disease-looking-pictures-retina/344547002/.

Figure.5. Image of the Back of the Eye

Moreover, this system provides attention maps as its output that highlight its predictive conclusion. In the image given below, the attention map indicates areas that are correlated to various factors. This provides additional facts & information to doctors for better understanding and trusting the algorithm, since they can understand how it works. The algorithm can identify a patient's risk with 70% accuracy of a cardiovascular event. [28]



Source: Li, Abner, and Abner Li. 2018. "Alphabet's Verily Analyzing Retinas W/ Machine Learning To Predict Heart Disease". *9To5Google*. <https://9to5google.com/2018/02/19/alphabet-verily-eyes-heart-disease/>.

Figure.6. Predictions of Factor that can Result in Cardiac Event

7. Role of AI in Future Medicine

AI is becoming an integral part of all our lifestyle. From smartphones and gadgets to cars, and more importantly in our healthcare. Artificial intelligence (AI) is transforming the way we operate the healthcare industry. In healthcare, Patient's experience is already changed with AI, the way doctors practicing medicine, and how the pharmaceutical industry operates. [29] The journey has just started. Basically, the applications of AI in healthcare can be divided into three categories, namely patient-centric AI, Clinical-oriented AI, and Administrative-oriented AI. This system enables remote diagnosis for the patients who can't afford to come large hospitals. [30] The FDA is monitoring the latest developments and trying to get a grip on how to regulate the entire ecosystem of AI dividend medicine. In addition, the FDA is working on developing a comprehensive database for AI-based healthcare technologies. This database acts as a repository that provides information of Approved AI application, which offers Important information about efficacy and safety. Different levels of AI today Human intervention are required and decide whether to agree or disagree. The sophistication of AI makes it easier for humans to focus and concentrate on one area, and the right patient for quick care. In future AI can provide more efficiency and accuracy in diagnosis and treatment planning for patients. With its image recognition and self-learning abilities.

8. Conclusion

We are providing overview of the AI literature in healthcare. We performed this study with analysing the applications of AI in healthcare and understanding the Google's AI in cardiovascular event prediction. The growing AI gives great promises for the health care industry, it still has significant challenges that must be overcome to fully realize its potential. It is providing variety of services such as patient care, diagnosis which helps doctors to make accurate decisions. Google AI is providing extraordinary solution in diagnosing the diabetic retinopathy and predicting the cardiovascular events using the eye scans. The google diabetic retinopathy detection algorithms has accuracy of 90% but in real-life clinical setting it faced challenges due to varying image quality, however the adaptive algorithms can learn to this condition by itself by delivering more accurate results. These algorithms can revolutionise the healthcare industry, but it has some limitations to overcome. Also, we need to set some regulatory guidelines, because it has involved the persons personal details it generates questions on privacy. Currently there are some limitations that will affect potential research future, especially in ethics, data governance and the health competencies. Also, this is quite

expensive we need work on cost effective solutions. Considering the future research perspectives, we have analysed that healthcare organisation having AI technologies could be helpful.

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Authors' Disclaimer

This paper is an independent review written solely for educational and academic discussion. It synthesizes previously published research, public literature, and technology reports. The authors were not involved in designing, training, testing, or conducting clinical trials for any of the Google AI systems, datasets, or retinal scanning tools (such as ARDA) mentioned in this work.

All brand names, product titles, and trademarks—including "Google," "Google Health," and "ARDA"—belong to Google LLC / Alphabet Inc. Mentioning them in this paper does not imply any official affiliation with, endorsement by, or sponsorship from Google LLC.

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Conflict of Interest/Competing Interests

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Data Availability

The raw data supporting the findings of this research paper will be made available by the authors upon a reasonable request.

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