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# Emerging Techniques & Technologies of Artificial Intelligence & Machine Learning

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# Abstract

Artificial Intelligence (AI) and Machine Learning (ML) has revolutionized our world today. Some of the fields that AI and ML have contributed to include the medical field, the business sector, research and more. However, what are the platforms that AI used on? What AI and ML to work efficiently? What are some related words in AI and some Marketing Implications of AI? This paper discussing the answers to these topics by examining “Emerging Techniques & Technologies of Artificial Intelligence & Machine Learning”.



# Introduction

Artificial Intelligence (AI) and Machine Learning (ML) have revolutionized our world today. It has been able to assist humans in research, the medical field, in our daily lives, and more through the act of Automation. We will be reviewing the following topics in AI: Enabling Technologies, Architectures, Platform, Optimization Techniques, Evaluation Metrics, Market Implications, Related Works and the Challenges and Limitations of AI.

# Enabling Technologies



The images above depict devices and techniques that enable the technology we have today to work properly. These photos were provided from the following website: <https://unsplash.com/photos/mvbtVeRVJzg> (Male engineer with performance tracking device for boxing 2020), [https://unsplash.com/photos/m\\_HRfLhgABo](https://unsplash.com/photos/m_HRfLhgABo) (Gower, 2017) and, <https://unsplash.com/photos/gcsNOsPEXfs> (Iven, 2015).

# Enabling Technologies

Expert System programs or ES Programs are “computer programs which are derived from a branch of CSR called AI” (Latif, 2014). To implement AI, various techniques such as Rule Based Learning, Machine Learning, “Genetic Algorithms, ... Knowledge Representation...” (Cioffi et al., 1999) are needed.

List of enabling technologies we will discuss:

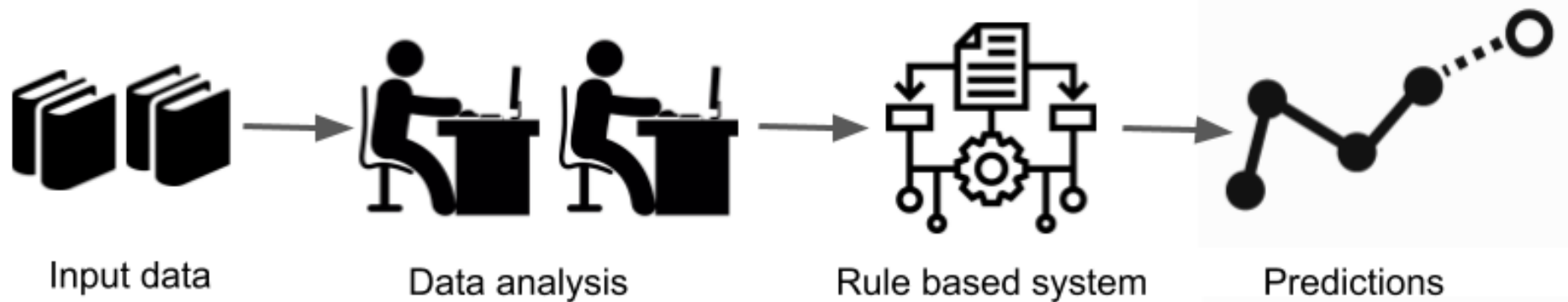
- Rule Based Learning
- Artificial neural network (ANN)
- Hybrid Learning System
- Genetic Algorithms



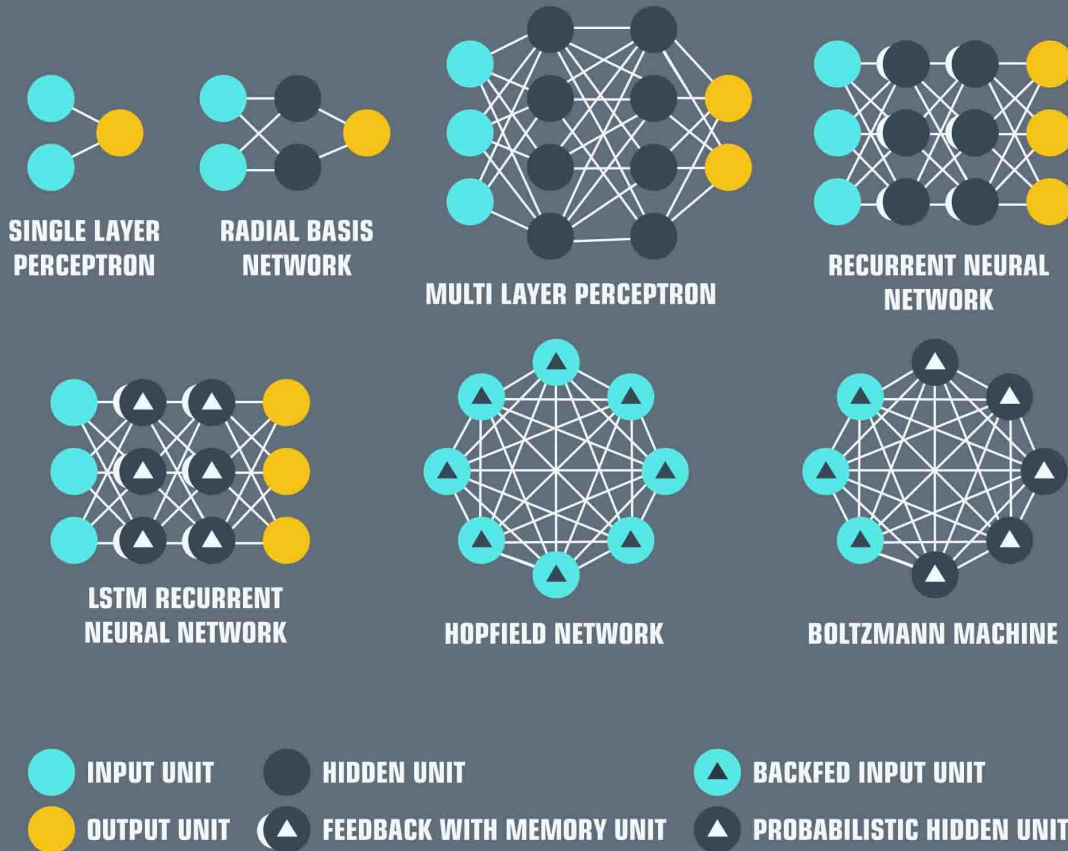
Image of a Robot by offered on this website:  
<https://unsplash.com/photos/zbLW0FG8XU8> (*White robot action toy photo 2018*)

# Rule Based Learning

- Rule-based AI is conducted by giving a set of conditions in the form of an "if-else" statement, that will help the AI determine what outcome to portray.
- This form of learning is easy to maintain, implement and easy to understand since the way that knowledge is provided to the system is straightforward.
- The problem with rule-based learning is that there is no real learning in Rule-based learning. Therefore, Rule Based Learning is only useful if a pre-existing knowledge base is available for use.



## NEURAL NETWORK ARCHITECTURE TYPES

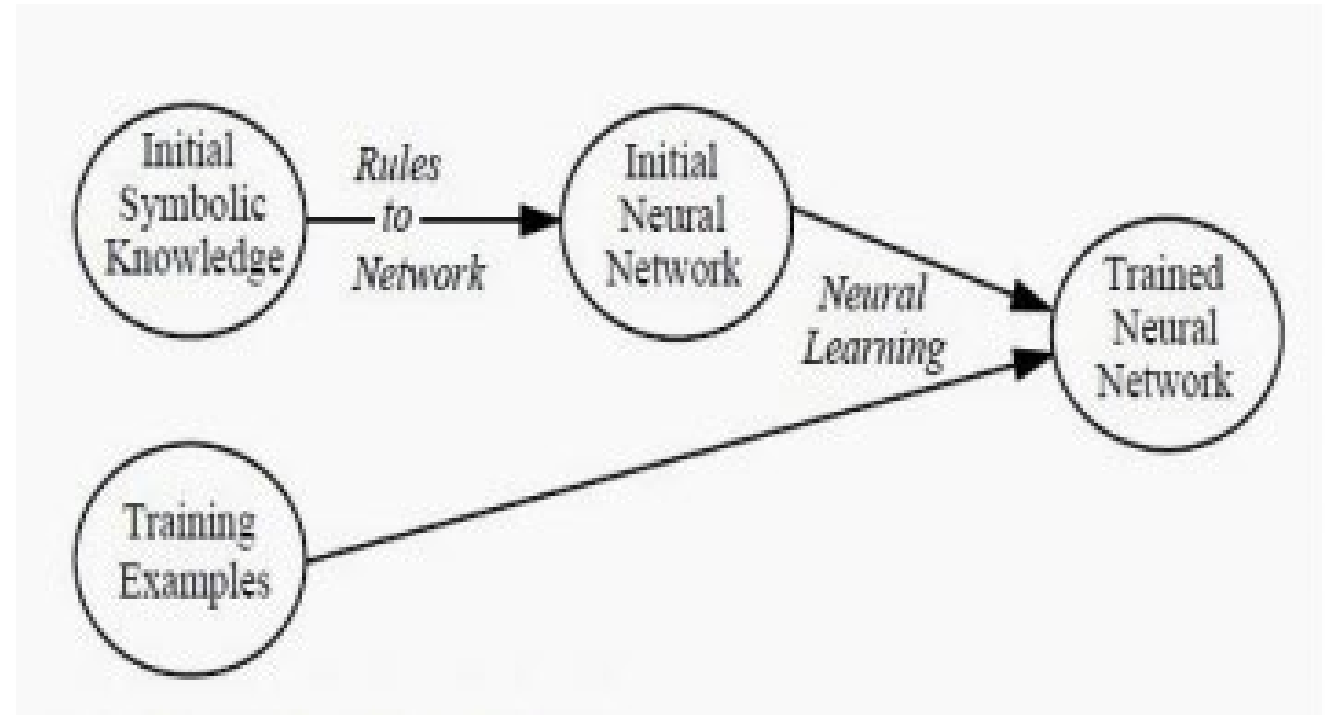


# Artificial Neural Network

- Artificial neural network (ANN) technique is inspired by the human nervous system.
- This technique allows the AI to learn and understand concepts through training (similar to a human brain).
- ANNs are useful when solving problems that require a lot of data

# Hybrid Learning System

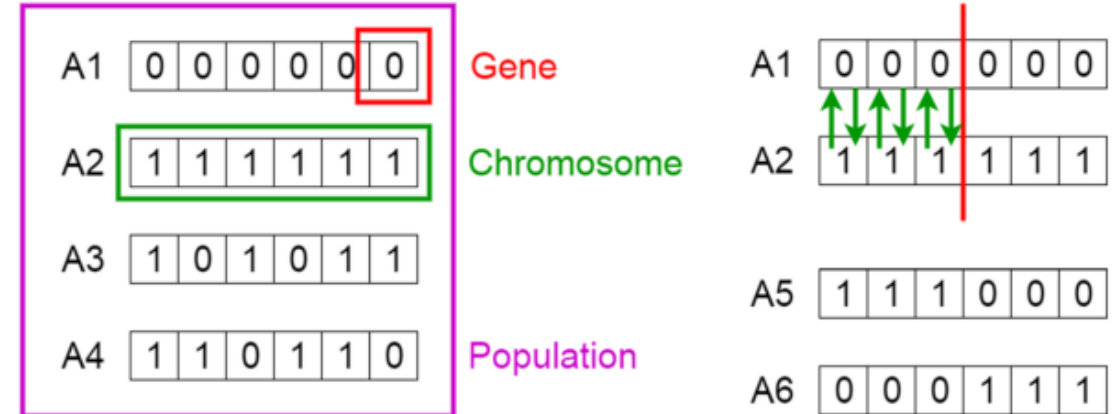
- Hybrid system learning is a method that is an extension of Artificial neural network (ANN)
- This technique is a combination of training the AI with the ANN technique while adding additional information that the AI did not learn during training
- It is useful because the system is expected to learn more when including extra learning materials that the system didn't learn.



# Genetic Algorithms

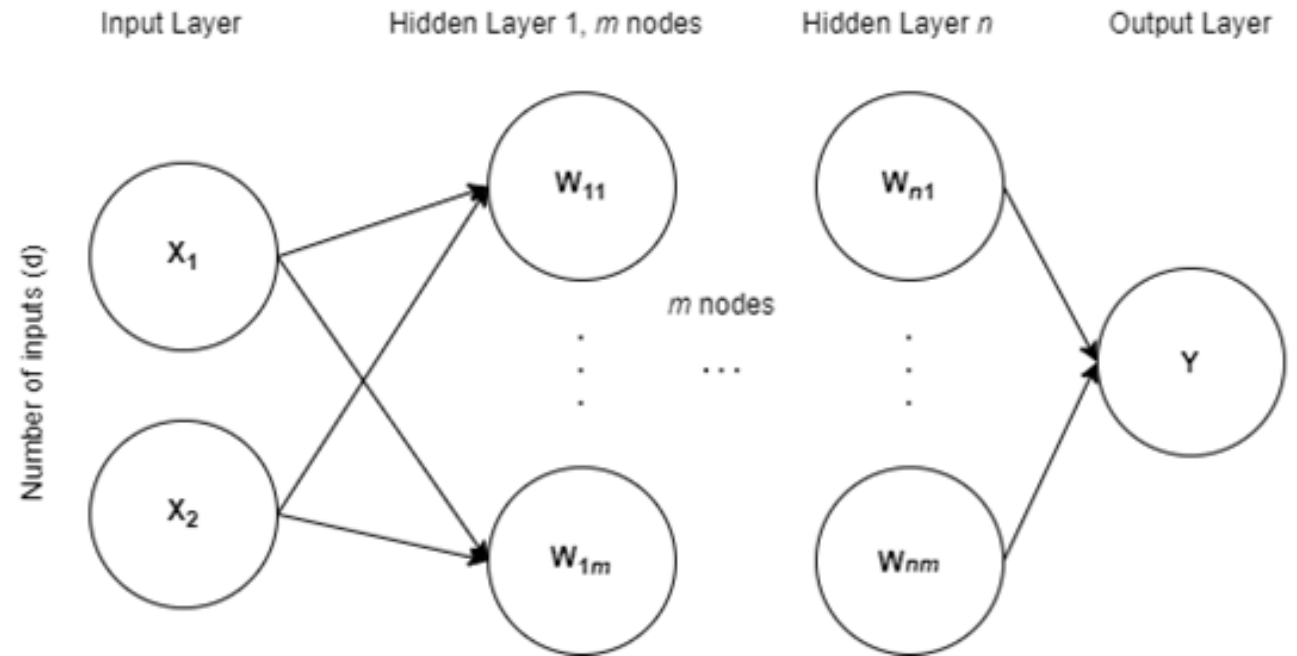
- Genetic algorithm is a technique that is inspired by natural selection.
- This technique evolves new possible solutions to a problem based off pre-existing solutions over time.
- This algorithm keeps evolving till the problem is fully solved.

## Genetic Algorithms



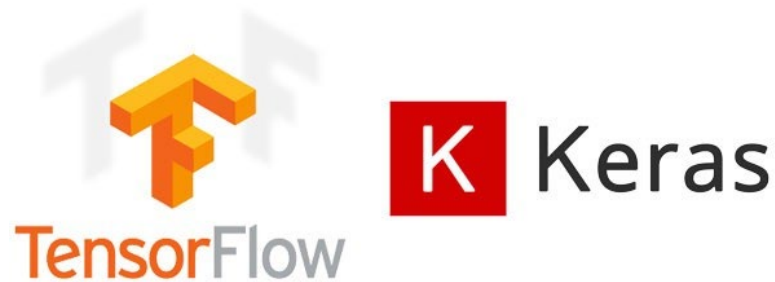
# Architectures and Platforms

- Benchmarks for AI are designed to check off certain AI milestones
  - Turing Test
- Artificial Neural Networks(ANN's)
  - Mimic biological neural networks
  - Input layers --> hidden layers/activation function --> output layer



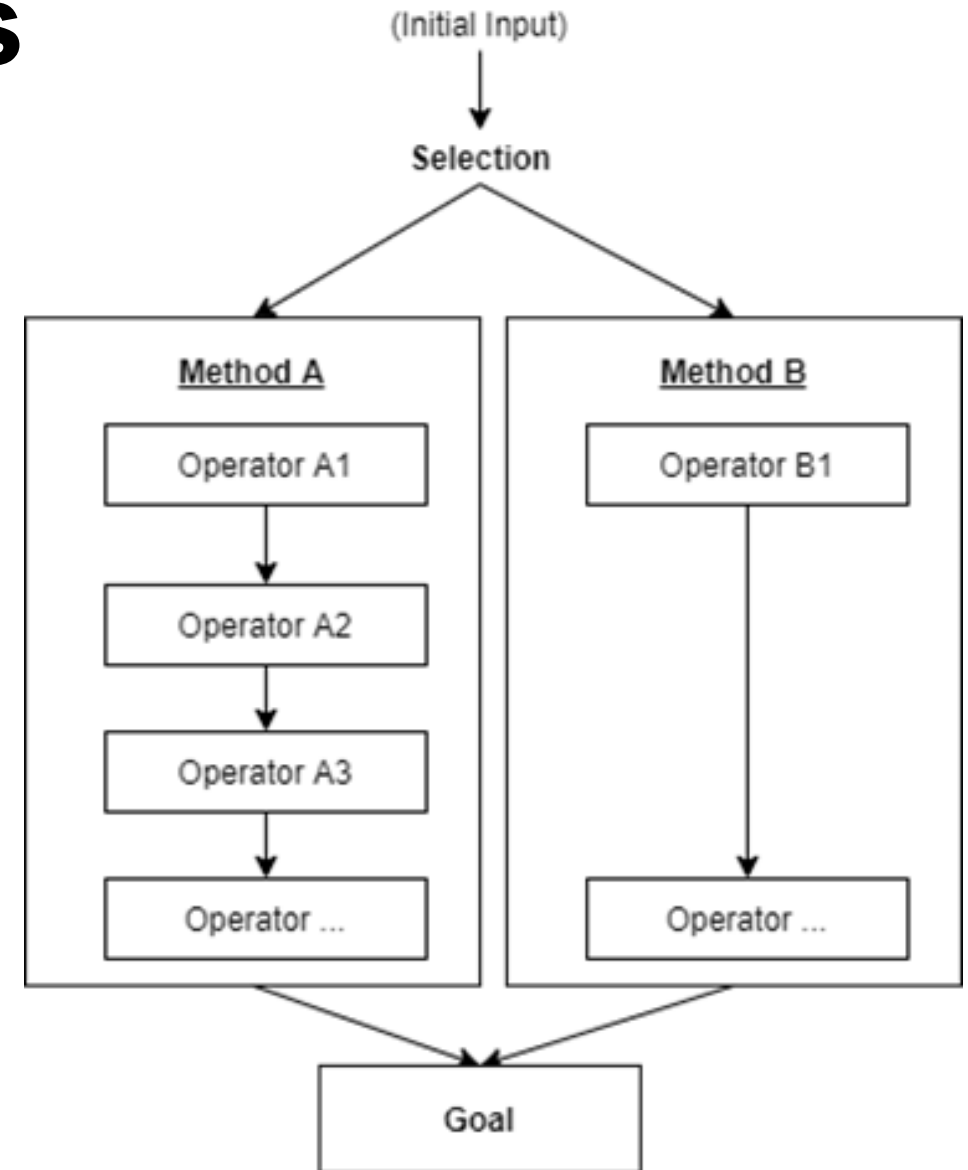
# AI in User Interface Design

- Two categories
  - AI for optimizing user interfaces
  - AI for creating user interfaces
- Python Libraries for easy implementation
  - Keras
  - Tensorflow
  - Pandas



# Optimization Techniques

- Keystroke Level Model(KLM)
- Goals, Operators, Methods, and Selection Rules (GOMS)
  - These tests help with human computer interaction prediction



# Keystroke Level Model for Prediction

- Keystroke Level Model(KLM)
  - Broken into different areas: K, P, H, D, M
    - K(keystroke) = keystroke/button presses by user
    - P(pointing) = time it takes for user to point to a target
    - H(homing) = time it takes for user to interact with multiple devices and return to original device
    - D(drawing) = time it takes for user to draw two line segments using a mouse
    - M(mental) = time it takes for user to make a mental decision about a task

$$\text{MeanAbsoluteError} = \frac{1}{N} \sum_{j=1}^N |y_j - \hat{y}_j|$$

$$\text{Recall} = \frac{\text{TruePositives}}{\text{TruePositives} + \text{FalseNegatives}}$$

$$\text{Precision} = \frac{\text{TruePositives}}{\text{TruePositives} + \text{FalsePositives}}$$

$$F1 = 2 * \frac{1}{\frac{1}{\text{Precision}} + \frac{1}{\text{Recall}}}$$

$$\text{TruePositiveRate} = \frac{\text{TruePositive}}{\text{TruePositives} + \text{FalseNegative}}$$

$$\text{TrueNegativeRate} = \frac{\text{TrueNegative}}{\text{TrueNegative} + \text{FalsePositive}}$$

$$\text{Accuracy} = \frac{\text{TruePositive} + \text{TrueNegative}}{\text{TotalSample}}$$

$$\text{LogarithmicLoss} = \frac{-1}{N} \sum_{i=1}^N \sum_{j=1}^M y_{ij} * \log(p_{ij})$$

$$\text{Accuracy} = \frac{\text{Number of Correct Predictions}}{\text{Total number of Predictions made}}$$

# Evaluation Metrics

# Related Works

In our paper we describe different methodologies that have been utilized in many of the emerging technologies we see today.

Though many of the newer and more efficient technologies use methods that are more complex, at the core of them all are the fundamentals we cover throughout our project. The related works can encompass all fields of AI within different practices because AI's basic function has always been kept the same.

# Market Implications

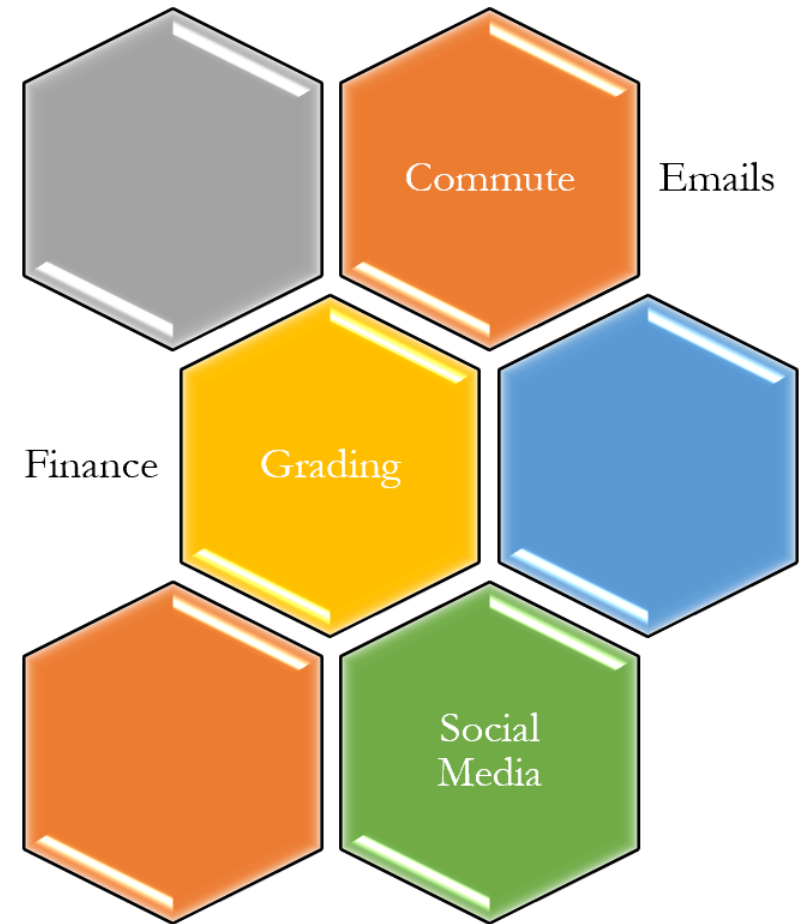


Figure 3.1- This figure (made by Jas) above displays the topics that will be discussed.



# General

- Increased communication
- Increased automation
- Enabled the production of smart technology with the ability of solving and assisting problems
- AI is everything that has not been done yet



## Displaying fastest route

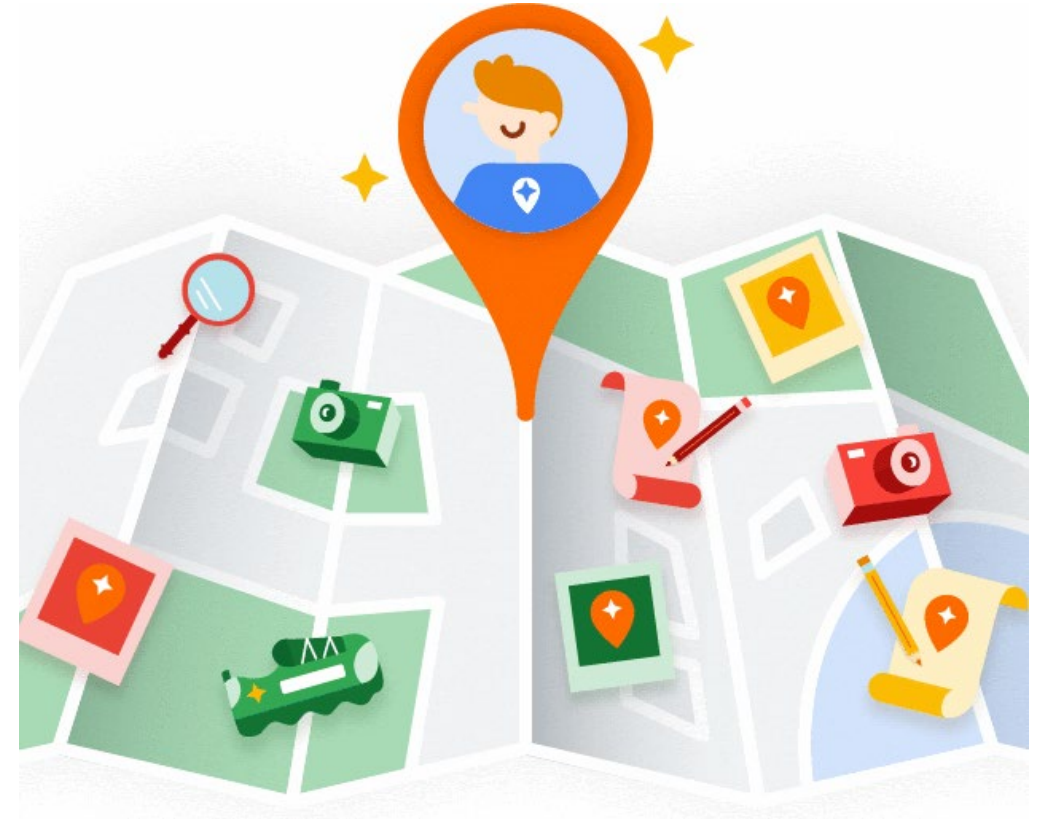


Figure 3.2- The picture above displays google maps.



# Emails

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Spam channels, simple – rule-based filters can be defeated

Gmail filters 99.9% of spam

Classifies your messages into primary, social, and promotion inboxes and "significant" messages

Smart replies

Maybe – smart reply would be able to give progressively complex reactions



Figure 3.3- The picture above displays an email notification.

# Grading

Plagiarism checkers such as Turnitin  
Robo-readers



Figure 3.4- The picture above displays a robo-reader as a teacher.

# Finance

- Store checks through wireless application
- AI to check over handwriting and investigating the text
- Fraudulent exchanges
- Too many exchanges daily for people to check each one
- AI helps
- When applying for a loan or credit card – banks need to decide to acknowledge or decay applications

# Social Media

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Face highlighting

Object identifying

Recommending similar posts

Replacing text with emojis

Snapchat face lenses

Tracking facial movements

Amazon – relevant products

Recommendations through emails

Voice-to-text message

Siri



Figure 3.5- The picture above is the logo of Snapchat.

# Challenges and Limitations



Figure 3.6- The picture above displays a board with "Challenges Ahead" written on it.



# Data

- Hard to get enough and the right amount of necessary data for AI
- Example – health care



# Multitasking

- Cannot multitask.... YET
- Google DeepMind



# Lack of insight

- Knowing how they are put together, knowing what information is going in them
- But we are unaware of the certain decisions and outputs
- Example – bedroom curtains



# Conclusion

AI and ML have evolved itself in different Architectures and Platforms across the Medical Field, the Business field, and more. For us to better utilize AI and ML in society, we need to weigh the pros and cons of these technologies as well as examine its related works, how these algorithms created, the metrics that measure these technologies and more. When doing this, we can better understand Emerging Techniques & Technologies of Artificial Intelligence & Machine Learning.

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# Images

Figure 3.1- Made by Jaspinder Kaur

Figure 3.2- <https://support.google.com/maps/thread/20033642?hl=en>

Figure 3.3- <https://www.techradar.com/news/best-email-provider>

Figure 3.4- <https://www.reuters.com/article/us-usa-schools-grading-idUSBRE82S0ZN20120329>

Figure 3.5- <https://1000logos.net/snapchat-logo/>

Figure 3.6- <https://skylineentourage.com/en/7-reasons-exhibitors-exhibit-marketers/challenges-jpg/>

AI architecture: figure by Haley Granger

Keras/Tensorflow logos: [https://miro.medium.com/max/1200/0\\*a6XSwHsfvz\\_oWSSJ.jpg](https://miro.medium.com/max/1200/0*a6XSwHsfvz_oWSSJ.jpg)