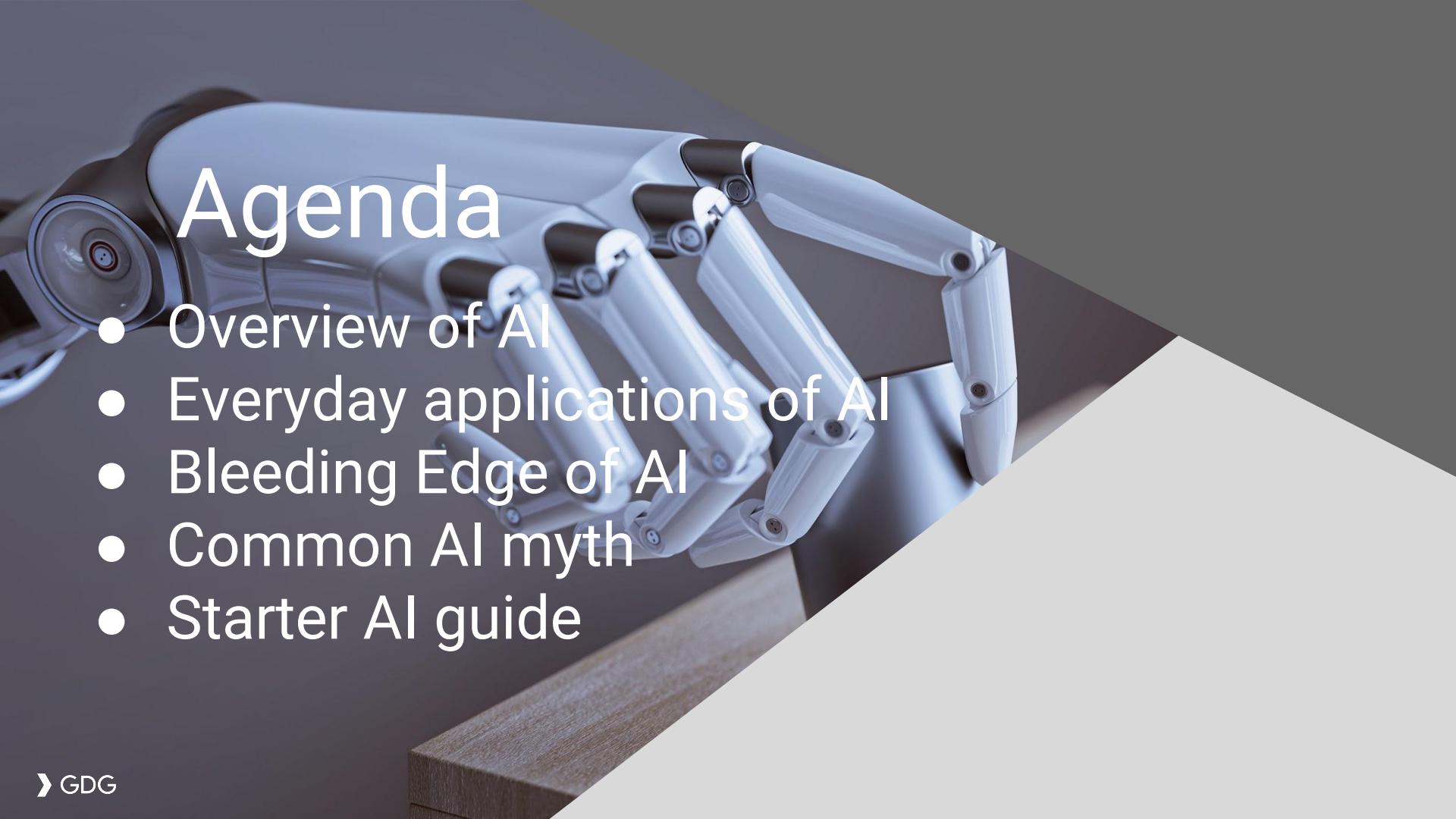


Introduction to AI

George Igwegbe
Artificial Intelligence
Saturday (AI6), Lagos





Agenda

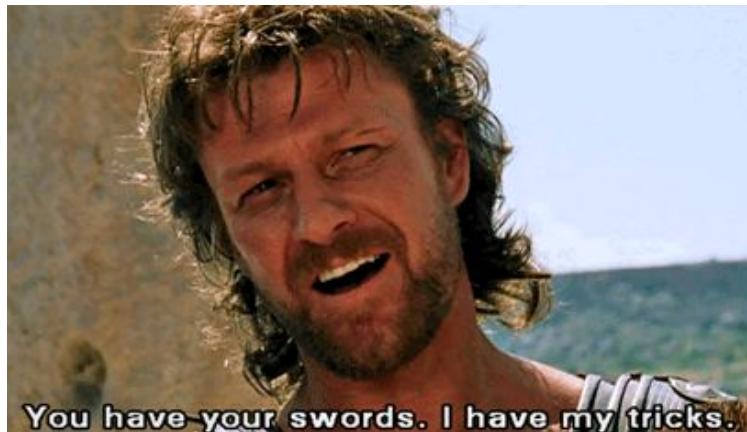
- Overview of AI
- Everyday applications of AI
- Bleeding Edge of AI
- Common AI myth
- Starter AI guide

TROJAN WAR

Agamemnon



Odysseus



Achilles



PROPHECY=PREDICTION

PROPHECY=PREDICTION



www.theoi.com

Artemis: goddess of hunt...



Athena: goddess of wisdom



Thetis: Immortal



www.theor.com

Artemis:goddess of hunt...



Athena:goddess of wisdom



Thetis: Immortal

What they have in common? ...they are goddesses



www.theoi.com

Artemis:goddess of hunt...



Athena:goddess of wisdom



Thetis: Immortal

What they have in common? Prediction..



www.theoi.com

Artemis: goddess of hunt...



Athena: goddess of wisdom



Thetis: Immortal

PREDICTION: is the act of saying what will happen in the future.

HARVARD BUSINESS REVIEW PRESS

Prediction Machines



The Simple Economics of
Artificial Intelligence

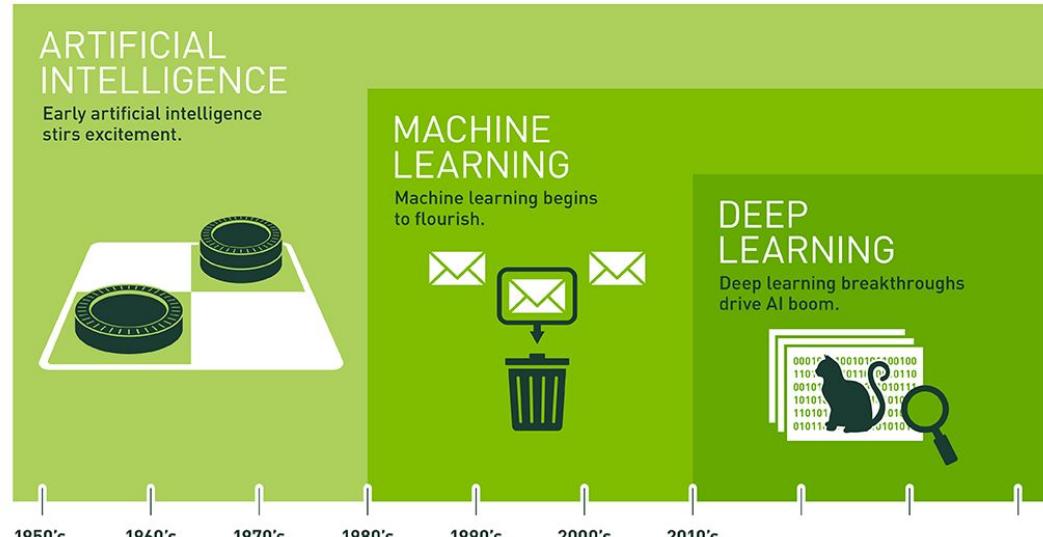
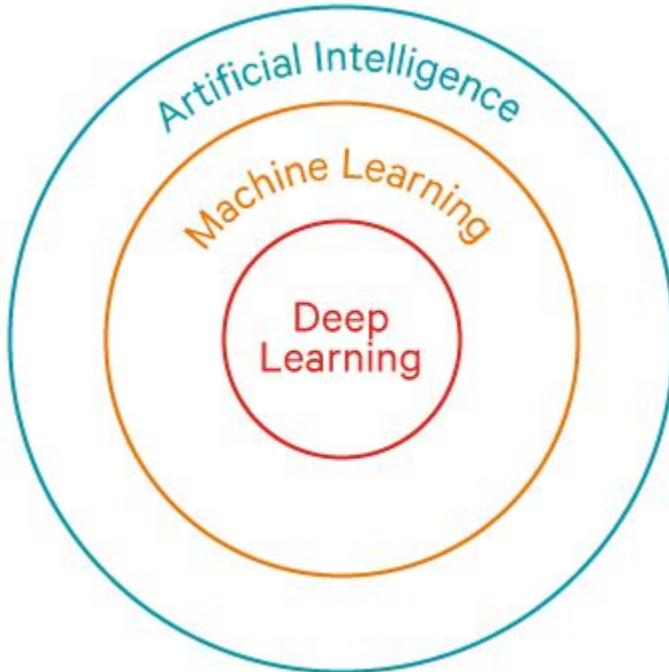
AJAY
AGRAWAL

JOSHUA
GANS

AVI
GOLDFARB

“The current wave of advances in AI **doesn't** actually bring us intelligence but instead a critical component of intelligence, **prediction**”

• Overview of Artificial Intelligence



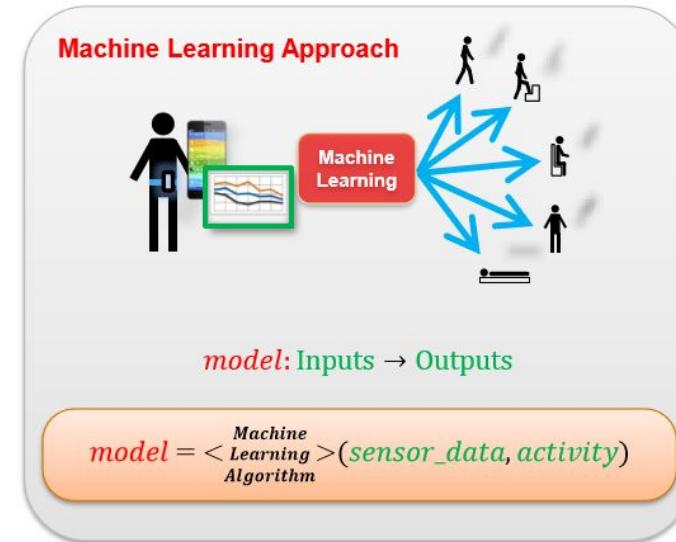
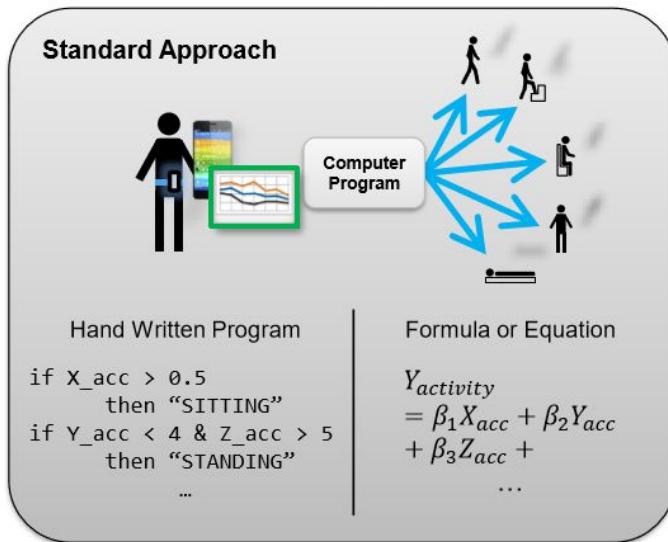
Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

AI, in the broadest sense, describes the different ways a machine interacts with the world around it. To maximize our chance of achieving a given goal. At its core, ML is a simple way of achieving AI.

What is Machine Learning

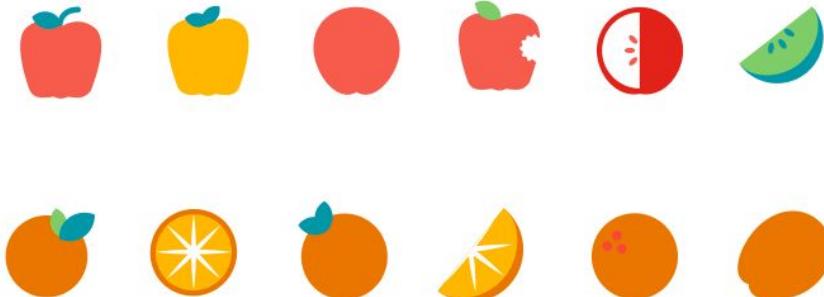
Machine learning uses **data** and produces a **program** to perform a **task**

Task: Human Activity Detection



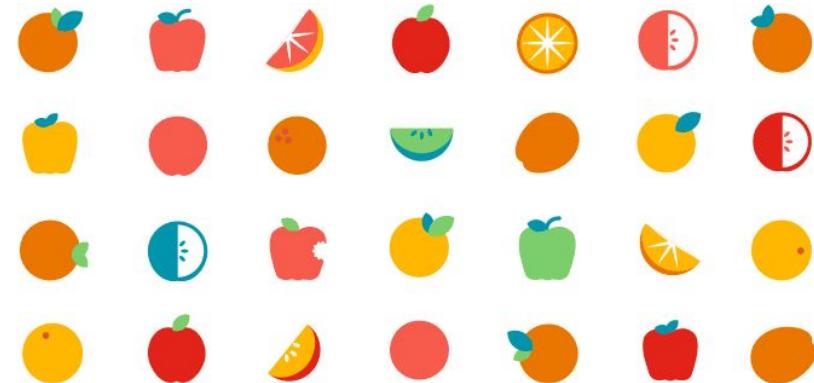
- Introduction to AI

- Machine Learning



- ML - subset of AI
- Machines learn to do task without explicitly programmed to do so.
- Reinforcement learning, decision tree, DL, clustering.....

- Deep Learning



- DL - subset of ML
- DL learns to do task without explicitly programmed to do so.
- Mimics the neurons in a human brain.
- CNN, RNN, AutoEncoder.....

Classes of Machine Learning

Supervised Learning:

Predicting values. **Known** targets.

User inputs correct answers to learn from. Machine uses the information to guess new answers.

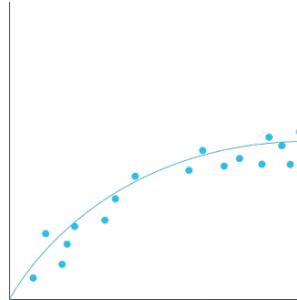
REGRESSION:

Estimate continuous values
(Real-valued output)

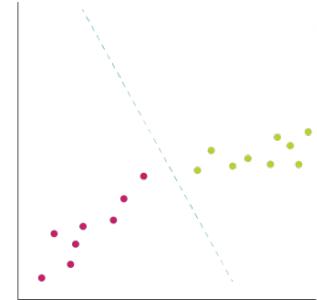
CLASSIFICATION:

Identify a unique class
(Discrete values, Boolean, Categories)

Regression



Classification



Unsupervised Learning:

Search for structure in data. **Unknown** targets.

User inputs data with undefined answers. Machine finds useful information hidden in data.

Cluster Analysis

Group into sets

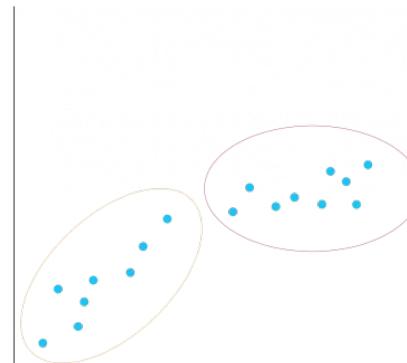
Density Estimation

Approximate distributions

Dimension Reduction

Select relevant variables

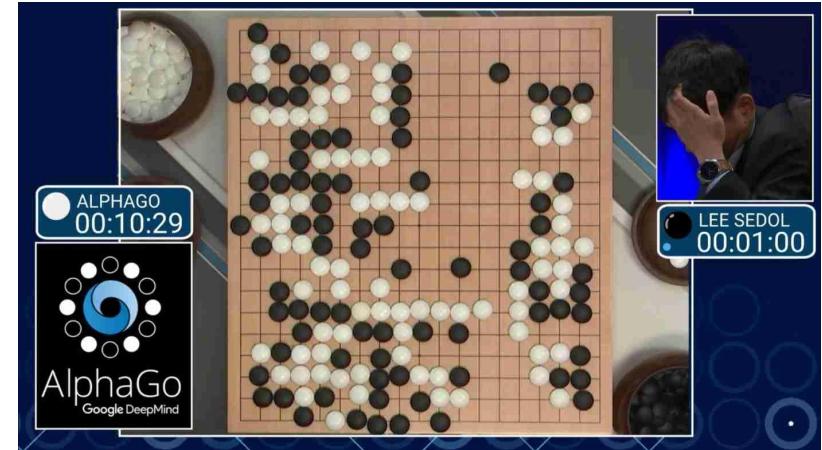
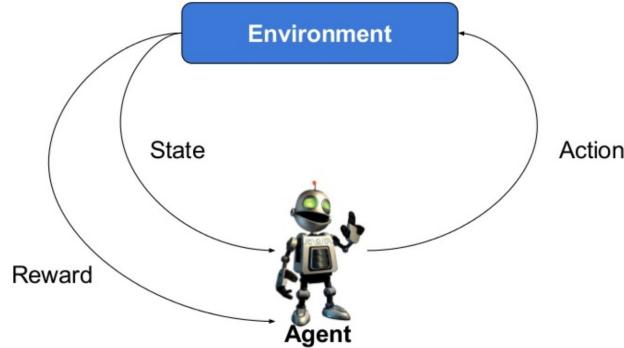
Clustering



Others: RL

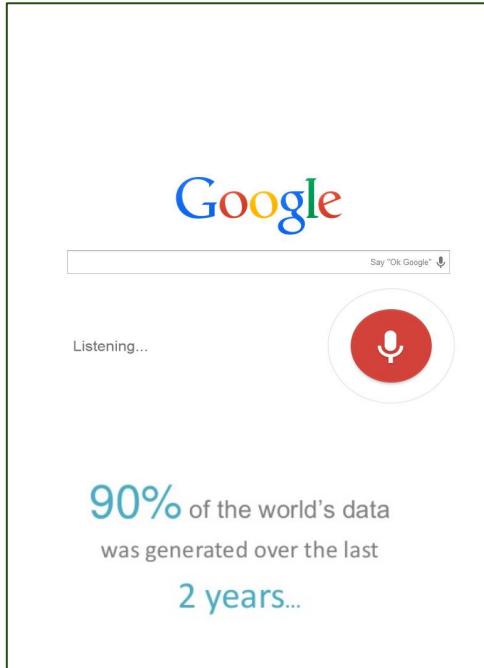
Reinforcement Learning

In the problem, an agent is supposed decide the best action to select based on his current state. When this step is repeated, the problem is known as a *Markov Decision Process*.

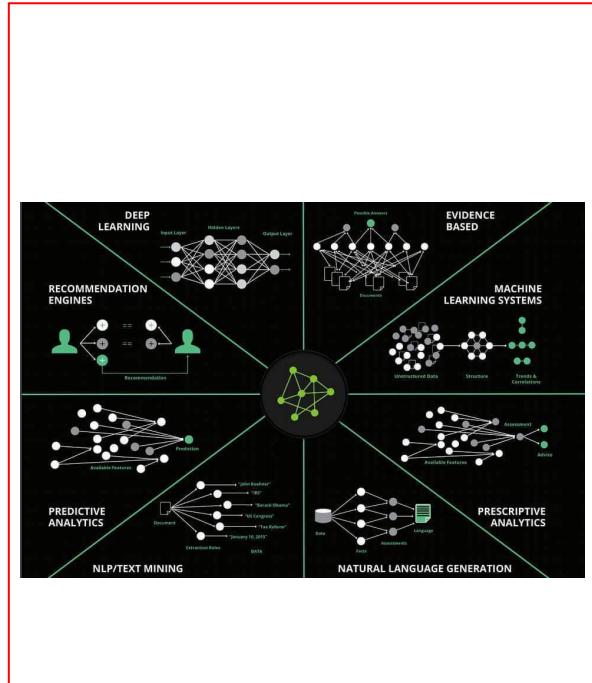


Why deep learning is having great impact in the world?

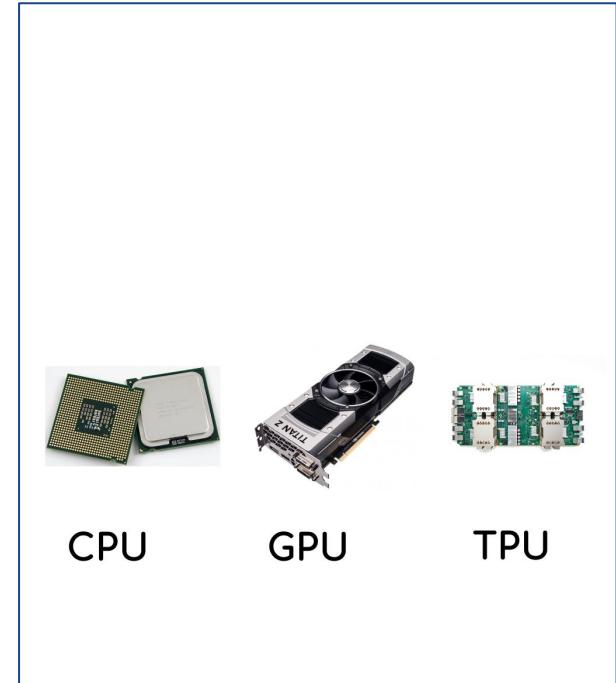
Massive Data



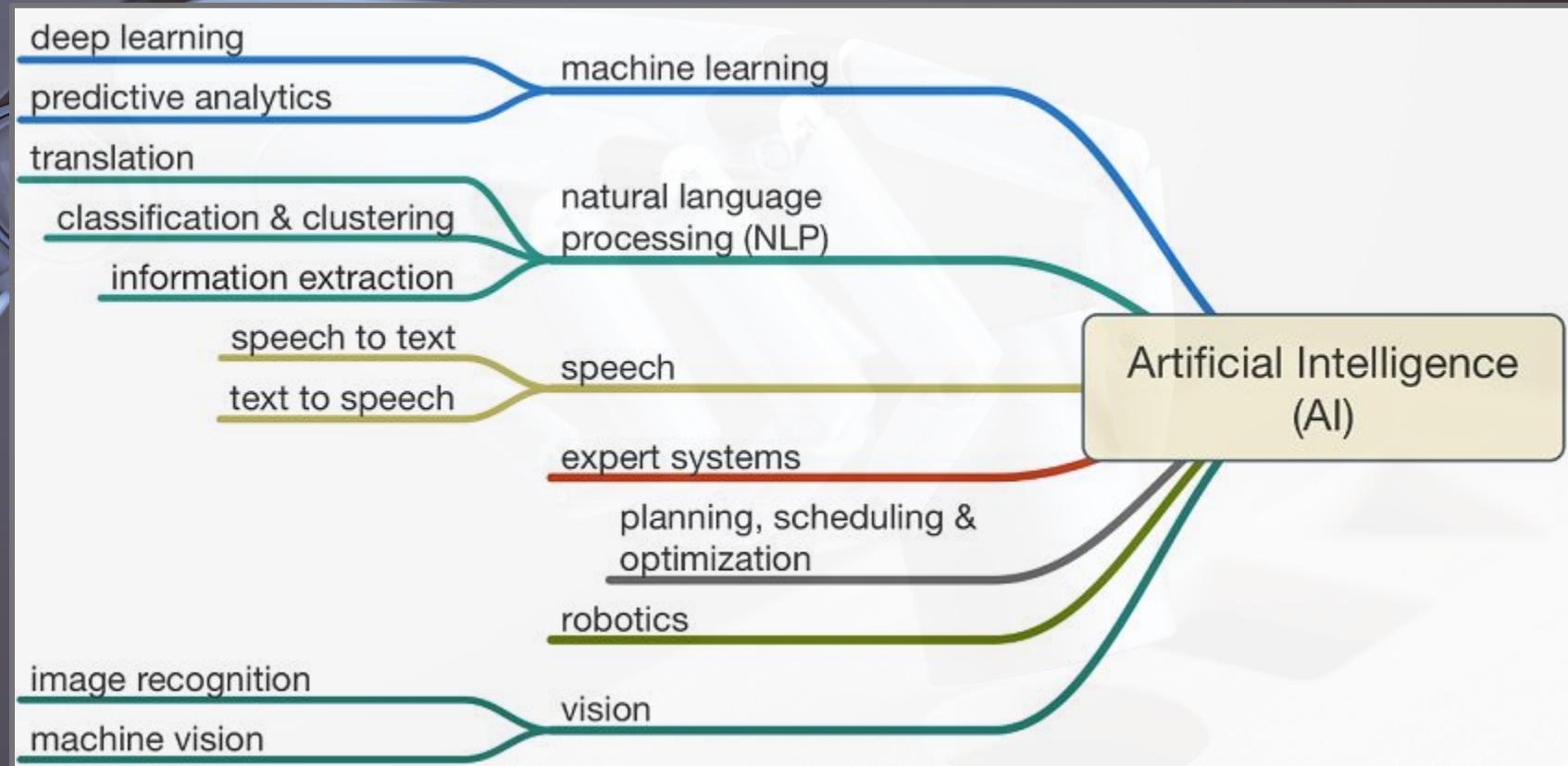
Modern Algorithms



Computational Powerhouse



DL isn't a single approach but a rather a class of algorithms that you can apply to broad spectrum of problem.



Deep Learning Architecture

A mostly complete chart of

Neural Networks

©2016 Fjodor van Veen - asimovinstitute.org

○ Backfed Input Cell

○ Input Cell

△ Noisy Input Cell

● Hidden Cell

○ Probabilistic Hidden Cell

△ Spiking Hidden Cell

● Output Cell

○ Match Input Output Cell

● Recurrent Cell

Perceptron (P)

Recurrent Neural Network (RNN)

DCN

Feed Forward (FF)

LSTM

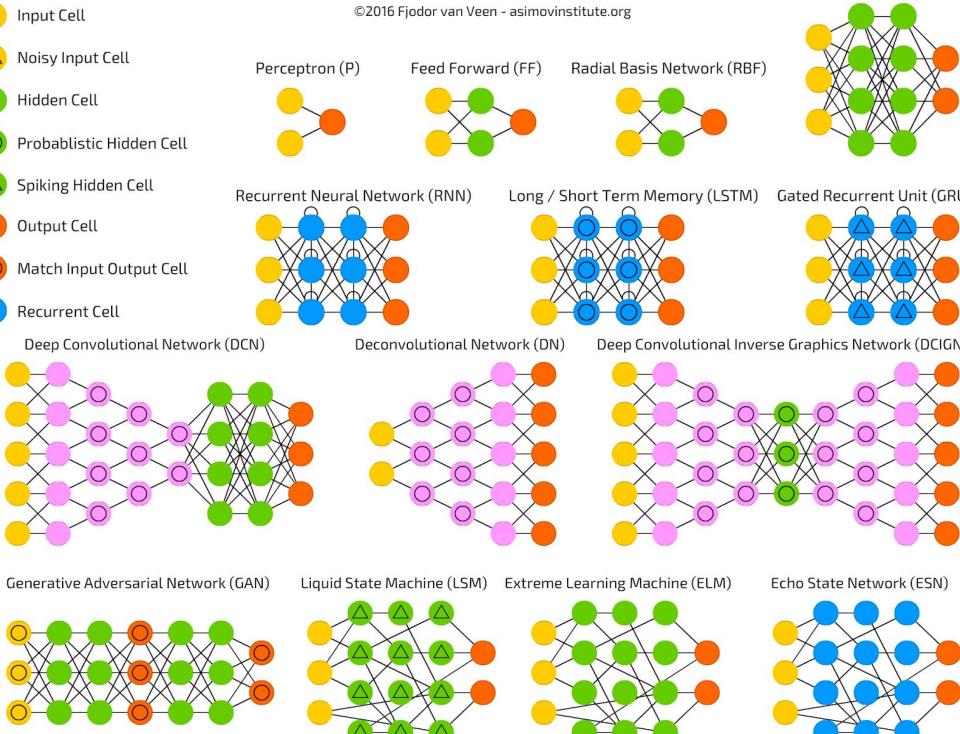
Deconvolutional Network (DN)

Radial Basis Network (RBF)

Gated Recurrent Unit (GRU)

DCIGN

Deep Feed Forward (DFF)



Natural Language Processing: Study of interaction between computers and human languages.

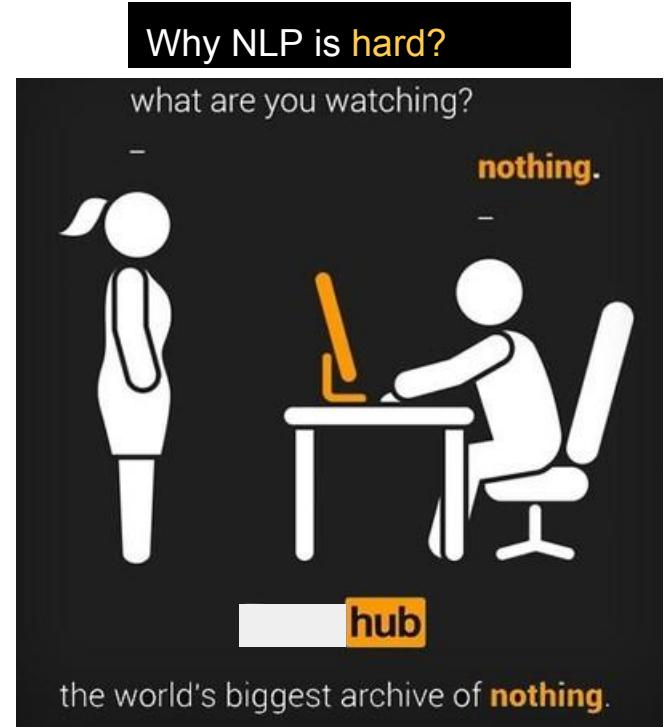
Interdisciplinary Tasks: Speech-to-Text



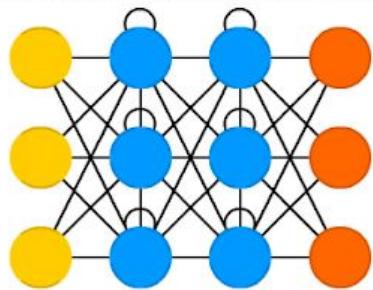
- Sentimental analysis
- Chatbot
- Machine translation
- Text classification



- 300+ ethnic groups in Nigeria(NLP Bigger than Wazobia)
- Languages are ambiguous("I love Blackberry?")
- Interpretation of context(I am hungry, because I am broke)
- Machine don't understand Language.

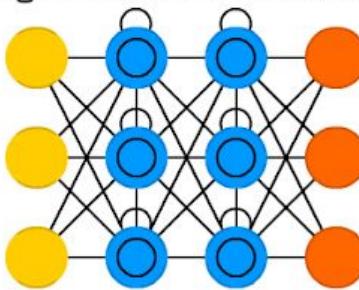


Recurrent Neural Network (RNN)



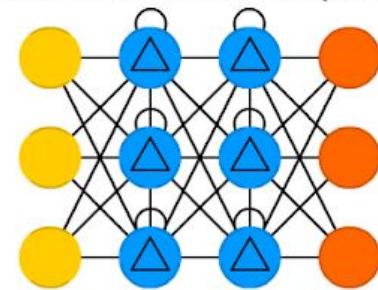
- Feed-forward network
- Feedback mechanism

Long / Short Term Memory (LSTM)



- Memory cell
- Retain information
- Can remember info. Not just the last computed value.

Gated Recurrent Unit (GRU)

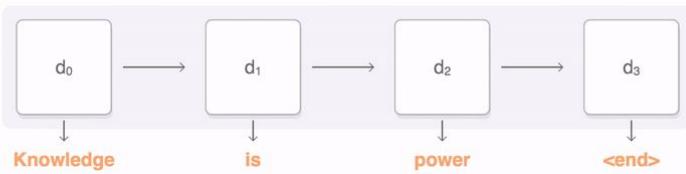


- Faster and simpler LSTM
- Fewer weight
- Two gates
- Update gates - maintain info.
- Reset gates - flush info.

Encoder



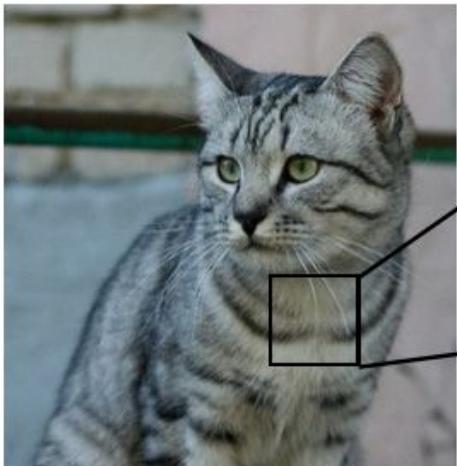
Decoder



1. Machine translation
2. Speech synthesis
3. Language modelling
4. Time series prediction
5. Music generation

Computer Vision: Is a field of computer science that works on enabling computer see, identify and process images. CV is linked with AI as computer must interpret what it sees and perform necessary analysis.

The Problem: Semantic Gap



(assume given set of discrete lab
{dog, cat, truck, plane, ...})



cat

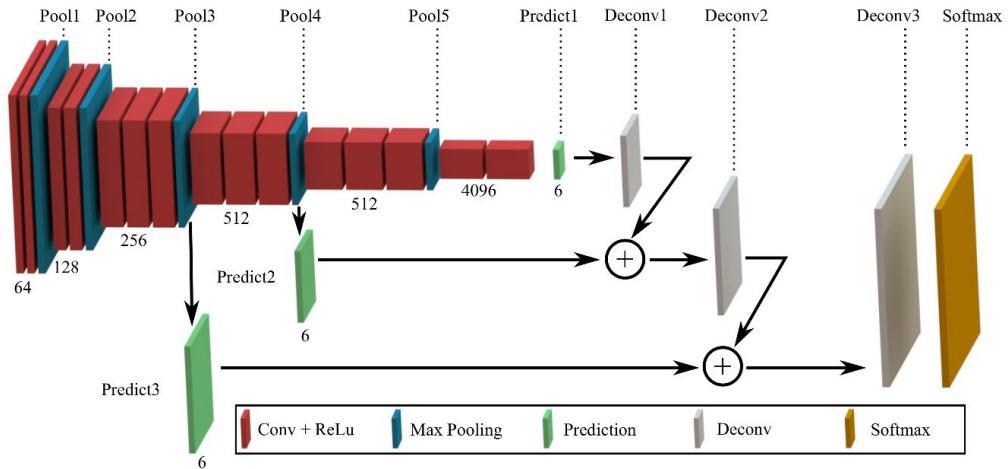
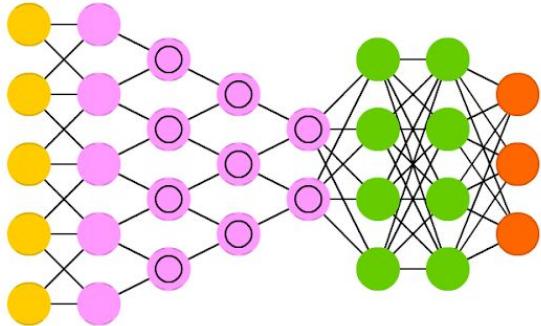
[105 112 188 111 104 99 106 99 96 103 112 119 104 97 93 87]
[91 98 102 186 104 79 98 103 99 105 123 136 110 105 94 85]
[76 85 98 185 128 105 87 96 95 99 115 112 106 183 99 85]
[99 81 81 93 120 131 127 100 95 98 102 99 96 93 101 94]
[106 91 61 64 69 91 88 85 181 107 109 98 75 84 96 95]
[114 108 85 55 69 64 54 64 87 112 129 98 74 84 91]
[133 137 147 183 65 81 80 65 52 54 74 84 102 93 85 82]
[128 137 144 148 109 95 86 70 62 65 63 63 66 73 86 101]
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[127 125 131 147 133 127 126 131 111 96 89 75 61 64 72 84]
[115 114 109 123 150 148 131 118 113 109 100 92 74 65 72 78]
[89 93 98 97 108 147 131 118 113 114 113 109 106 95 77 80]
[63 77 86 81 77 79 182 123 117 115 117 125 125 138 115 87]
[62 65 82 89 78 71 80 101 124 126 119 101 107 114 131 119]
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[87 65 71 87 106 95 69 45 76 138 126 187 92 94 105 112]
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[164 146 112 88 82 128 124 104 76 48 45 66 88 181 102 109]
[157 170 157 128 93 86 114 132 112 97 69 55 70 82 99 94]
[130 128 134 161 139 188 109 118 121 134 114 87 65 53 69 86]
[128 112 96 117 158 144 120 115 184 107 102 93 87 81 72 79]
[123 107 96 86 83 112 153 149 122 109 104 75 88 187 112 99]
[122 121 102 88 82 86 94 117 145 148 153 182 58 78 92 107]
[122 164 148 183 71 56 78 83 93 103 119 139 102 61 69 84])]

What the computer sees

An image is just a big grid of numbers between [0, 255]:

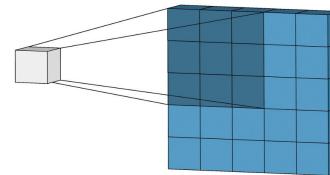
e.g. 800 x 600 x 3
(3 channels RGB)

Deep Convolutional Network (DCN)



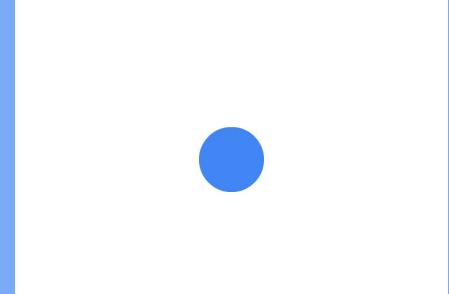
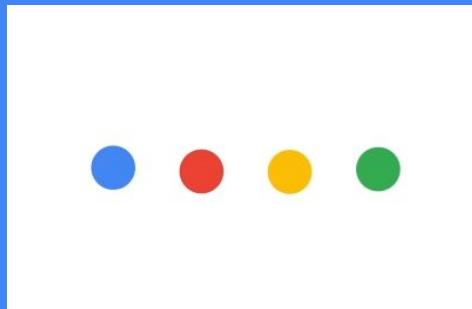
- Inspired by the brain visual cortex
- High Image processing application
- Learn higher-order features in data via **convolution**.

Convolve the filter/kernel with the i.e “slide over the image spatially computing dot products”



1. Image generation
2. Image classification
3. Image captioning
4. Robotic.....

Everyday applications of AI



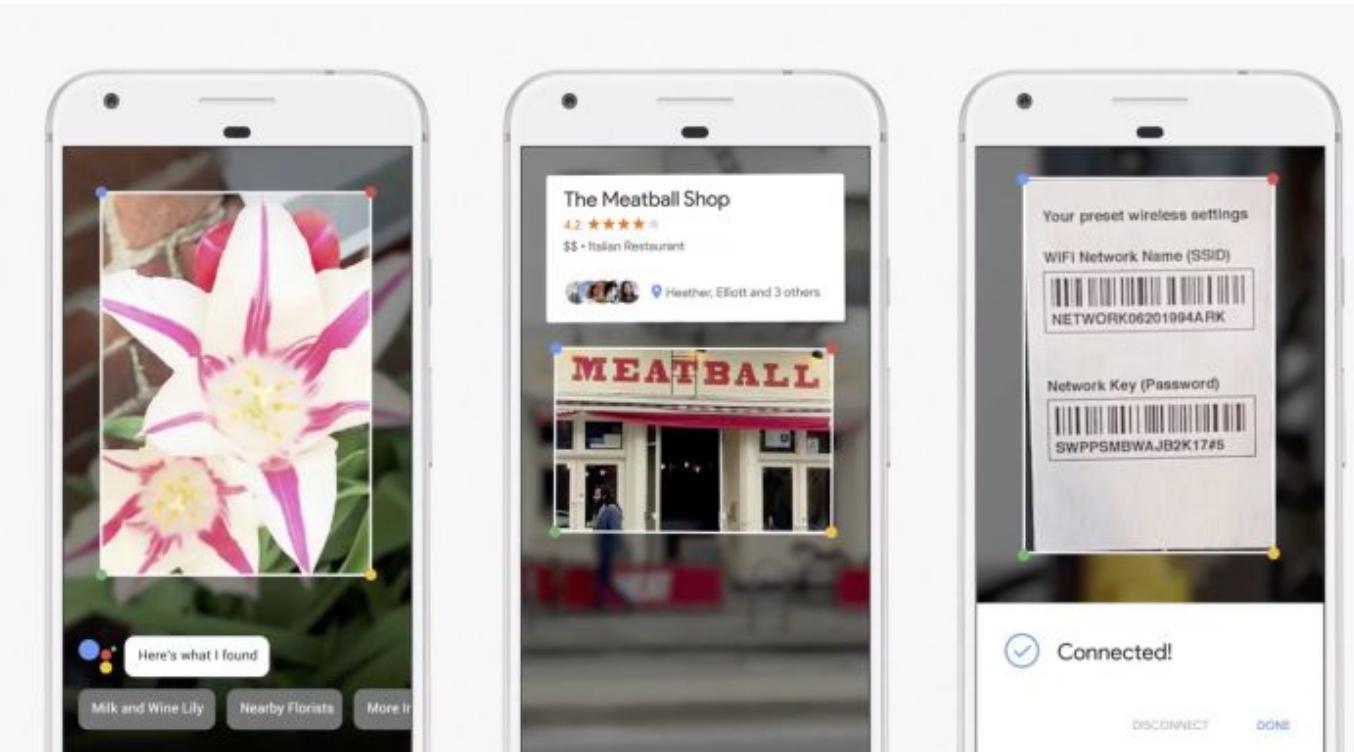
● Smart Compose



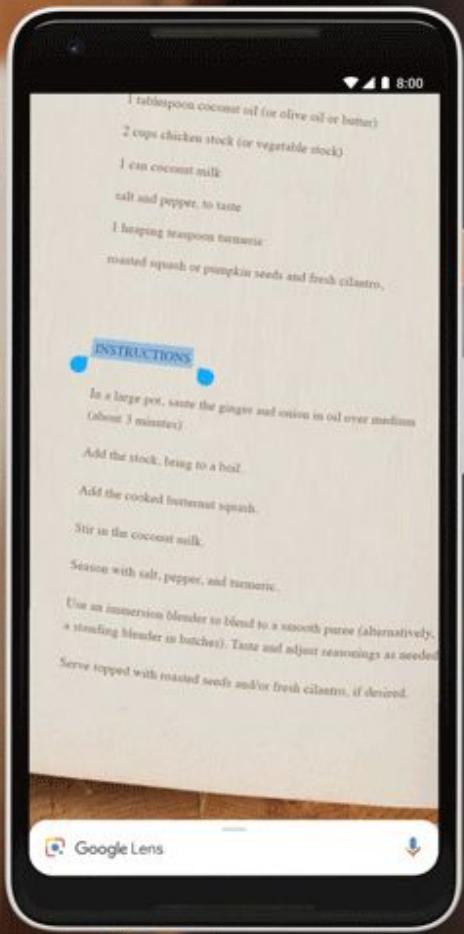
A screenshot of the Gmail web interface. On the left, there's a sidebar with navigation links: Compose, Primary, Social, Promotions, Updates, and a list including Starred, Snoozed, Important, Sent, Work, and More. The main area shows the inbox with several messages listed. A message from Salit Kulla about a trip to Cairngorms National Park is selected. A modal window titled "Taco Tuesday" is open, showing suggestions like "Jacqueline Bruzek" and "Taco Tuesday". At the bottom of the screen, there are standard email controls: Send, reply, forward, and attachments.

Typical language generation models, such as [ngram](#), [neural bag-of-words](#) (BoW) and [RNN language](#)(RNN-LM) models, learn to predict the next word conditioned on the prefix word sequence.

● Google Len



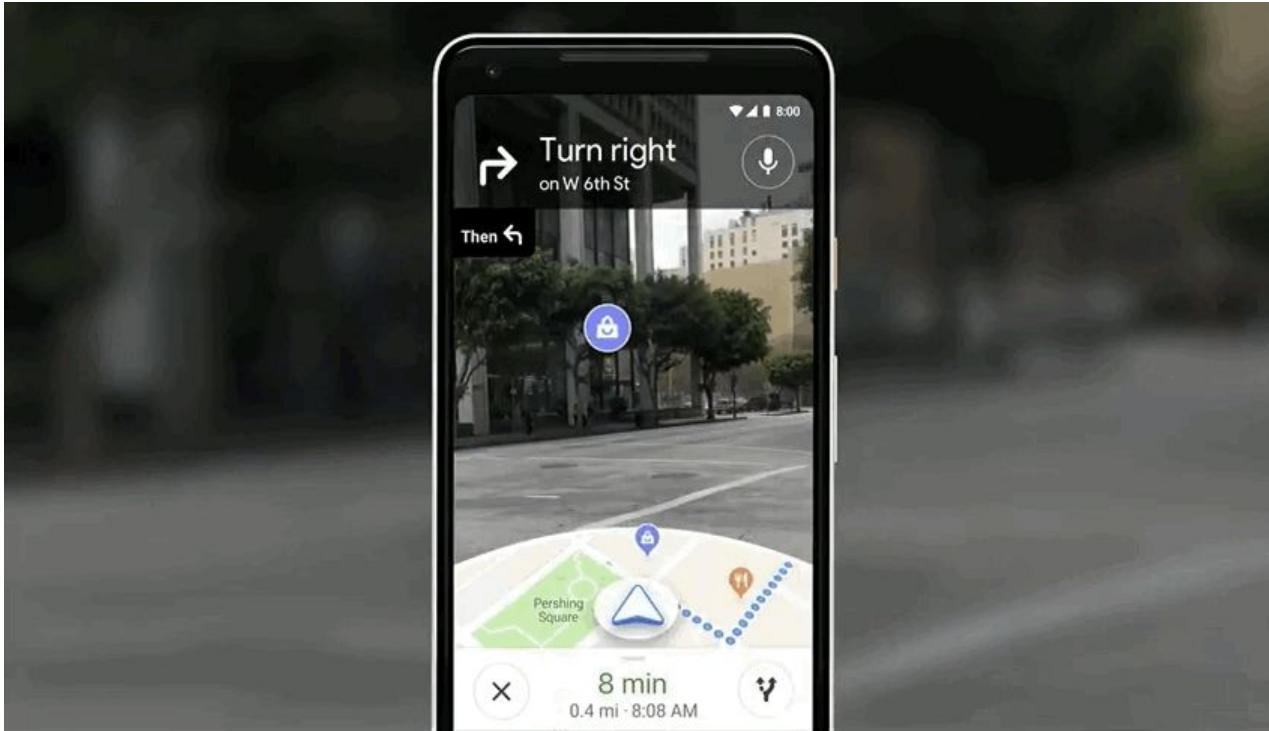
Text Selection



- Google leveraged on digitization of books around the world.



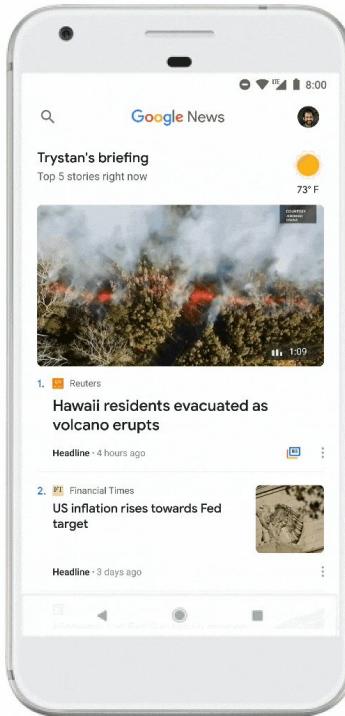
● Google Map



- Google leveraged on geo-location mapping.

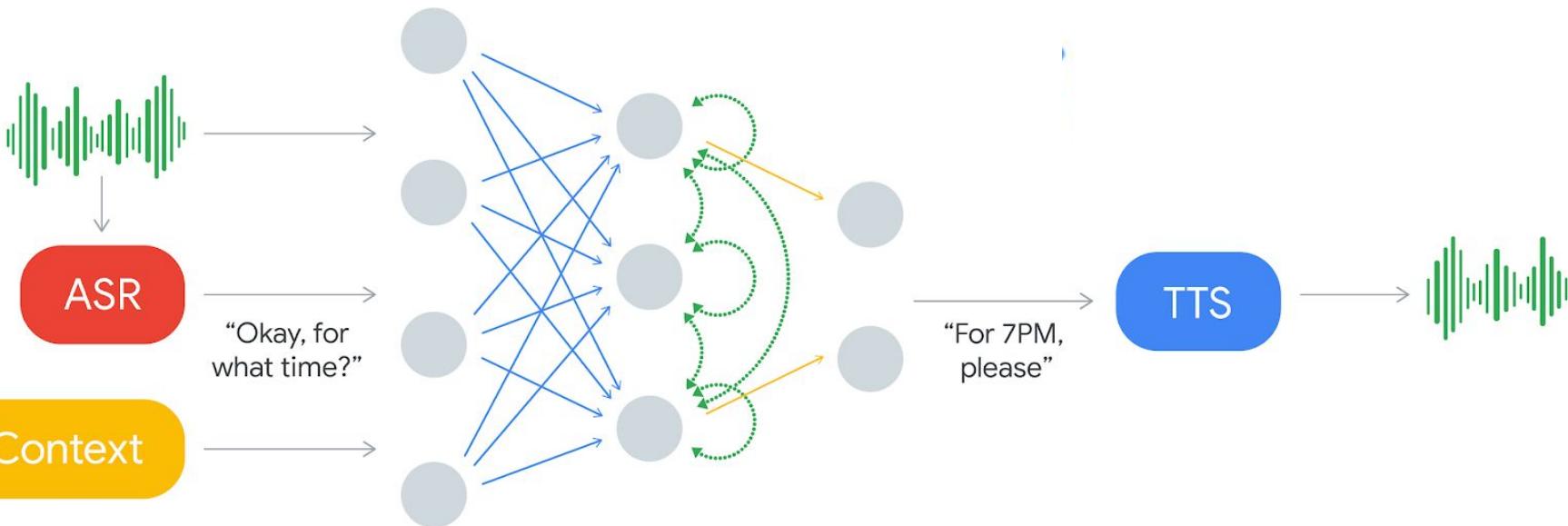


● Google News



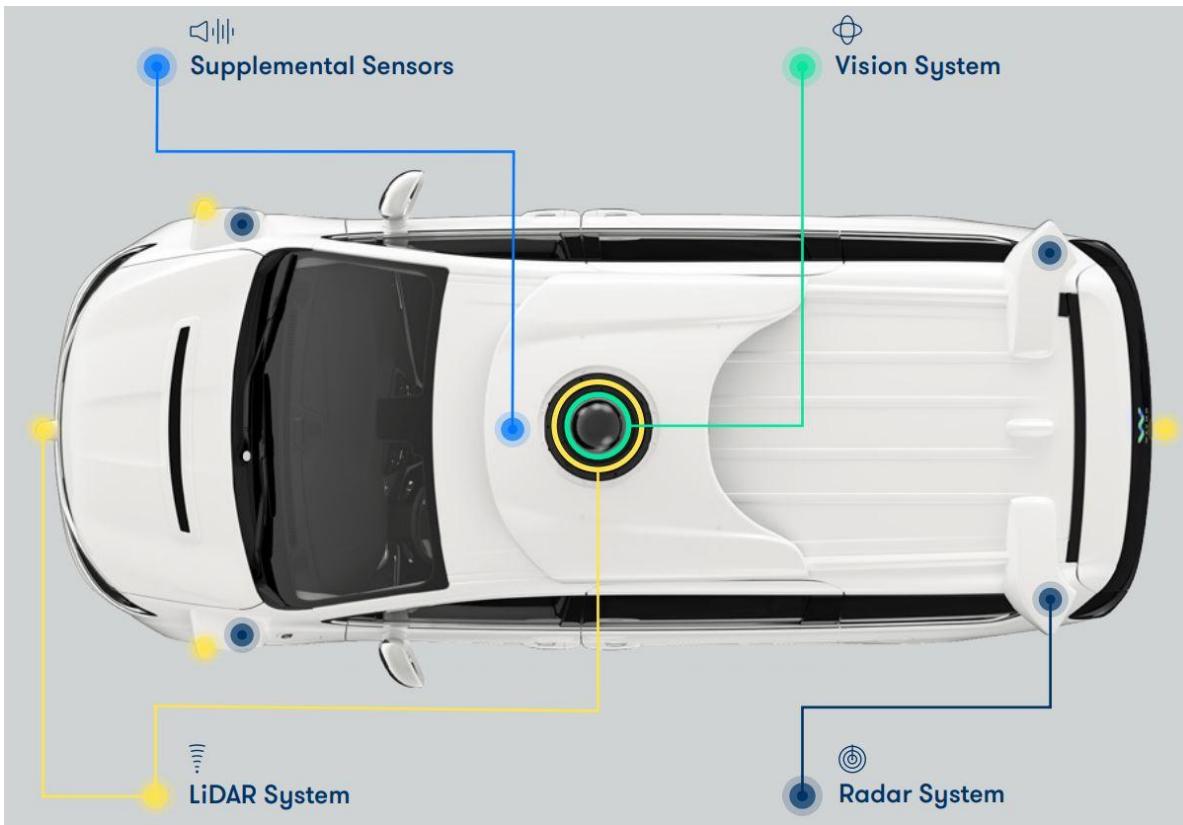
- **Clustering**
- **Recommender System**
- **Topic modelling**

Google Assistant - WaveNet



The ability of computers to understand natural speech has been revolutionised in the last few years by the application of deep neural networks (e.g., [Google Voice Search](#)). However, generating speech with computers — a process usually referred to as [speech synthesis](#) or text-to-speech (TTS).





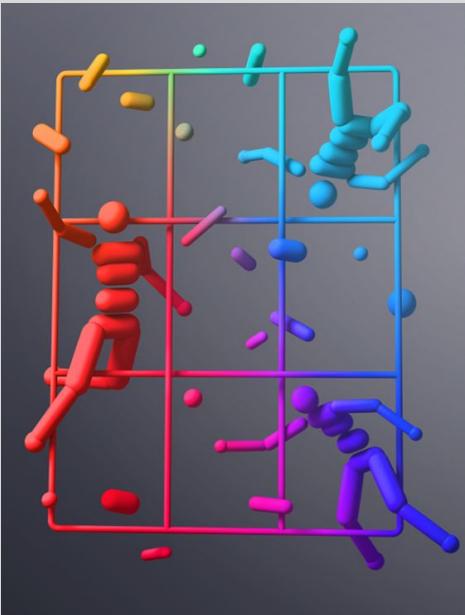
Sensor fusion and deep learning.

Radar: a device that sends radio wave for find out the position and speed of moving object.

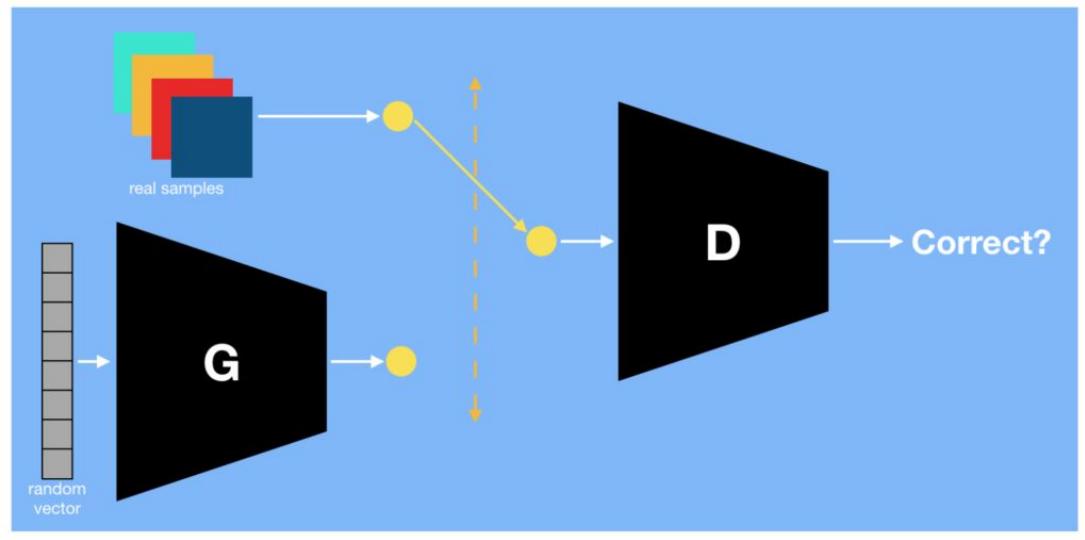
Lidar: like radar, but instead of sending out radio waves it emits pulses of infrared light—aka lasers invisible to the human eye.

Vision: High end camera for real-time object detection.

Bleeding Edges of AI



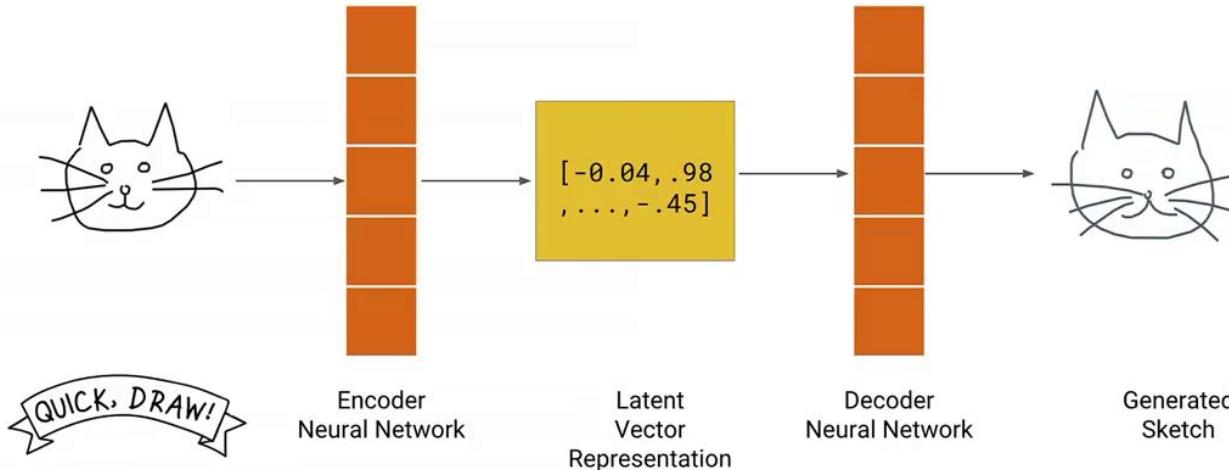
Self-play



Generative Adversarial Network

Generative Adversarial Network

A Latent Vector Space for Drawing



A Neural Representation of Sketch Drawings
David Ha and Douglas Eck

Generative Adversarial Network

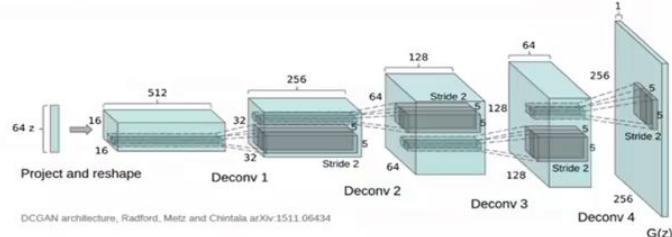
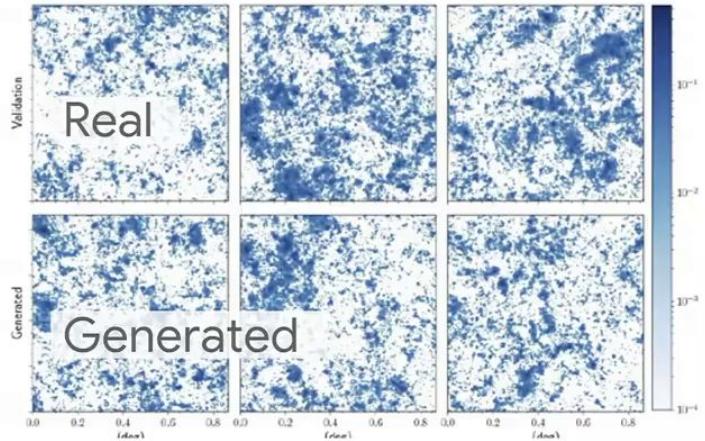
Latent Space Analogies

$$\text{cat} + (\text{pig} - \text{pig}) = \text{cat}$$

$$\text{pig} + (\text{cat} - \text{cat}) = \text{pig}$$



Generative Adversarial Network



- Augmentation Gan
- Reduce computational simulation

Performance RNN

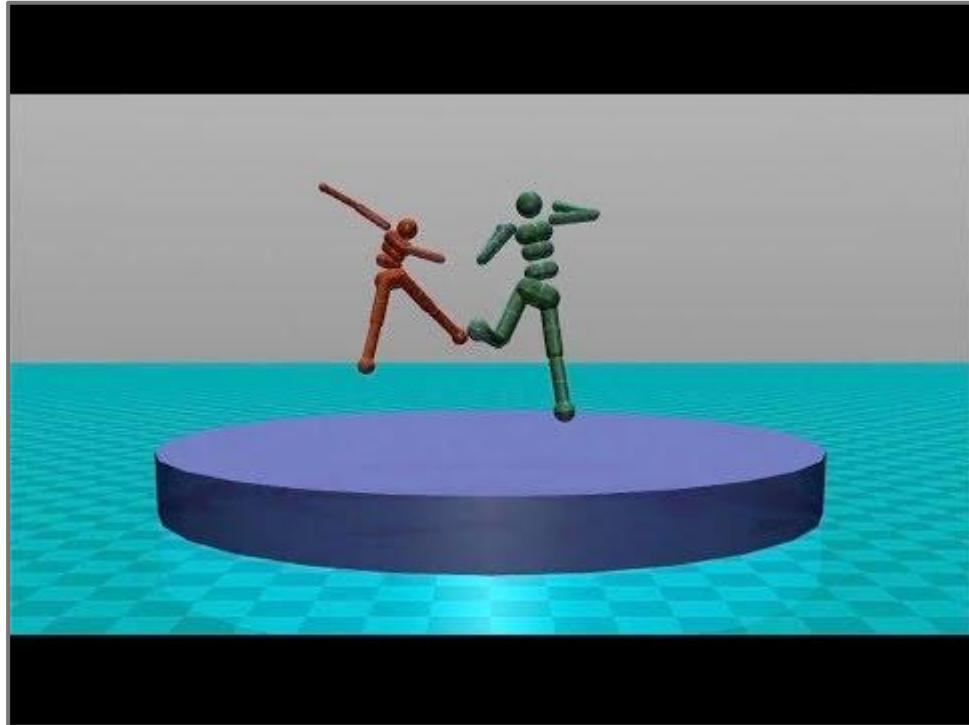


- Generation of music



- Generation of Art

Self-Learning and Self-Playing



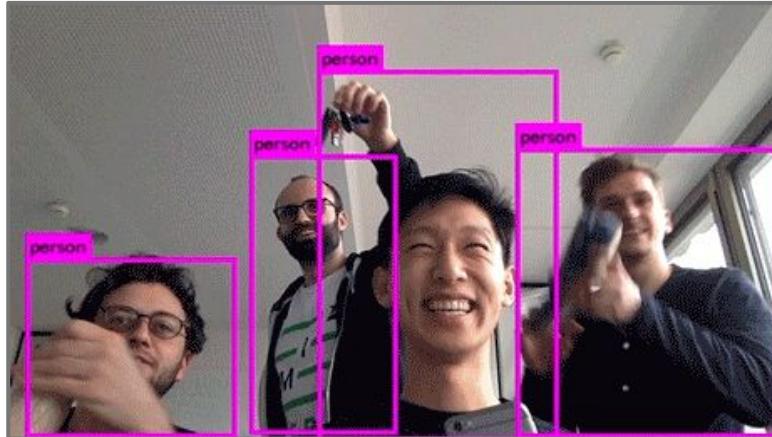
Dota 2



- Using a separate LSTM for each hero and no human data, it learns recognizable strategies.
- OpenAI Five plays 180 years worth of games against itself every day, learning via self-play.

Open AI Bots vs Humans

Application of Deep Learning in real life.



object detection



Real-time tracking



Generation of Language

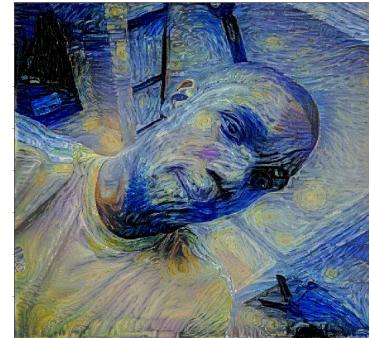
Style Transfer



+



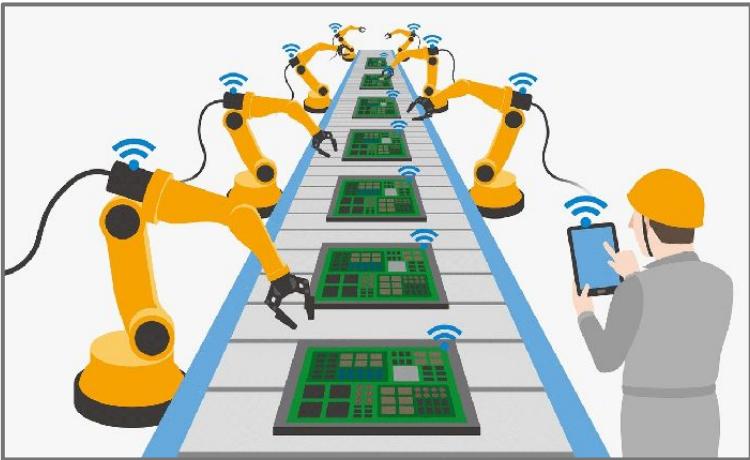
=



Generation and captioning of image

This flower is pink, white, and yellow in color, and has petals that are striped

Stage-I	Stage-II



Manufacturing



Robotic



Why AI is REALLY important:

AI is a **threat** for the developing world:

- A lot less value on **energy** resources going fwd
- A lot less of value on **unskilled human work**(**60%** of Africans are under **25 years old**)

AI is an **opportunity**:

- **Low barrier** to entry: just curiosity and willpower
- Few of the limits in physical goods trading apply

Common myths around AI



Jay Shah, MS Computer Science & Machine Learning, Arizona State University
(2020)

Answered May 11

A lot of people looking to get started in machine learning usually are concerned for,

"I can't get into machine learning until..."

- I get a degree or higher degree.
- I complete a course.
- I am good at linear algebra.
- I know statistics and probability theory.
- I have mastered this library or that tool.

But these are not true in all contexts.

Totally.....BS



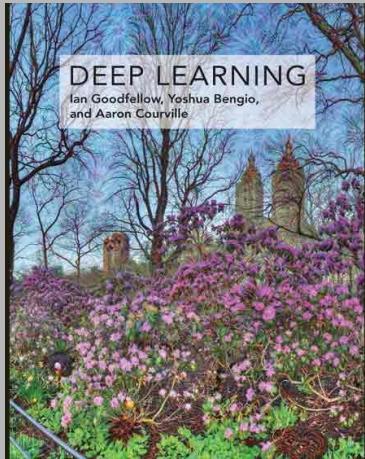
- Jan - April, 2018 for 1st cycle.
- Young people from different background.
- Stanford course - CS231n & Fastai course.
- Reading and implementing research papers.
- Aug. 2018 - 2nd cycle.

Starter Kit

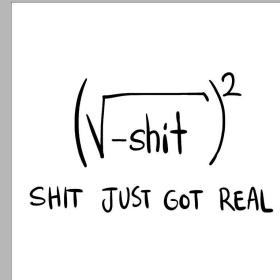
- Curiosity (Ok with failure)



- AI Holy Book



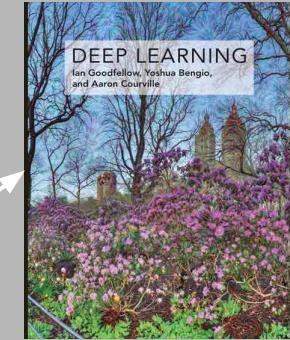
- Self-Education



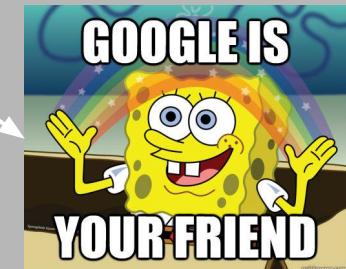
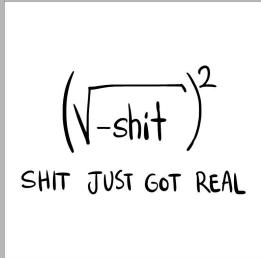
1. Linear Algebra
2. Calculus
3. Statistics
4. Siraj Raval(Guy is a blessing ☐)
5. Andrew Ng
6. Stanford C231n
7. Just Paper(they don't usually make sense)
8. ∞

Google™ Is Your Best Friend ...

Read and understand



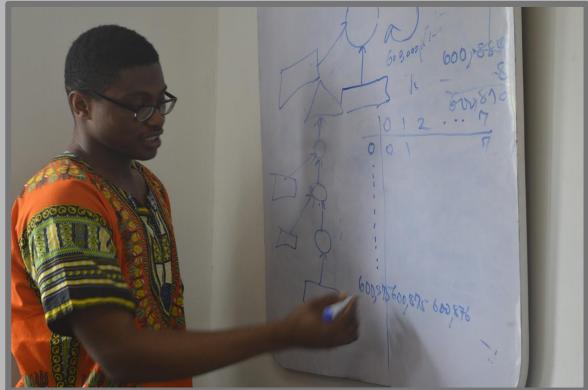
Learn shit



AI6 YOUR REAL FRIENDS

Not the only one

Community Guide





“AI will digitally disrupt all industries.
Don’t be left behind” - Dave Waters



Thank you & goodluck in your AI endeavours.

**Anything you can do,
AI can do better**

