

An Introduction to AI

WEEK 1, COHORT 4



“aimed at getting you to
kickass in AI”

What is Artificial Intelligence?

- Before we answer this question, let see if we remember some familiar personalities.



Agamemnon



Odysseus



Achilles

What is Artificial Intelligence?

- How about these guys?



Artemis



Athena



Thetis

- What do they all have in common?

What is Artificial Intelligence?

- How about these guys?



Artemis



Athena

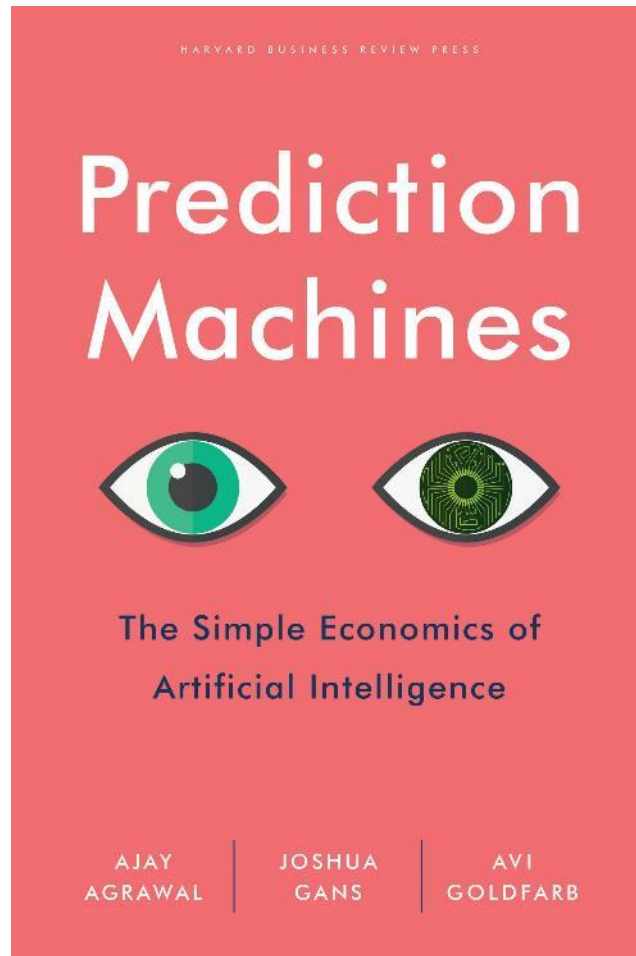


Thetis

- What do they all have in common?

Prophecy, and we can say **Prophecy** which is **Prediction**, is the act of saying what will happen in future

What is Artificial Intelligence?

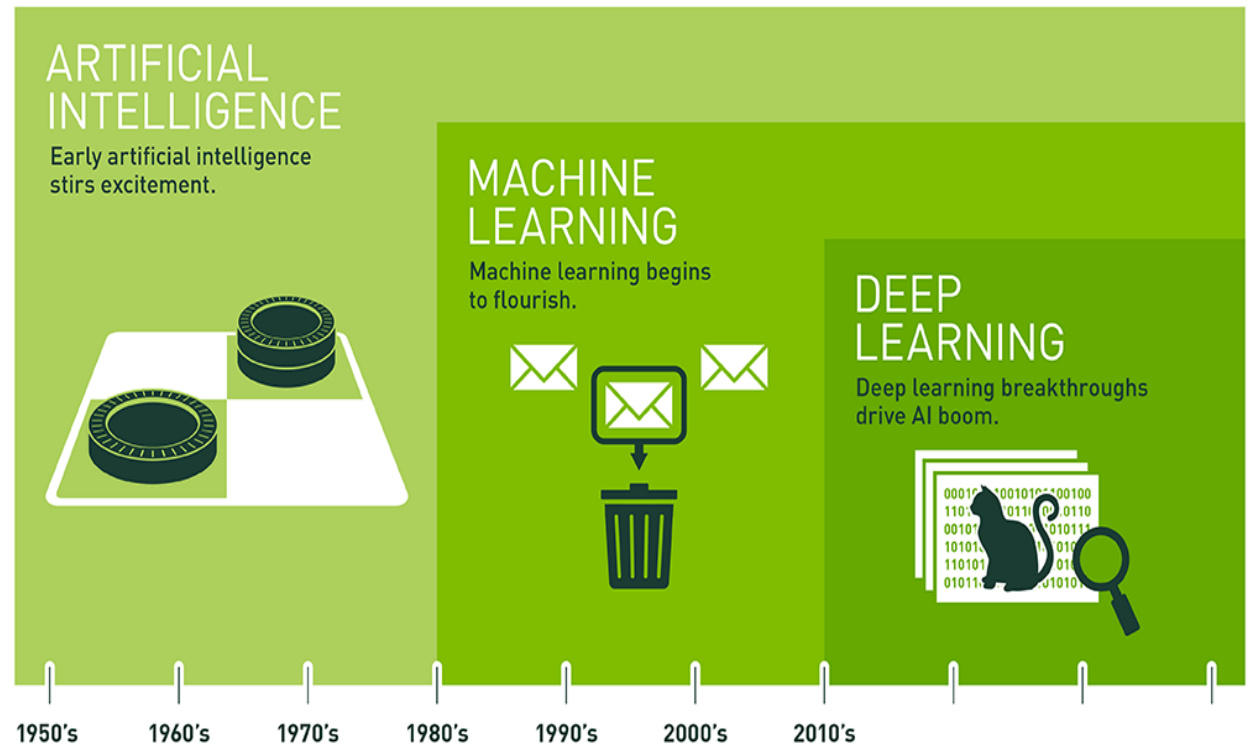
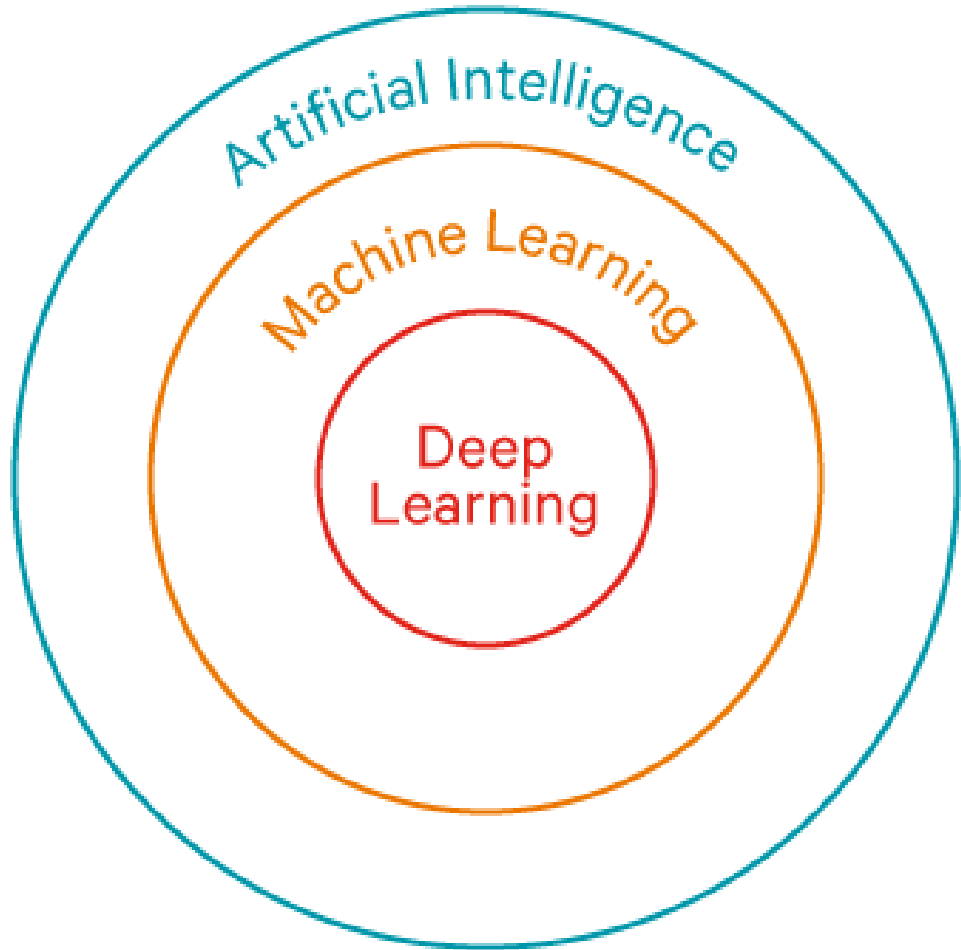


Back to Artificial Intelligence

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

- 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 simply way of achieving AI.

Overview of Artificial Intelligence



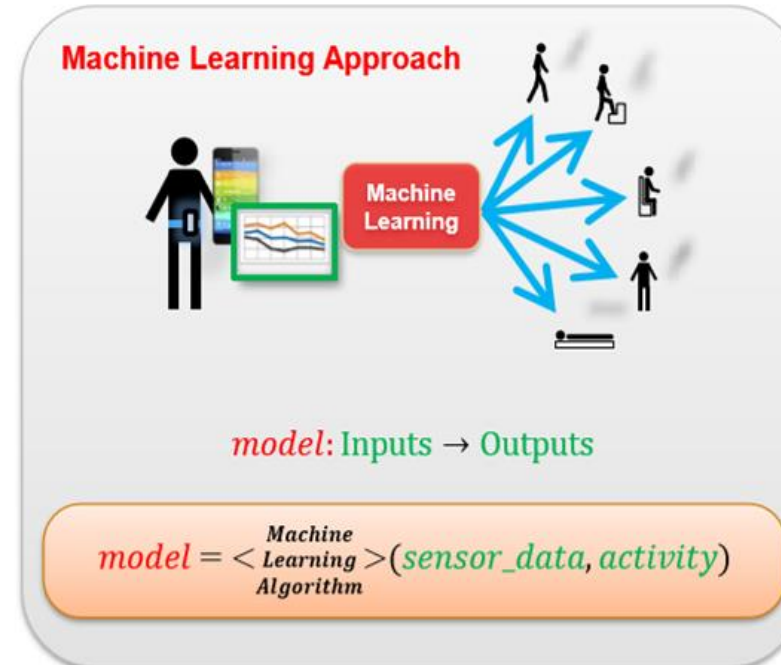
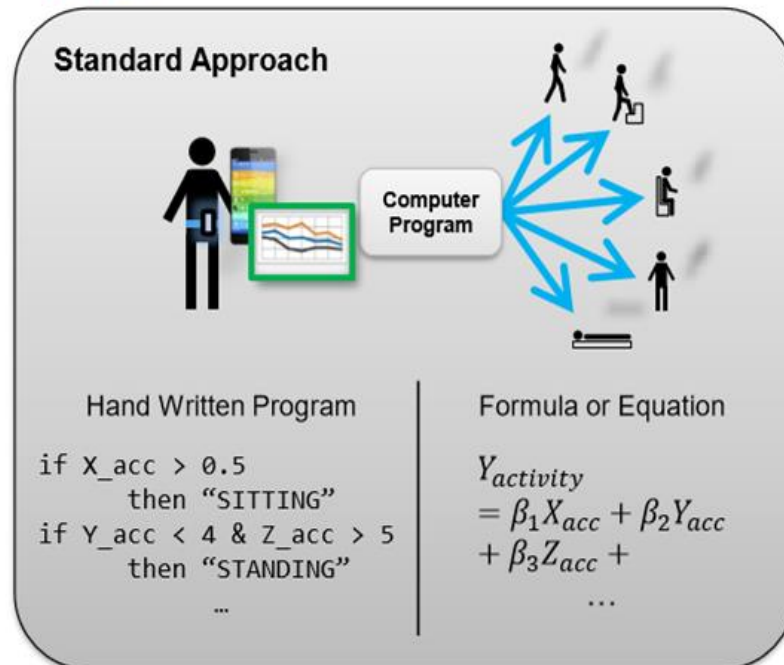
Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Machine Learning

What is Machine Learning

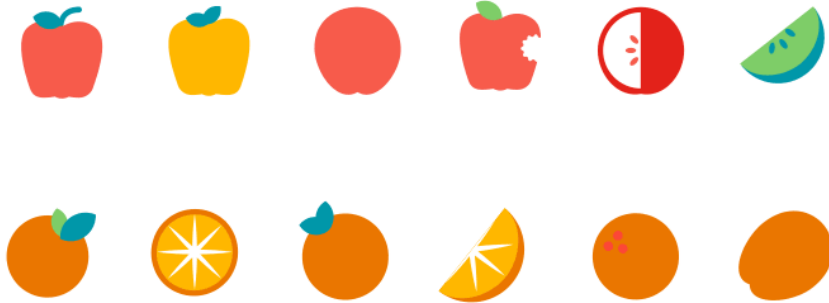
Machine learning uses **data** and produces a **program** to perform a **task**

Task: Human Activity Detection



Machine Learning vs Deep Learning

ML



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

DL



- 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.

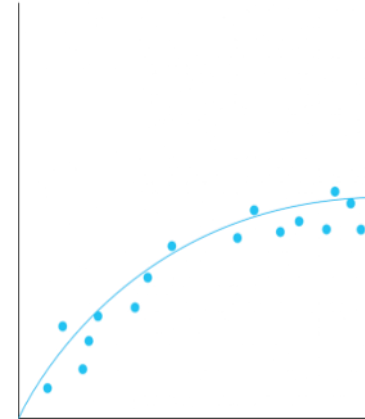
REGRESSION:

Estimate continuous values
(Real-valued output)

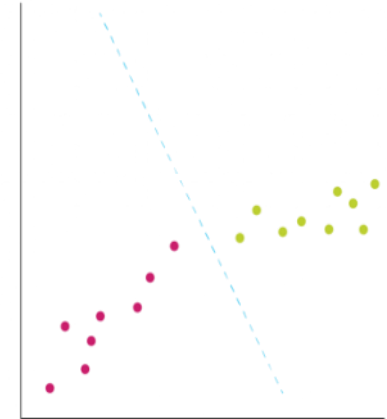
CLASSIFICATION:

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

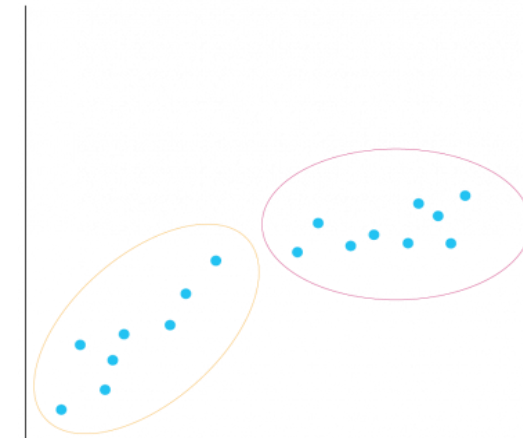
Density Estimation

Approximate distributions

Dimension Reduction

Select relevant variables

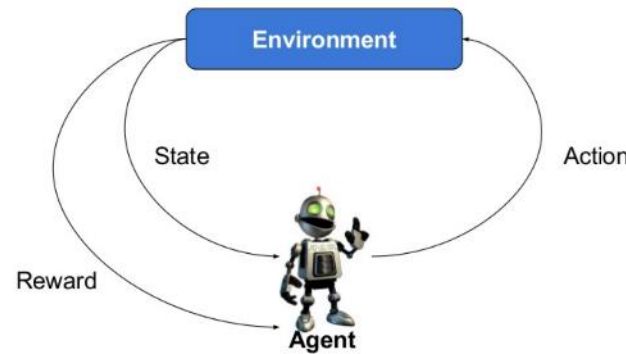
Clustering



Others: RL

Reinforcement Learning

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



Deep Minds



Alpha Go

Reinforcement Learning

Dota 2



Open AI Bots vs Humans

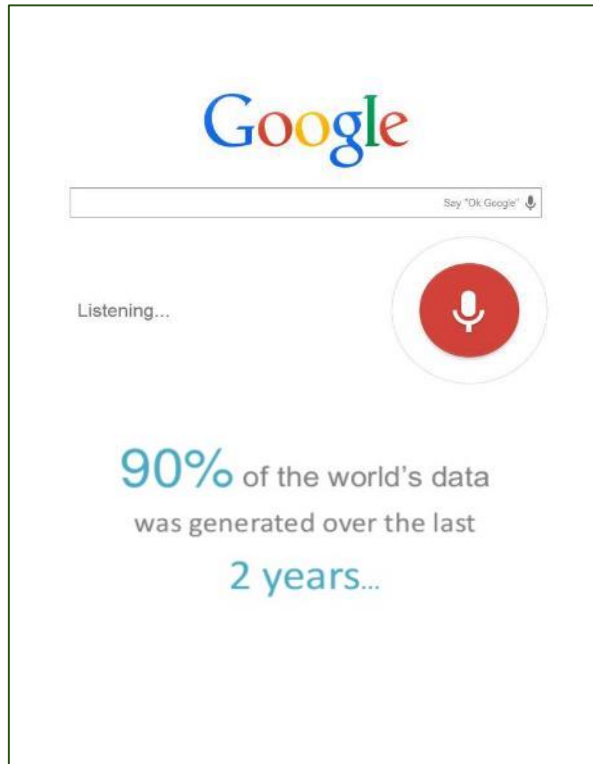
- Using a separate [LSTM](#) for each hero and no human data, it learns recognizable strategies.
- OpenAI Five plays 180 years worth of games against itself every day, learning via self-play.

Deep Learning

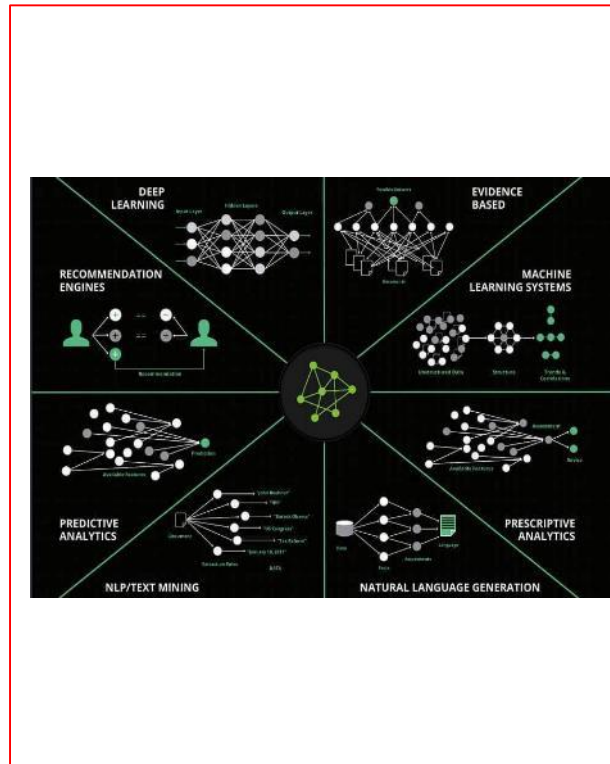
Lets focus a little more on Deep Learning.

Why deep learning is having great impact in the world?

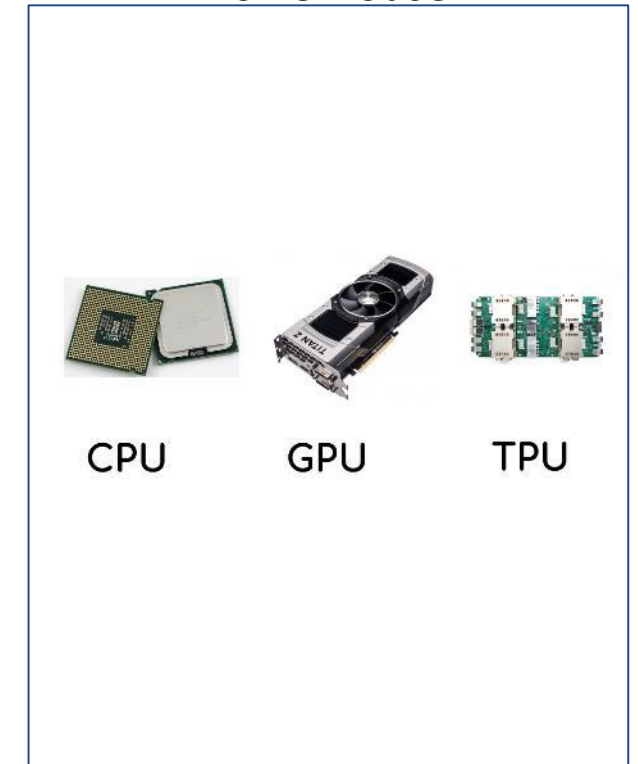
Massive Data



Modern Algorithms

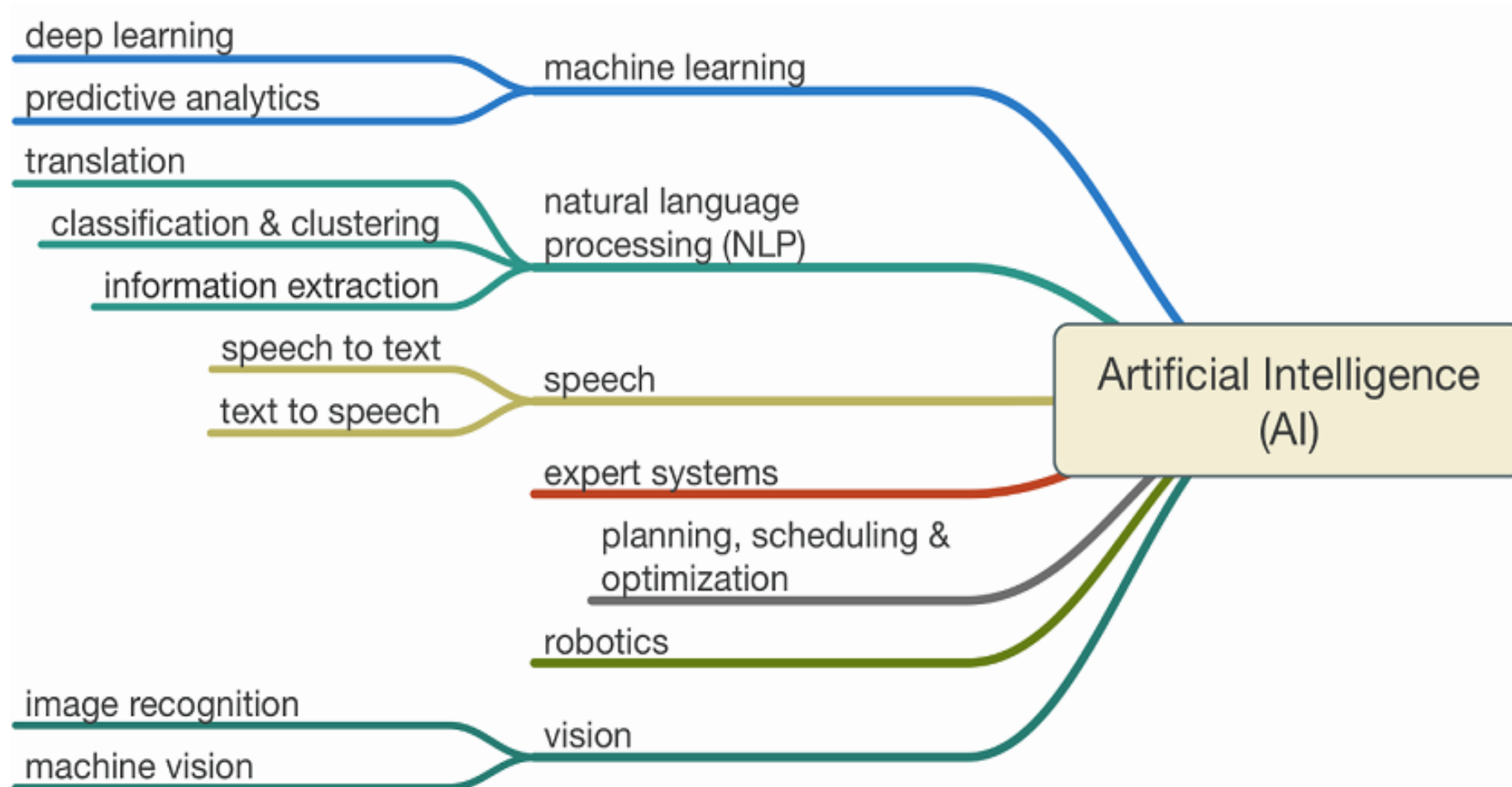


Computational Powerhouse



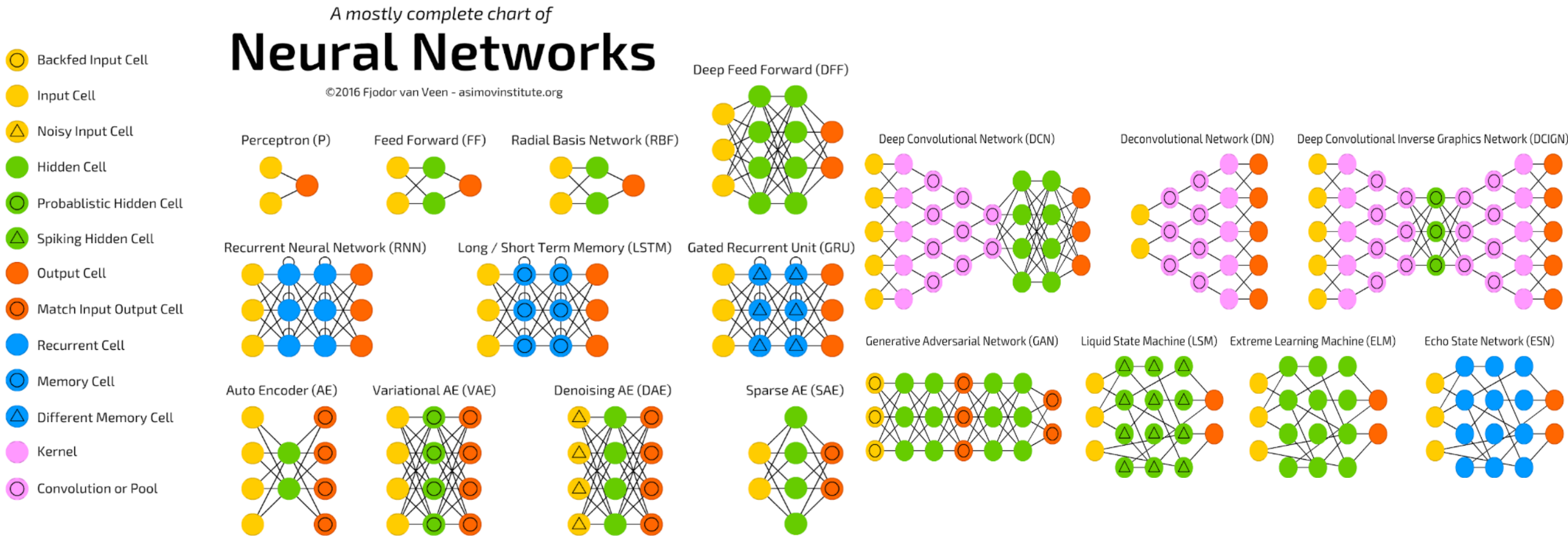
Deep Learning

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



Deep Learning

There are different types of Deep Learning Architecture



Deep Learning

Natural Language Processing

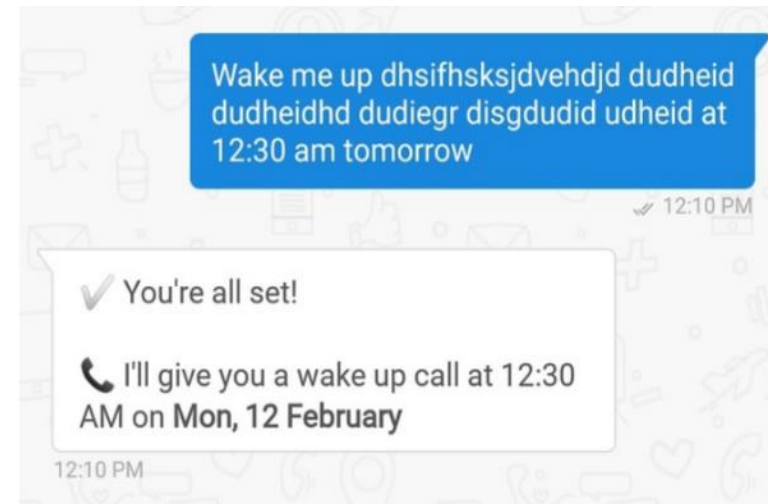
- Study of interaction between computers and human languages.

Interdisciplinary Tasks: Speech-to-Text



- Sentimental analysis
- Chatbot
- Machine translation
- Text classification

Why NLP is hard?

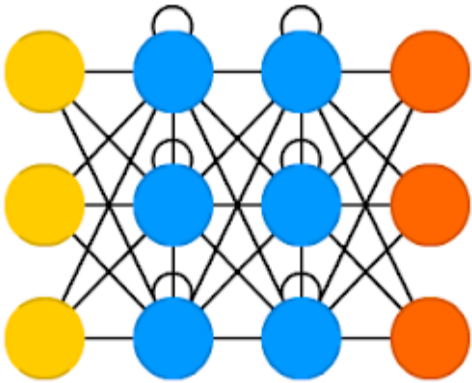


- 300+ ethnic groups in Nigeria(NLP Bigger than Wazobia)
- Languages are ambiguous("I love Blackberry?")
- Interpretation of context(I am hungry, because I am broke)
- Machine don't understand Language.

Deep Learning

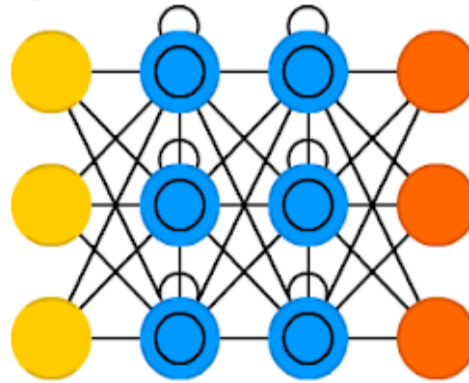
Natural Language Processing - Architectures

Recurrent Neural Network (RNN)



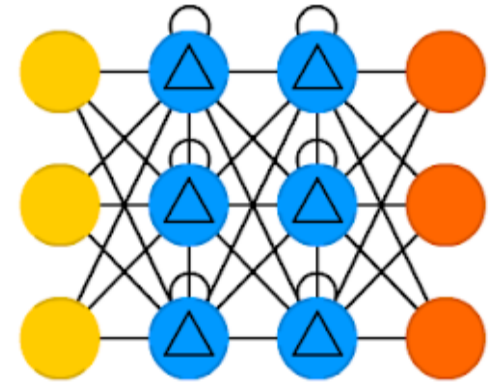
- Feed-forward network
- Feedback mechanism

Long / Short Term Memory (LSTM)



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

Gated Recurrent Unit (GRU)



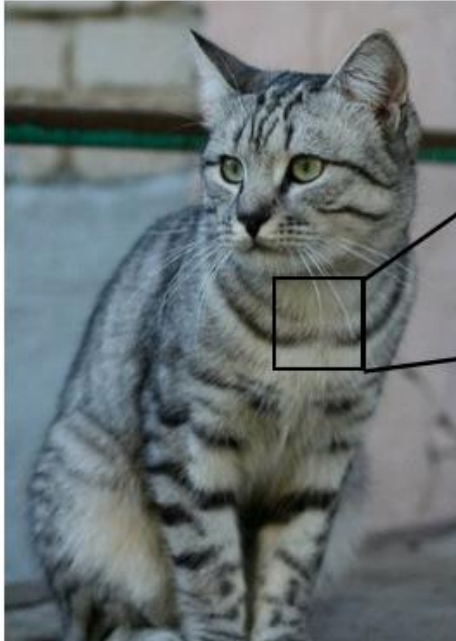
- Faster and simpler LSTM
- Fewer weight
- Two gates
- Update gates - maintain info.
- Reset gates - flush info.

Deep Learning

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



This image by Nikita is
licensed under [CC-BY 2.0](#)

```
[[105 112 100 111 104 99 106 99 96 103 112 119 104 97 93 87]  
[ 91 98 102 106 104 79 98 103 99 105 123 136 110 105 94 85]  
[ 76 85 90 105 120 105 87 96 95 99 115 112 106 103 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 85 101 107 109 98 75 84 96 95]  
[114 108 85 55 55 69 64 54 64 87 112 129 98 74 84 91]  
[133 137 147 103 65 81 80 65 52 54 74 84 102 93 85 82]  
[120 137 144 140 109 95 86 70 62 65 63 63 60 73 86 101]  
[125 133 148 137 119 121 117 94 65 79 80 65 54 64 72 98]  
[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 90 97 108 147 131 118 113 114 113 109 106 95 77 80]  
[ 63 77 86 81 77 79 102 123 117 115 117 125 125 130 115 87]  
[ 62 65 82 89 78 71 80 101 124 126 119 101 107 114 131 119]  
[ 63 65 75 88 89 71 62 81 120 138 135 105 81 98 110 118]  
[ 87 65 71 87 106 95 69 45 76 130 126 107 92 94 105 112]  
[118 97 82 86 117 123 116 66 41 51 95 93 89 95 102 107]  
[164 146 112 80 82 120 124 104 76 48 45 66 88 101 102 109]  
[157 170 157 120 93 86 114 132 112 97 69 55 70 82 99 94]  
[130 128 134 161 139 100 109 110 121 134 114 87 65 53 69 86]  
[120 112 96 117 150 144 120 115 104 107 102 93 87 81 72 79]  
[123 107 96 86 83 112 153 149 122 109 104 75 80 107 112 99]  
[122 121 102 80 82 86 94 117 145 148 153 102 58 78 92 107]  
[122 164 148 103 71 56 78 83 93 103 119 139 102 61 69 84]]
```

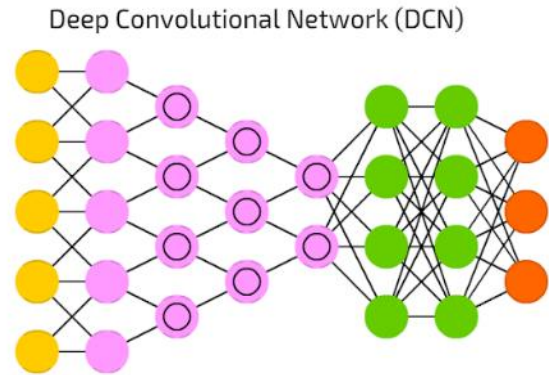
What the computer sees

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

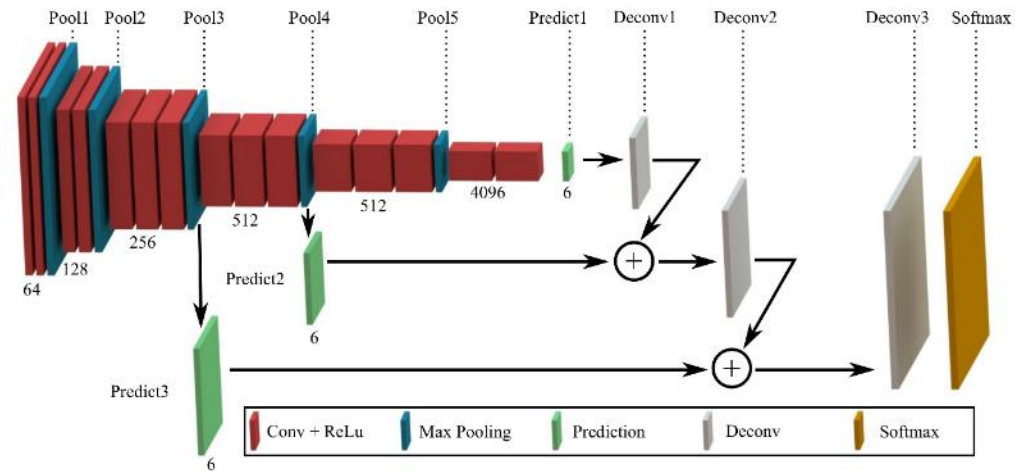
e.g. 800 x 600 x 3
(3 channels RGB)

Deep Learning

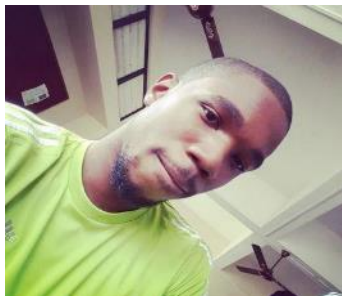
Computer Vision- Architectures



- 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”



+



=



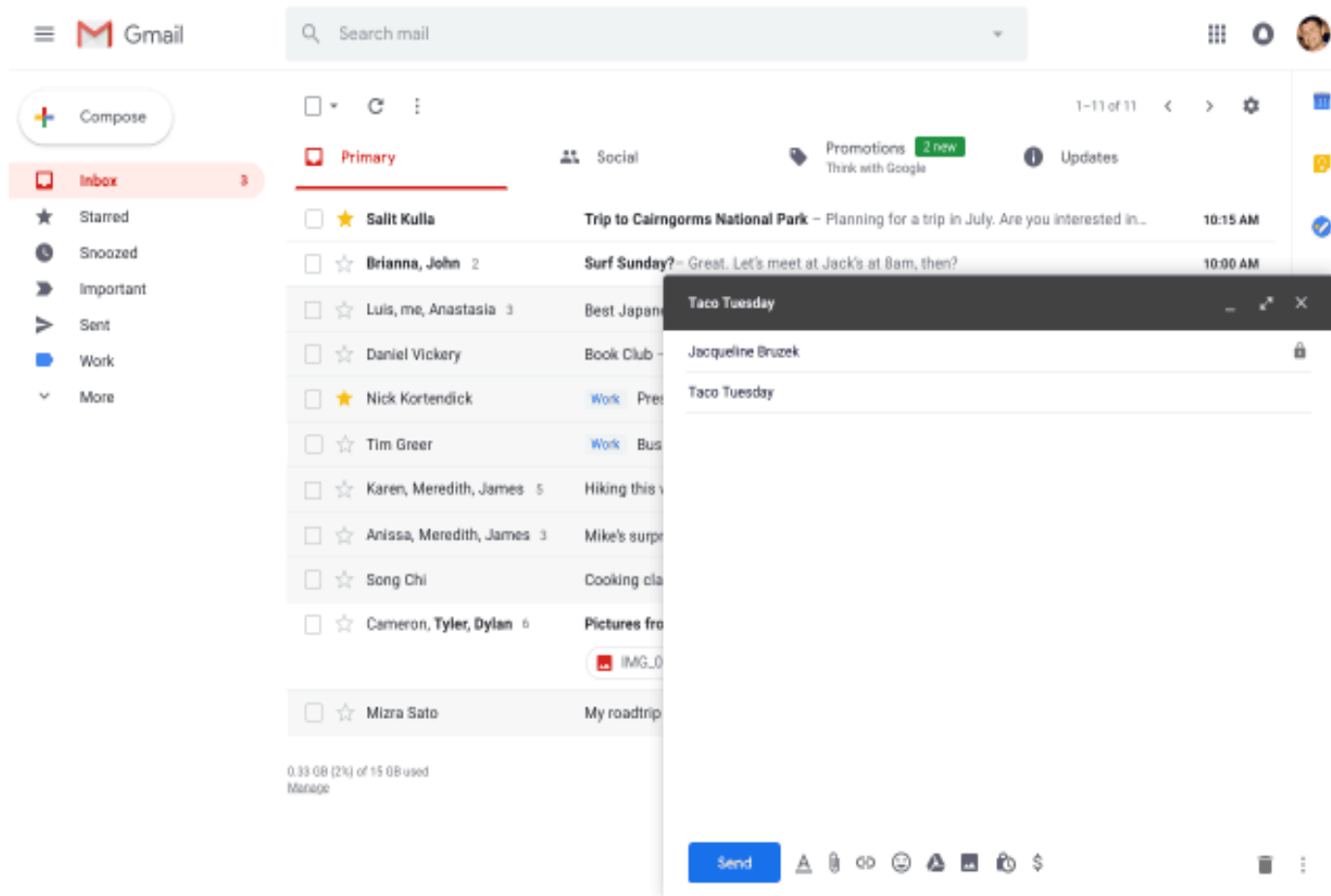
Style Transfer



EVERYDAY APPLICATIONS OF AI

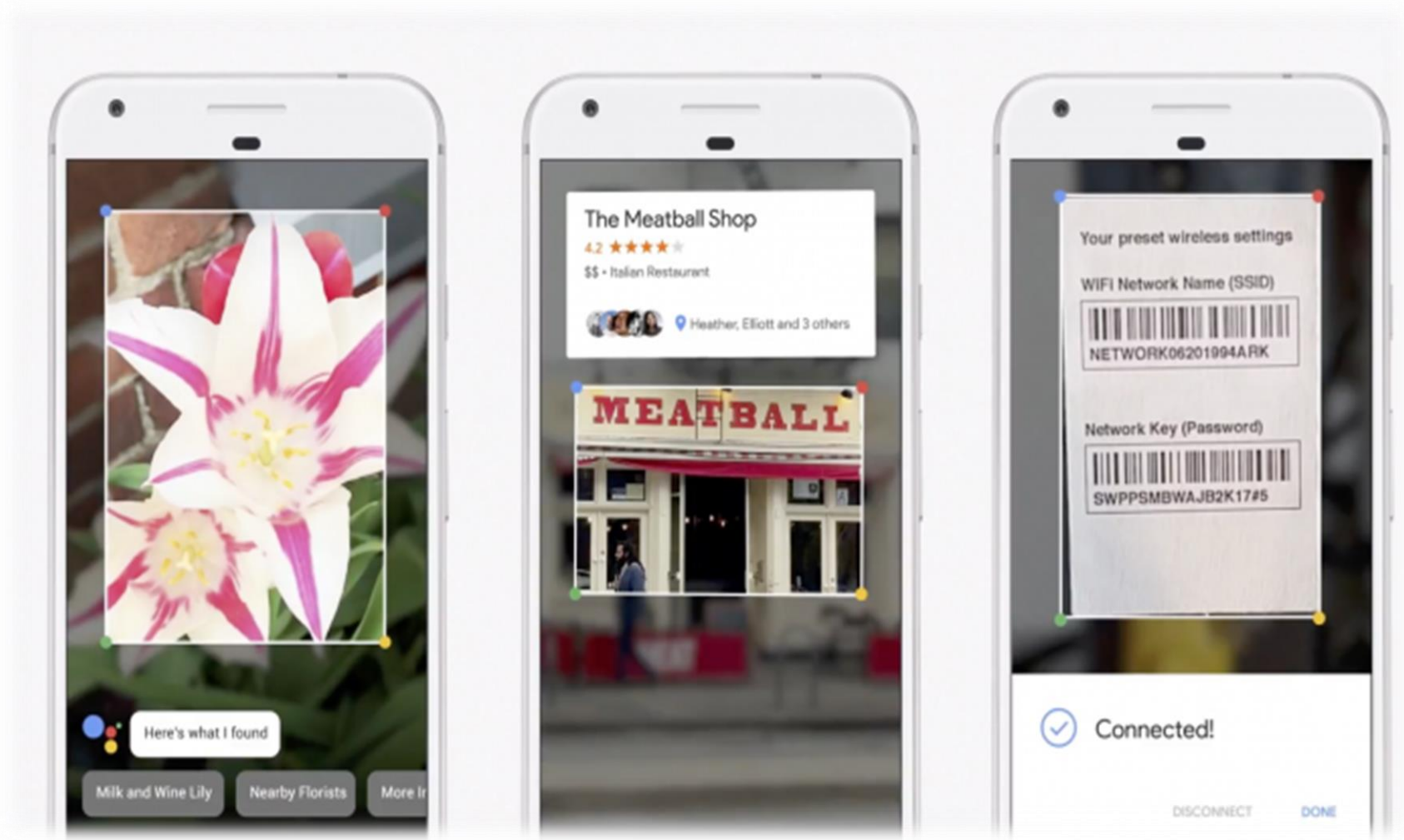


Gmail - Smart Compose

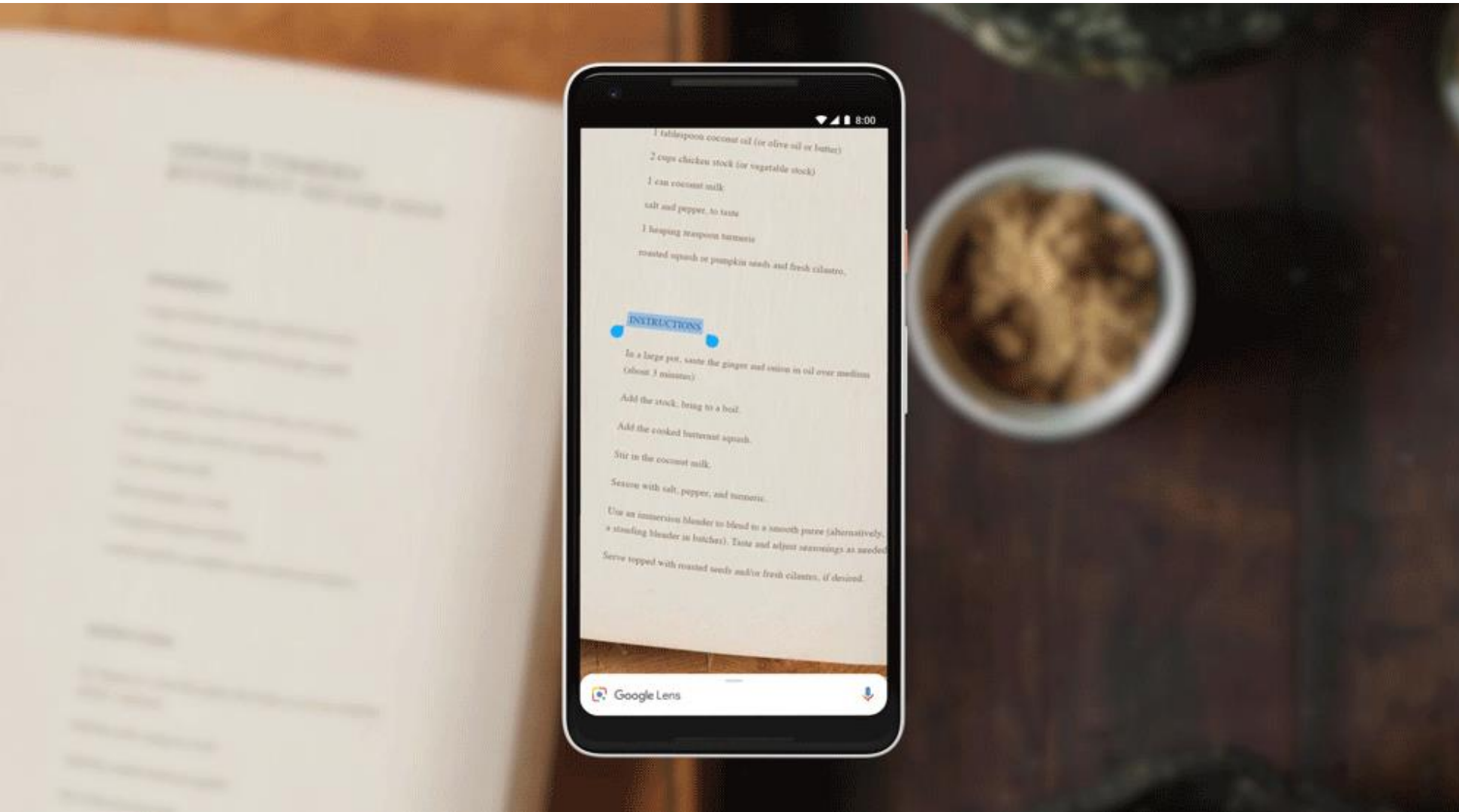


Typical language generation models, such as [ngram](#), [neural bag-of-words \(BoW\)](#) and [RNN language \(RNN-LM\)](#) models, learn to predict the next word conditioned on the prefix word sequence.

Google Len

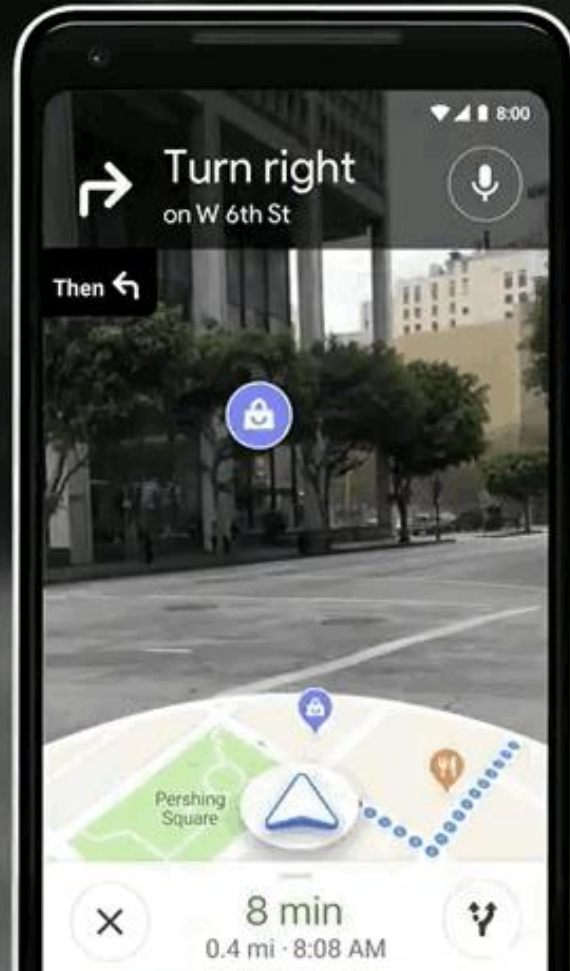


Google Len - Text Selection



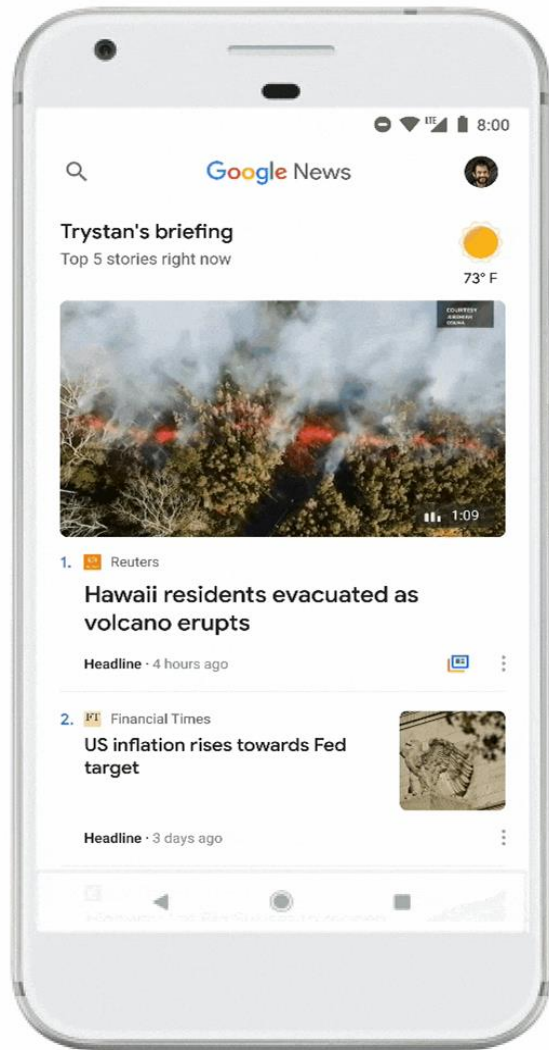
Google leveraged on digitization of books around the world.

Google Map



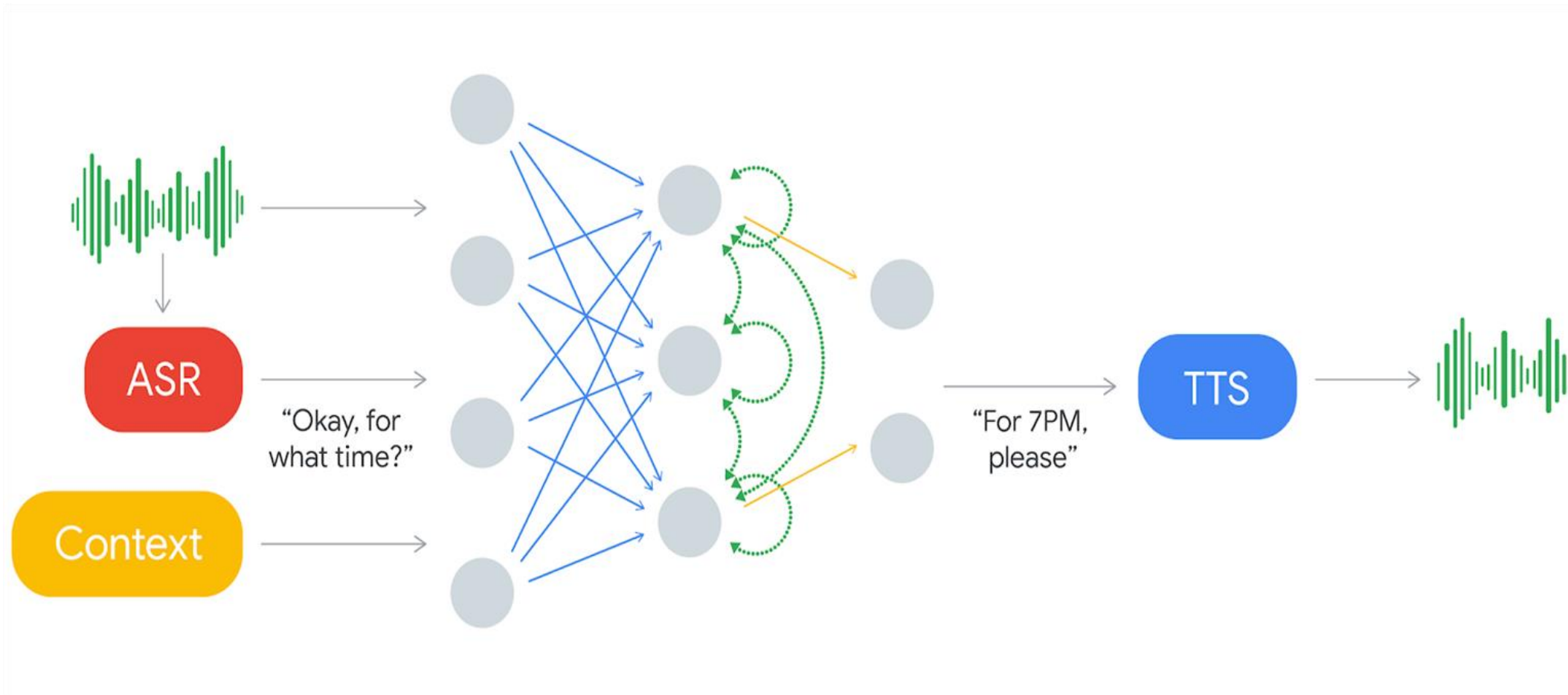
Google leveraged on geo-location mapping.

Google News



- Clustering
- Recommender System
- Topic modelling

Google Assistant - WaveNet

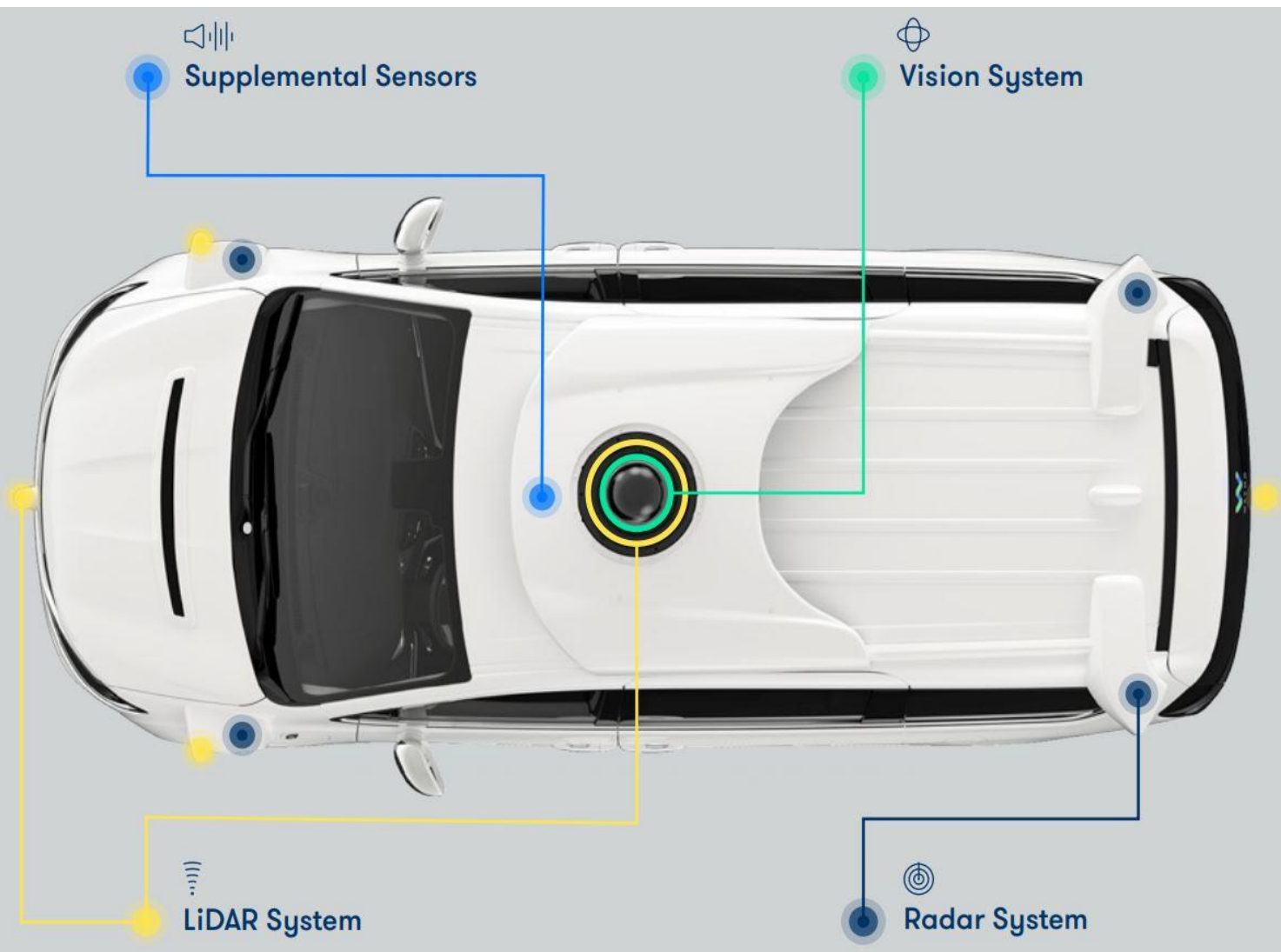


The ability of computers to understand natural speech has been revolutionised in the last few years by the application of deep neural networks (e.g., [Google Voice Search](#)). However, generating speech with computers — a process usually referred to as [speech synthesis](#) or text-to-speech (TTS).

Waymo



Waymo



Radar: a device that sends radio wave to 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.

Sensor fusion and deep learning.



Generative Adversarial Networks

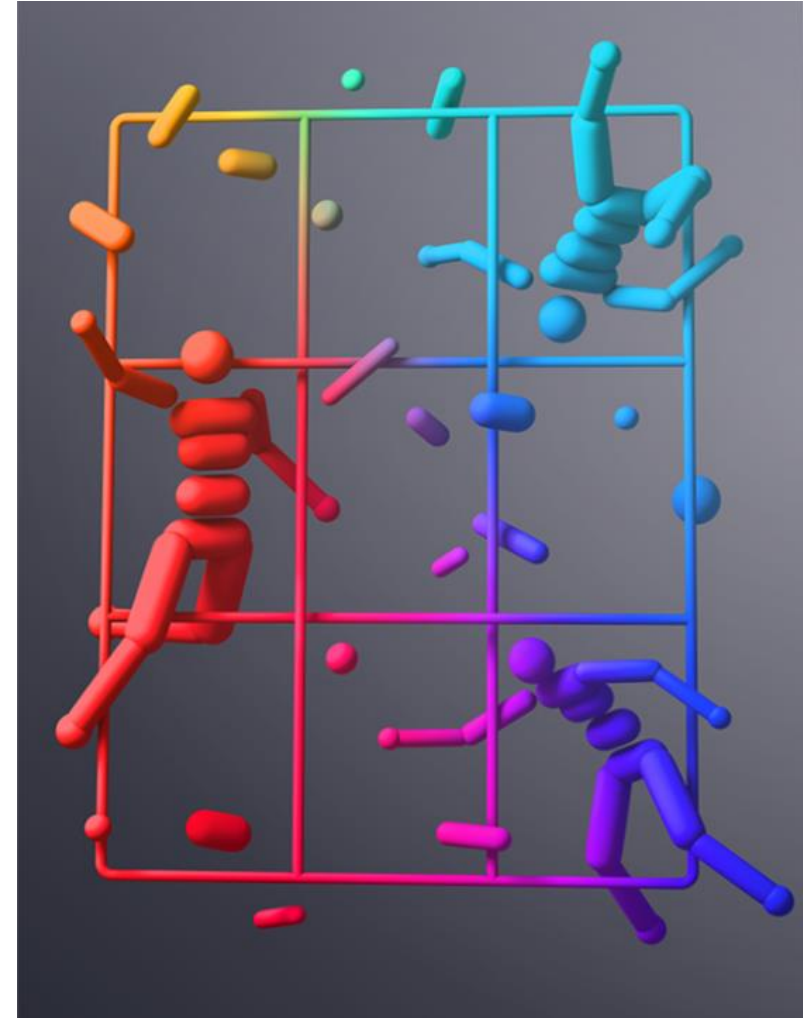
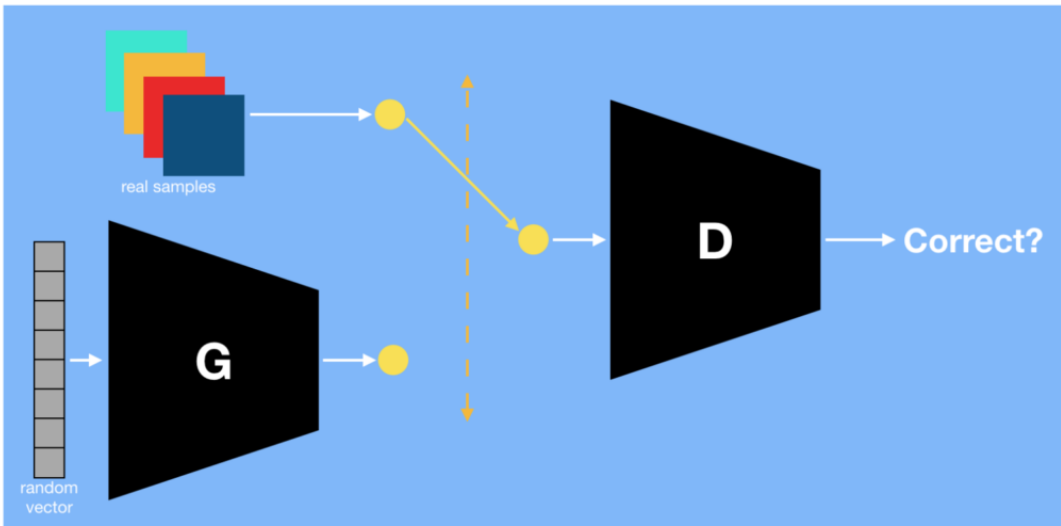


The Bleeding
Edges of AI

GANs

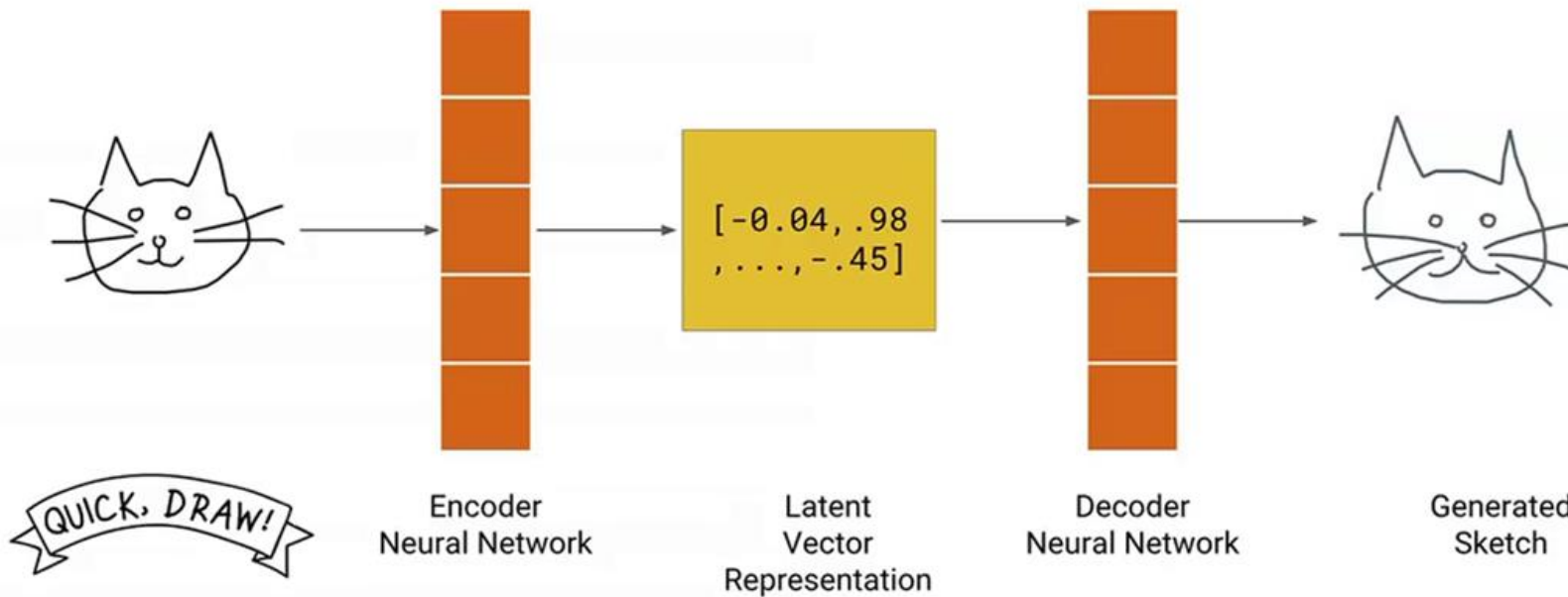
A generative Adversarial Network is a class of machine learning system invented by Ian Goodfellow and his colleagues in 2014.

Two neural networks contest with each other in a game.



GANs - Application

A Latent Vector Space for Drawing

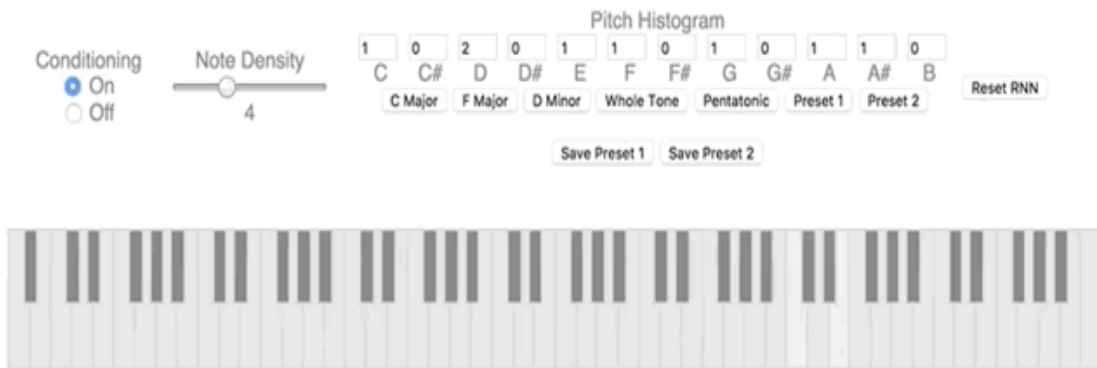


A Neural Representation of Sketch Drawings
David Ha and Douglas Eck

GANs - Application



Performance RNN



Generation of music



Generation of Art



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.

Which of them do you think is correct?



Starter Kit

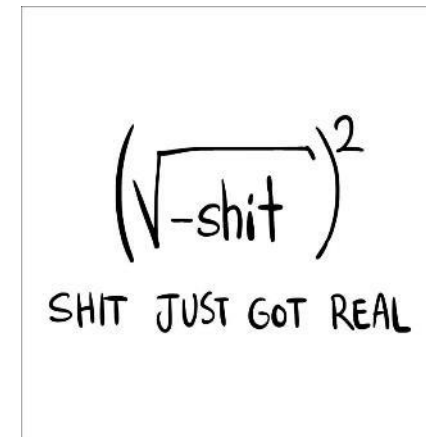


Google™ Is Your Best Friend ...

Curiosity (Ok with failure)



Self-Education



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

