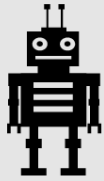


# Machine Learning



## Artificial Intelligence

"The science and engineering of making intelligent machines"

- John McCarthy, 1956

## Machine Learning

An application of Artificial Intelligence.

"The practice of using algorithms to parse data, learn from it, and then make a determination or prediction about something in the world."

- Nvidia, 2016



## Success of Machine Learning

- 1 Access to large amounts of data
- 2 Computing hardware (supercomputers & GPUs)
- 3 Artificial Neural Networks

# Types of Machine Learning

## Supervised Learning

Uses a test set (input labelled with the correct output).

A function is trained to describe the test set & then applied to analyze new data.


Predicts a discrete value (output: a category)


### Classification

Handwriting recognition

*Hello!*  
↓  
Hello!

Facial recognition

 → Hey, that's Jack!

 → Junk mail  
Spam filter → Not junk


Predicts a continuous quantity (output: a number)

### Regression

  
Housing prices  


Which form of media contributes most to sales?



**Did you know...**   
most available applications of machine learning are Supervised Learning?

## Unsupervised Learning

No test set is used.

An algorithm categorizes data based on patterns in the data itself.

Divide data into groups based on similarities

### Clustering

    
Cluster users for targeted advertisements

Decrease the number of variables (data) for easier analysis

### Dimension Reduction

  
Audio noise reduction

## Reinforcement Learning

An algorithm is trained with a reward for a positive outcome & penalty for a negative outcome.

Self-driving cars are penalized for collisions



Chess moves associated with wins are rewarded

# The big buzz about Artificial Neural Networks

Example: Handwriting recognition



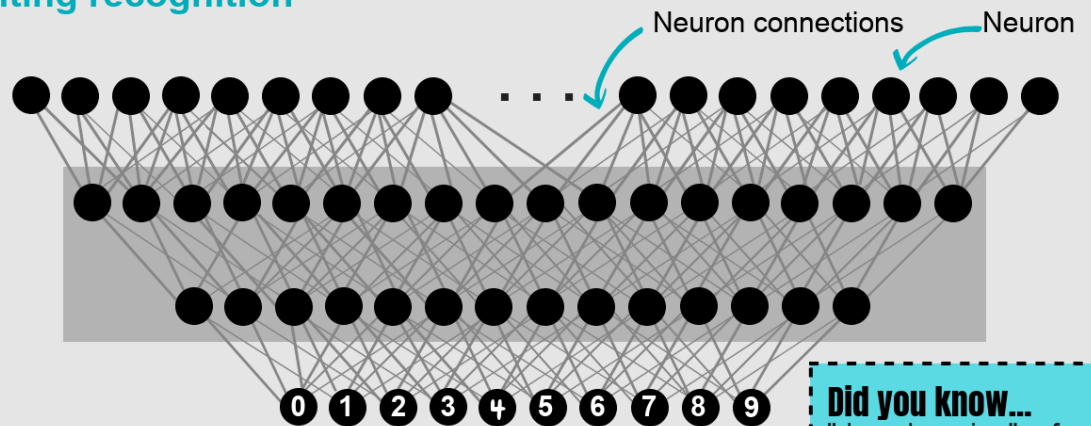
Input layer:  
Each pixel in an image becomes input for a neuron



Hidden layers:  
Break down input into patterns



Output layer:  
The neuron with the greatest activation is the answer



**Did you know...**  
"deep learning" refers to many layers in the neural network?

**But what does it mean?**

Large and complex data can be analyzed, even if the connection between input & solution is not intuitive.  
Works with Supervised, Unsupervised & Reinforcement Learning.

## Machine Learning Applications

### Predictions from health records



Researchers used machine learning to predict the risk of suicide attempts from health records. The test set included cases of self injury separated into categories of suicidal & nonsuicidal behavior. Important predictors for suicide attempts were also identified.

### Diagnostic imaging



Researchers at the University of Alberta are applying machine learning to fMRI images to diagnose the presence & extent of schizophrenia.

### Determining mental health via social media



Facebook has implemented AI that identifies posts containing suicidal thoughts & flags post for humans to review.



A new AI study uses Instagram photos to detect depression in users. Photos tend to be darker in colour & feature fewer people.

### Factors leading to addiction

IBM is trying to combat the opioid crisis by identifying factors leading to addiction. This includes:



- opioid class
- quantity prescribed
- related medical procedures

