



# 1 Decomposition

- Break problem down into manageable parts

# 2

# Pattern Recognition

- find the similarity in the items

## Computational thinking

# 3

# Abstraction

- I identify specific similarities and differences among similar problems

# 4

# Algorithm

- Step-by-Step process to solve the problem

## Decomposition in Bio

### 1) Fragmentation



### 2) Divide & Conquer

## Pattern recognition in Bio

- Observing Trends, Similarities

↳ Help to solve problems better

## Abstraction in Bio

- Simplify stuff into simple diagrams

↳ DNA structure

- Pointing out necessary info

- Simplifying complexity

- Filtering out irrelevant detail

## Algorithm in Bio

- Ordering things (complexity, alphabet)

→ Matching 2-2 DNA / 3-3 DNA

→ Repeatedly managing data

## WK 2 Computational Thinking IRL

### Decomposition

↳ Break down study plan

↳ Sort out money to count

### Abstraction

↳ Use simplified MRT map instead of Gmap

↳ Synopsis of books are an extraction of key themes

### Pattern recognition

↳ UNO, Chess

↳ Learning to speak/write

### Algorithm

↳ Cook recipe

↳ Process a criminal

# Quantitative Reasoning

- Thinking in numbers

## Data Driven

Steps to obtain insights

- 1) Frame numerical questions
- 2) Identify tools for analysis
- 3) Build models to analyse
- 4) Analyse the results

- 1) I identify the data
- 2) Formulate the q<sup>n</sup>



## Identify Data

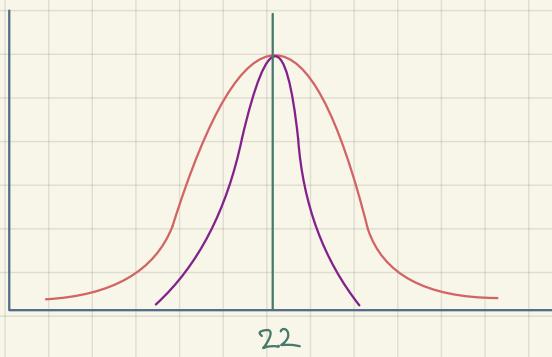
What type is relevant?

Binary      Continuous

How much data is needed?

Single      Multiple

## CORE CONCEPT: Likelihood / Standard D



Dataset :

Mean = 22

Standard Deviation = 3.21

Mean of Dataset:

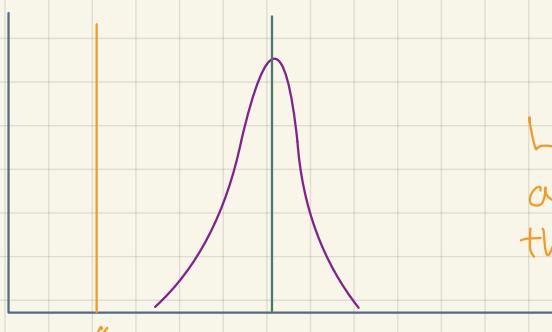
Mean = 22

Standard Deviation =  $\frac{3.21}{\sqrt{30}}$

$$= 0.586$$

30 data points.

More data means future trials will have more similar means



Lets say orange data has a mean of 18. The distribution of the purple mean is far from orange.

∴ Not likely to be correlated

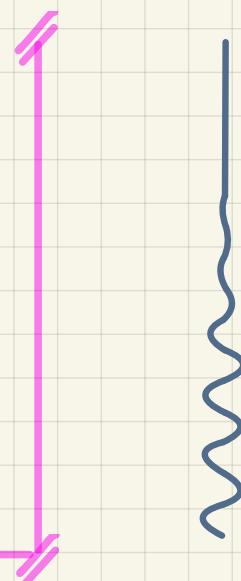
$$22 - 18 = 4$$

$$\frac{4}{0.586} = 6.83 \text{ units of SD away... far!}$$

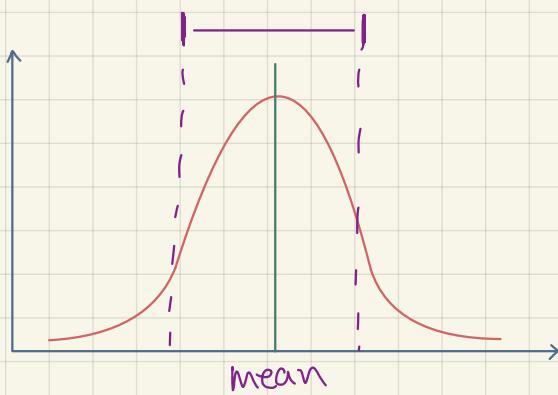
divide by purple SD

## Steps to compare Data.

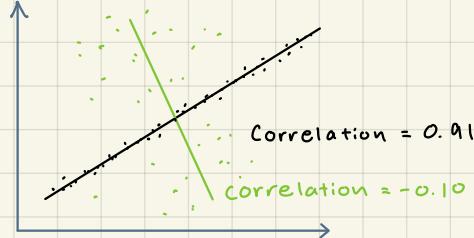
- 1) Presume the two sets of data are identical
- 2) This means that the experimental data should be identical
- 3) From a statistical POV, should be identical, aka we can presume one data set "comes" from the other data set
- 4) The probability that one data is drawn from the other set is high/low possibility



$$2SD = 68\%$$



→ Correlation



## Cyber Security

**C**onfidentiality → Protect info, share only necessary info

**I**ntegrity → Good Cyber hygiene, beware of sources of info

**A**vailability → Prevent getting locked out of devices,  
your actions affect others

Data  
Physical  
Digital

- 1) Lock computer
- 2) Clean Desk Positive
- 3) Use official emails
- 4) Keep storage safe



# Cyber Trilemma

Password

- Use passphrase
- 2FA

Anti-Virus

Spot signs of Phishing

Software Updates



# Fake News

Short term:

- Political decisions
- Business
- Peace & Order
- Reputation

Long Term:

- Devaluation of info.
- Erosion of trust
- Social Division
- Chilling Effect

# Individual

1) Internal:

- Self -check
- Source
- The message
- Message Queues

2) External:

- Interpersonal (friends)
- Institutional

Intentional

Interpersonal

## Falsehoods

"A statement is false if it is false or misleading, whether wholly or in part, and whether on its own or in the context in which it appears" (POFMA, 2019)

## Misinformation

The inadvertent dissemination of false information (Wardle, 2017)

## Disinformation

### Fake news

A specific type of falsehood intentionally packaged to look like news to deceive others (Tandoc, 2021)

# Motivations for Fake News

- **Financial**

- Attracting clicks
- Advertising revenues

- **Ideological**

- Personal agenda
- Weapons of mass misinformation

# What Makes People Vulnerable?

- **Sender**

- Credible or familiar?
- Trustworthy or similar?
- Proximate or distal?

- **Message**

- Format
- Plausibility

- **Channel**

- Trusted or depended on?
- Closed or open?
- Feedback

- **Receiver**

- Confirmation bias
- Motivations
- Corrections

- **Context**

- Information overload
- Instability



# Who is the Actual Source

- Original source
- Immediate source
- Invisible source
- Trusted source
- Disregarded source

# Authentication as a Social Process

- Motivations for authenticating

- Self-image → don't wanna seem dumb
- Group cohesion

- Strategies of authentication

- Group beliefs; "deep stories"
- Source affiliation
- Sharing as authenticating

- Consequences of authentication

- Institutionalisation of Interdependence
- Ritualisation of collective authentication

People share in hopes that others will authenticate for them

friends may have similar beliefs, echo chamber

## What is "False"?

“

(2) In this Act –

- (a) a statement of fact is a statement which a reasonable person seeing, hearing or otherwise perceiving it would consider to be a representation of fact; and
- (b) a statement is false if it is false or misleading, whether wholly or in part, and whether on its own or in the context in which it appears.

## What Constitutes as Communicating?

“

### Meaning of "communicate"

3. - (1) In this Act other than in Part 2, a statement or material is communicated in Singapore if it is made available to one or more end-users in Singapore on or through the internet.

(2) In Part 2, a statement is communicated in Singapore if it is made available to one or more end-users in Singapore on or through –

- (a) the internet; or
- (b) MMS or SMS.

(3) A reference in this Act to communicating a statement or material in Singapore includes causing its communication (within the meaning of subsection (1) or (2), as the case may be) in Singapore.

## "Public Interest"

“

### Meaning of "in the public interest"

4. For the purposes of this Act and without limiting the generality of the expression it is in the public interest to do anything if the doing of that thing is necessary or expedient –

- (a) in the interest of the security of Singapore or any part of Singapore;
- (b) to protect public health or public finances, or to secure public safety or public tranquillity;
- (c) in the interest of friendly relations of Singapore with other countries;
- (d) to prevent any influence of the outcome of an election to the office of President, a general election of Member of Parliament, a by-election of a Member of Parliament, or a referendum;
- (e) to prevent incitement of feelings of enmity, hatred or ill-will between different groups of persons; or
- (f) to prevent a diminution of public confidence in the performance of any duty or function of, or in the exercise of any power by, the Government, an Organ of State, a statutory board, or a part of the Government, an Organ of State or a statutory board.

Supporting third-party fact-checkers and journalists

Promoting media literacy among users

Reducing financial incentives for content producers

Implementing new features to flag content

Deleting post and removing accounts

Degree of direct intervention on content

## Verification

- Checking media before publishing

## Fact checking

- Vetting already posted media

# Fact Check Message

- 1) Videos
- 2) Rating Scales
- 3) Mixed Accuracy Statements
- 4) Truth Sandwich

↳ If factchecks start with wrong claim, it strengthens some people's view  
↳ remember now! claim

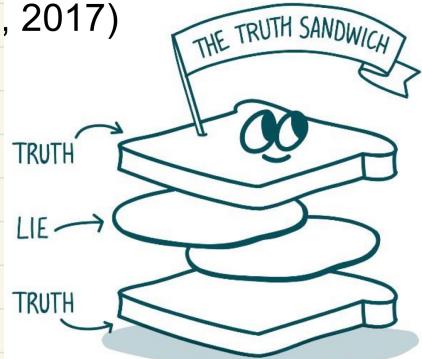
though, fact checkers may bring a set of issues

↓  
**Fact Checkers are the "arbiters"**  
↓

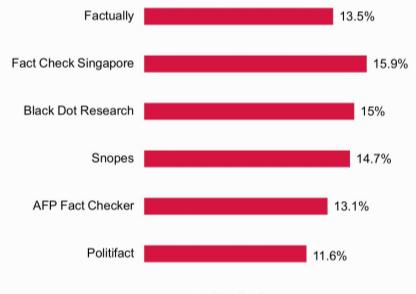
## What can we do?

1. Reflect on our own information behaviour.
2. Engage, rather than ignore.
3. Strive to understand others.
4. Use and support reliable and legitimate information sources.
5. Maximise available resources.
6. Equip ourselves.

, 2017)



21% said they use fact-checking sites often or very often



■ Familiar?

Normative Ethics

Well founded views

Data Ethics

Digital Ethics

## 1) Theory

- Explain features of the theory

### a) Utilitarian

- \* Wellbeing → i) Pleasure, ; absence of pain
- ii) Satisfaction of desires

### b) Virtue Ethics

- \* Right = Virtuous person would do
- wrong = " " " " " not do
- \* Virtuous person = Exhibit all the values

### c) Kant Deontological

- \* Right if ends, not mere means
- Respect the value of persons

## 2) Practical

- How to apply IRL

Ethis is vital to tech

↳ Tech ↑ knowledge

But

- Risk to
- 1) Privacy → autonomy
  - 2) Security 4) fairness

### Integrity

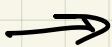
SCS members will act at all times with integrity. They will:

- not lay claim to a level of competence that they do not possess
- act with complete discretion when entrusted with confidential information
- be impartial when giving advice and will disclose any relevant personal interests
- give credit for work done by others where credit is due

### Professionalism

SCS members will act with professionalism to enhance the prestige of the profession and the Society. They will:

- uphold and improve the professional standards of the Society through participation in their formulation, establishment and enforcement
- not seek personal advantage to the detriment of the Society
- not speak on behalf of the Society without proper authority
- not slander the professional reputation of any other person
- use their special knowledge and skill for the advancement of human welfare



## Information Privacy

↳ Violated as researchers store ; re-deploy personal information without their consent

↳ Article 12, HR rights



## Whistle Blowing

↳ Law cannot monitor → Whistle Blowing; always ethical



1. The firm...will do [or has done] serious and considerable harm to employees or to the public;
2. Once employees identify a serious threat to the user of a product or to the general public, they should report it to their immediate superior and make their moral concern known;
3. If one's immediate supervisor does nothing effective about the concern or complaint, the employee should exhaust the internal procedures and possibilities within the firm.

Morally  
Permissible



4. The whistle-blower must have, or have accessible, documented evidence that would convince a reasonable, impartial observer that one's view of the situation is correct; and
5. The employee must have good reasons to believe that by going public the necessary changes will be brought about. The chance of being successful must be worth the risk one takes and the danger to which one is exposed.

Morally  
Obligatory

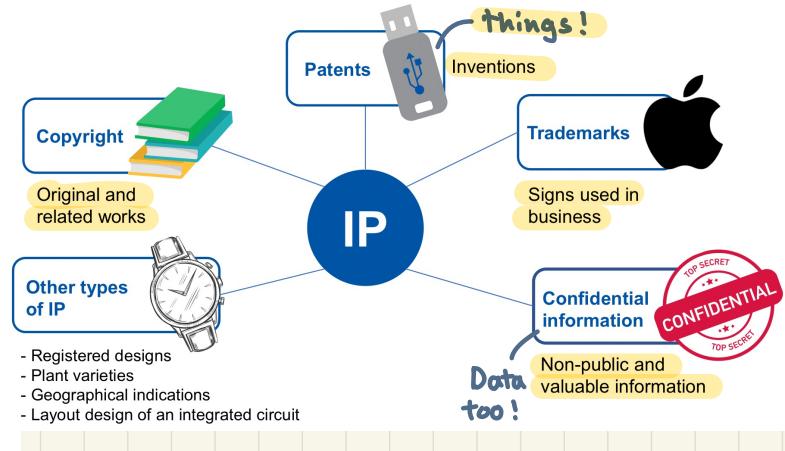
# Intellectual Property

Protect our ideas being exploited by others

Through licensing & assignment

## What is IP

- Creations resulting from the exercise of the human brain
  - Examples include inventions, designs, ideas, plant hybrids, music, poems, paintings, photographs, logos, books, films, cartoon characters, trade secrets.
- Bundle of legal rights protecting such creations, i.e., intellectual property rights (IPRs)
- IP law recognises that creators have the right to protect their work.
  - IP law gives legal rights to IP creators, allowing them to control and exploit the use of their IP for a specific period of time.



C 2004

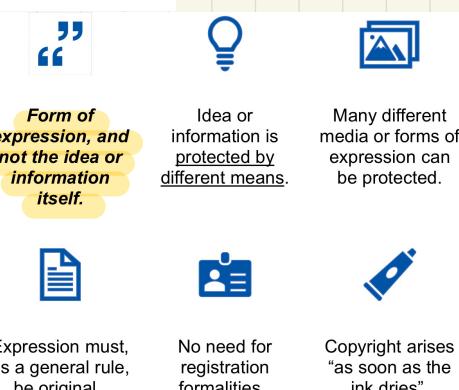
## Copyright

### What is Copyright?

- Copyright is the right to prevent the unauthorised **copying** of the **tangible form** in which a person has chosen to express his ideas, for example in a:
  - Short story, musical composition, theatre script, painting, computer programme, photograph, movie or video game
- It can be described as a **bundle of exclusive rights belonging to the copyright owner**.
  - Allows owners to enforce their rights against infringement
- Singapore's copyright law is governed by the Copyright Act.

Copyright protection arises automatically by operation of law, so long as certain basic criteria are satisfied:

- Falls within the categories of protection
- **Fixed in tangible form**
- Original
  - o Work was created independently by the author.
- Author/creator is a Singapore citizen or PR



Copyright protects the **"form"** of an idea and **NOT the idea itself**.

Purchasing a physical product does not give rights to underlying copyright work(s) (e.g., purchasing an original music CD does not give right to make copies)

Ideas and concepts	Discoveries (e.g., a research finding)	Procedures (e.g., steps in applying for a grant)	Literary, dramatic, musical and artistic works	Life of author plus 70 years from the end of the year in which the author died
Methods (e.g., solution to a mathematical problem)	Any subject matter that has not been reduced to a tangible form	Works in the public domain	Published editions	25 years from the end of the year in which the edition was first published
			Sound recordings and films	70 years from the end of the year of release
			Broadcasts and cable programmes	50 years from the end of the year of first broadcast
			Performances	70 years from the end of the year of the performance

## Unprotectable Matter

## Who Owns the Copyright?

### Joint authors:

Where work is created jointly by more than one author, the authors are all co-owners of the copyright in the work

### Concept of joint authorship:

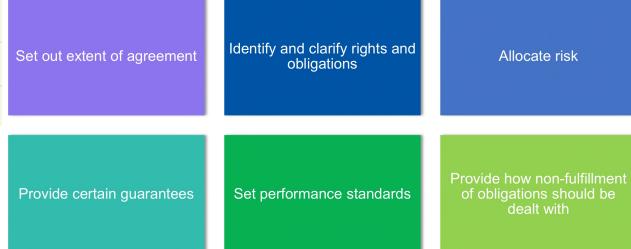
Where more than one author creates inseparable or interdependent parts of a whole work  
*E.g., two trainers involved in creating the training materials for a course*

Contributions must be original material expression, not just ideas or non-copyrightable materials.

## Contract Law

### What is a Contract?

- Definition of a contract:  
 "An agreement giving rise to obligations which are enforced or recognised by law"
- It is a voluntary agreement between two or more parties.
- The law exists to govern and regulate the parties' relationship in such agreements.
- It can be verbal or written, simple or complicated.



Contracts are written as people forget details

### Elements of a Contract

\* all needed



Indication by offeror of willingness to contract



Absolute and unqualified—must be communicated to offeror



Usually indicated by price or the carrying out of an act in return for the benefit



Reasonable to conclude from conduct of parties of their intention to be legally bound



- Parties must have the capability to enter a contract
- Issue of minors (below age of 18) and impaired mental capacity

## Breach and Remedies

- Contract is breached when there is non-performance of a term.
- Does not automatically terminate contract!
- Breach entitles the wronged party to demand cure of the breach from the other party, as well as financial compensation (damages) if there is loss.
  - May also be entitled to terminate contract

CC → Creative commons  
 ND → NO derivative (adaptation)  
 NC → NO commercial  
 SA → Must licence adaptation  
 BY → Credit to creator

IP can be bought / sold



License (verb)  
Licence (noun)

"Rent"



Assign (verb)  
Assignment (noun)

"transfer"

## Licence: Types and Uses

- Non-exclusive licence
  - Granted to more than one person
- Exclusive licence
  - Granted to one person only
- Where do you see licences being used?
  - All social media platforms
  - All SaaS platforms
  - All media aggregation platforms where works can be accessed for use

## Assignment: Legal effect

- Under the assignment, the assignor (person making the assignment) transfers all entitlement and ownership rights that are the subject of the assignment to the assignee (the person receiving these rights).
- The assignee is now the new owner of the property.

Grants someone else (other than the IP owner) the right to use the IP
Less costly
IP owner remains in control

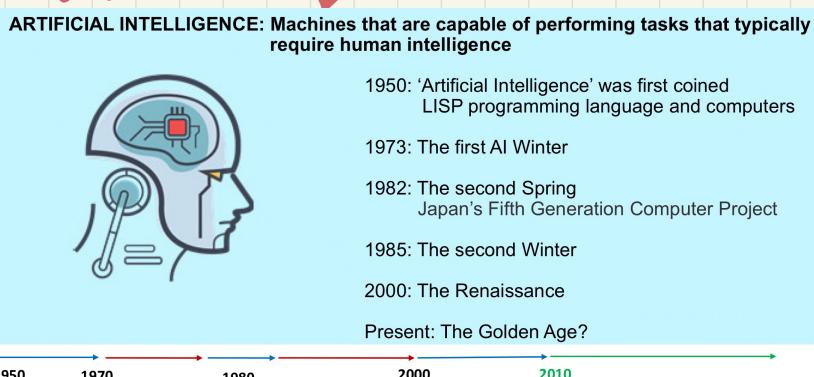
VS

Transfers the entire title and interest in someone's IP to another
More costly
IP owner gives up control

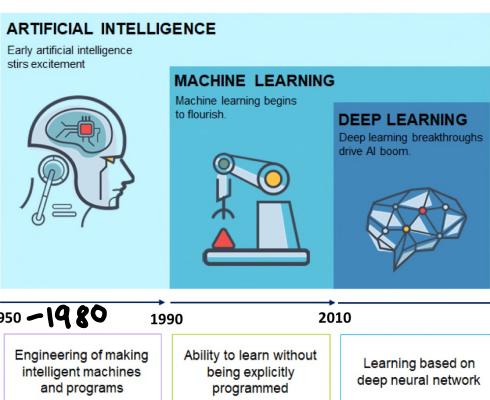
Block Chain



A ± ❤



## AI Present Day Renaissance



**Powerful computers:**  
Become widely available, such as Cloud computing and GPU

**Big Data:**  
Availability of large amount of data due to internet and smart mobile phones

**Software Algorithms:**  
Machine Learning, Deep Learning

## ARTIFICIAL INTELLIGENCE

Early artificial intelligence  
stirs excitement

## MACHINE LEARNING

Machine learning begins  
to flourish.

## DEEP LEARNING

## DEEP LEARNING

Deep learning breakthroughs  
drive AI boom.

Implementation of ML based on **Deep Neural Network** that mimics the human brains

### Artificial Neural Network (ANN)

Classifying numbers-based data

### Convolution Neural Network (CNN)

Classifying images

### Recurrent Neural Network (RNN)

Time series data (e.g., audio)

### Deep Reinforcement Learning

### Transfer Learning

Rule-based expert systems

Fuzzy logic

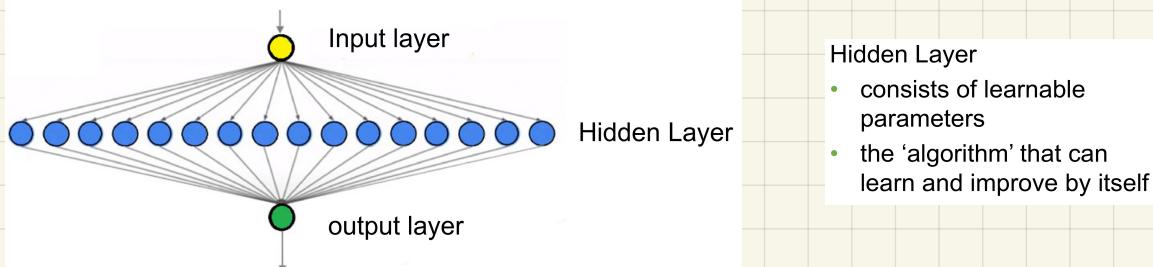
Need data

**Supervised Learning** with labelled data (e.g., regression and classification)

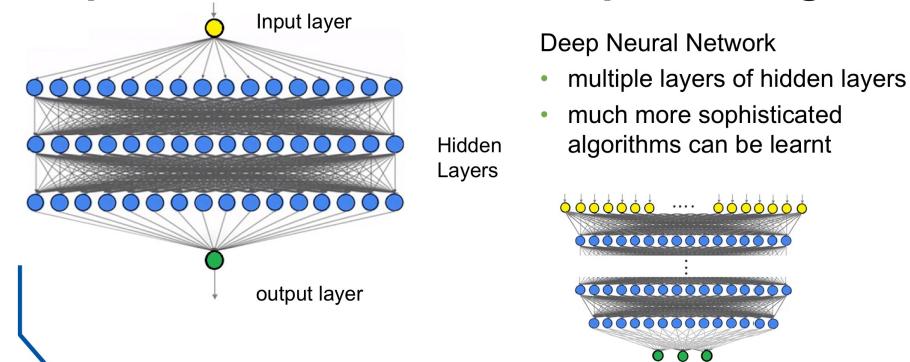
**Unsupervised Learning** without labelled data (e.g., clustering)

**Reinforcement Learning** with the use of 'agent' that learns to maximise 'reward' in an environment

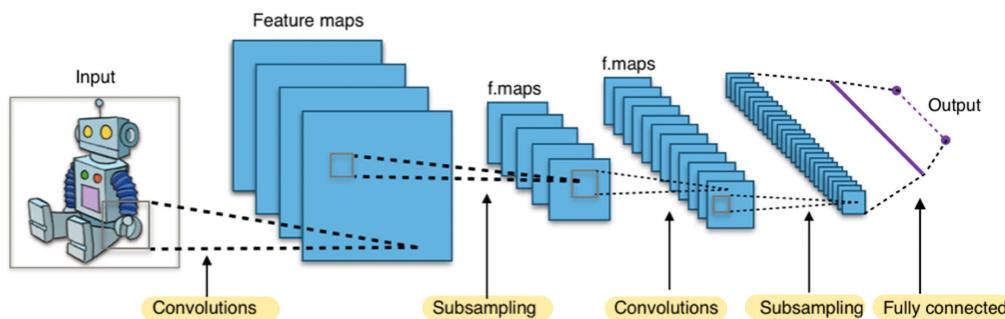
# NEURAL NETWORK



## Deep Neural Network for Deep Learning

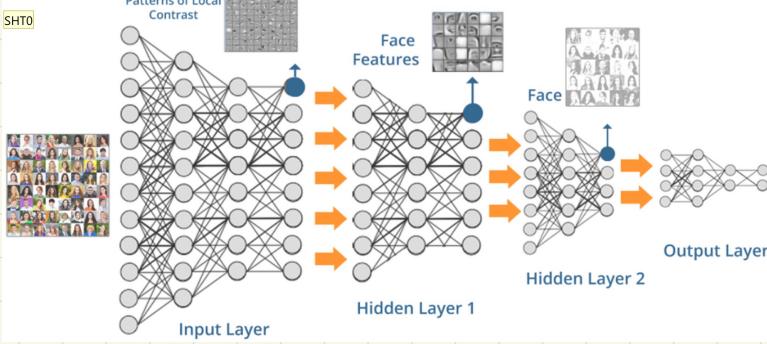


## CNN for Image Recognition



1. Subsampling
2. Convolution
3. Fully Connected

# Face Detection Training and Inference



## Robotics

- learn by themselves

## Application: Banking and Finance

- Better Business Analytics
- Algorithm Trading
  - execute trades at optimal prices
- Credit Risks Assessment
- Wealth Management
  - automated portfolio manager
- Fraud detection



## Summary

- AI is rapidly transforming the way we live:
  - Helps to makes things run more efficiently
  - Improves safety and work productivity
  - Frees up time for human to do more creative things
  - Enables better quality of life
- Current generation of AI technologies are still considered as Artificial Narrow Intelligence (ANI)
  - Goal is to eventually achieve Artificial General Intelligence (AGI)
- But there are also many concerns about the potential risk that we need to be aware of
  - Responsible AI

