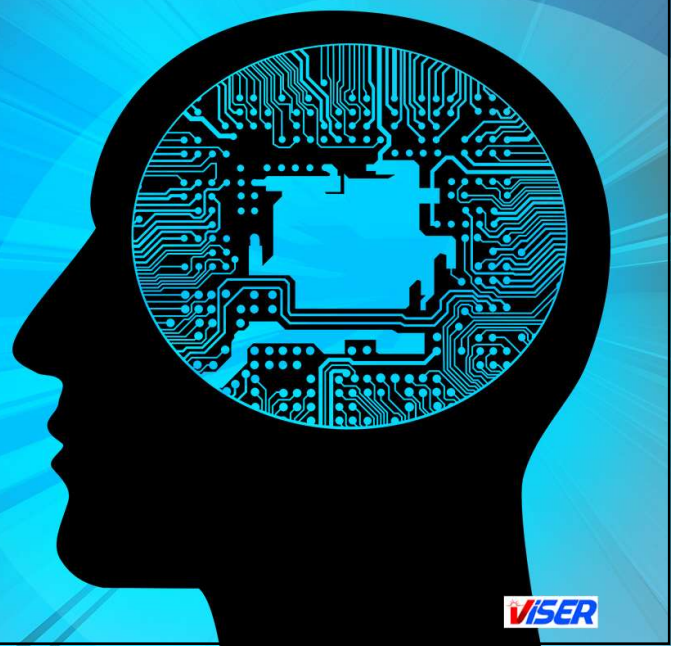
Decoding AI

Promoting the Understanding of AI Technologies Among Individuals (Oct 10 - Oct 31, 2020)



acm SIGAI

ViSER

About ViSER

- Started in Jan 2019 :
  - to promote STEM and Finance learning among kids and adults; conducted bootcamps, after school classes, enrichment classes in NY
  - to provide AI backed, data-driven solutions to businesses; filed a patent in IoT chatbots
- Recently shifted its base from New York to South Carolina
- website: https://www.go-viser.com/
- email: viserllc@gmail.com
- Founder and CEO: Vandana Srivastava
- About Vandana
  - MBA (Financial Management) Pace University, NY, USA
  - MS (Computational Mathematics) Arizona State University, AZ, USA
  - 12+ years of experience as:
    - Vice President, Investor Relation (Tantiv4), Incentive Analyst (IBM)
    - Assistant Professor at different Engineering Colleges in India including IIT Delhi
- https://bipvan.wixsite.com/vsrivastava
- https://www.linkedin.com/in/vandana-srivastava/

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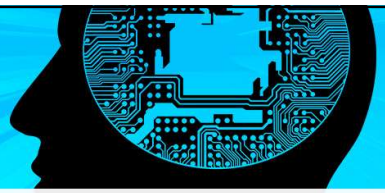
Class Participation Rules



- Be respectful and courteous during the session and on chats
- Questions can be asked on chat anytime; instructor will decide whether to answer immediately or not
- If someone is found disturbing the class, the person will be removed from the event

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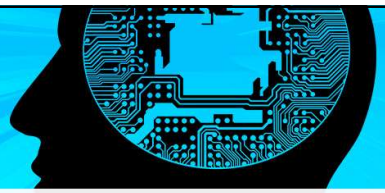
Event Layout



Oct 10

Intro to AI and Machine Learning

Basics of AI and ML
Basics of python programming
Data and its types

Oct 17

Python for Data Analysis

Introduce open data
Download and clean data
Explore, analyze and Visualize results
Student presentation

Oct 24

Machine Learning – Text Analysis

Introduction to NLTK
Clean and prepare text
Analyze text for insights
Student presentation

Oct 31

Create Conversation Agent (Chatbot)

Introduce DialogFlow, a chatbot building platform
Create a chatbot with DialogFlow
Expert talk on AI

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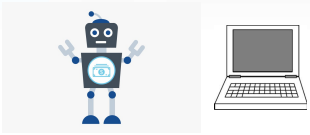
What is Artificial Intelligence?

Artificial ***Intelligence***



machines (or computers) that mimic "cognitive" functions that humans associate with the human mind:

- *learning*
- *problem solving*
- *reasoning*

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Intelligent Agents

Anything that perceives its environment through sensors and acting on that environment through effectors

Human agent:

- sensors (eyes, ears and other organs)
- Effectors (hands, legs, mouth etc)

Robotic agent

- sensors (camera, infrared range finders)
- Effectors (various motors)

THE JOB OF AI IS TO DESIGN THE AGENT PROGRAM

An Intelligent Agent takes the best possible action in a situation

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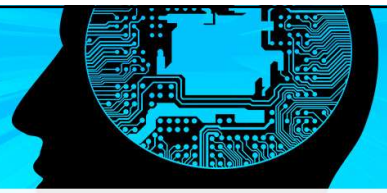
Evolution of Artificial Intelligence



Turing (1950s)

Computing Machinery and Intelligence --- discussed how to build intelligent machines and how to test their intelligence.

(1956)

The Logic Theorist was a program designed to mimic the problem solving skills of a human
John McCarthy came up with the name "artificial intelligence" in 1955.

(1957 to 1974)

AI flourished. Computers could store more information and became faster, cheaper, and more accessible

(1990 onwards)

AI research gained momentum
1997 -- IBM Deep Blue defeated Gary Kasparov
2011-- IBM Watson won the Jeopardy contest
Self-driving cars, smart devices

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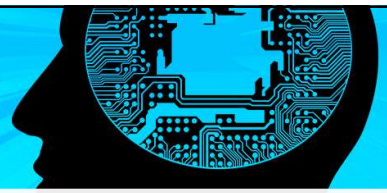
AI in Action Over the Years



ELIZA

(1964 - MIT Lab)

https://www.ecllecticenergies.com/ego/eliza

DEEP BLUE BEATS KASPAROV

(1997 - IBM)

https://www.youtube.com/watch?v=cwmIHnEHfr8

WATSON

(2011 - IBM)

https://www.youtube.com/watch?v=P18EdAKuC1U

Self Driving Cars, Virtual Assistant, IoT, GPS

(2000 onwards - Tesla, Uber, IBM, Amazon, Google …..

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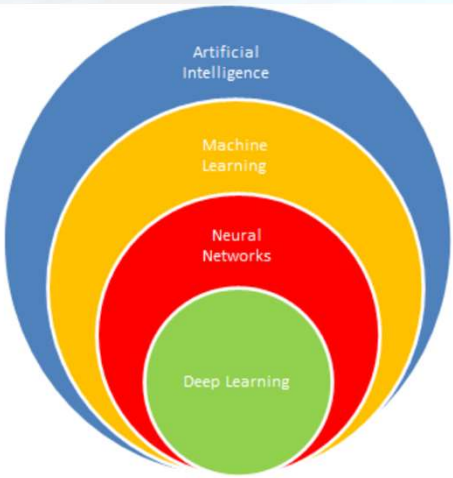
Artificial Intelligence Subfields

Artificial intelligence
planning, learning, reasoning, problem-solving, knowledge representation, perception, motion, and manipulation, and to a lesser extent social intelligence and creativity.



Neural Networks
is a collection of small computing units called neurons that take incoming data and learn to make decisions over time.

Machine Learning
- uses computer algorithms to analyze data and make intelligent decisions based on what it has learned,
- not explicitly programmed
- algorithms are trained with large sets of data and they learn from examples

Deep Learning
- algorithm scan label and categorize information and identify patterns
- enables AI systems to continuously learn on the job, and improve the quality and accuracy of results by determining whether decisions were correct

https://www.coursera.org/learn/introduction-to-ai/home/welcome

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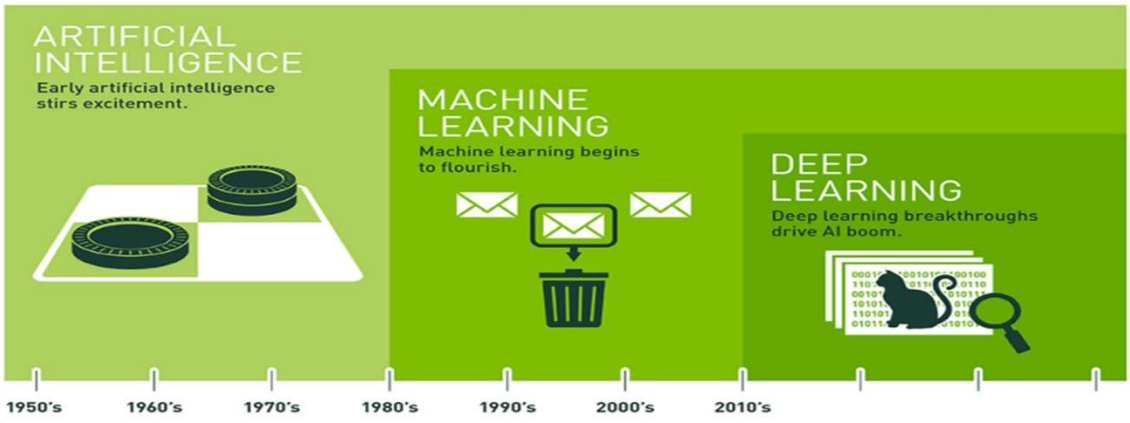
Artificial Intelligence Subfields



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.

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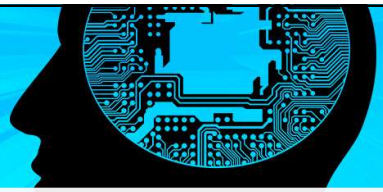
MACHINE LEARNING

AI ---> Machine Learning



Artificial Intelligence

- Recommend songs to EVERYONE based on:
  - number of copies sold
  - Top 10 in Billboard list
  - Grammy award winners
  - other (similar demographics etc)

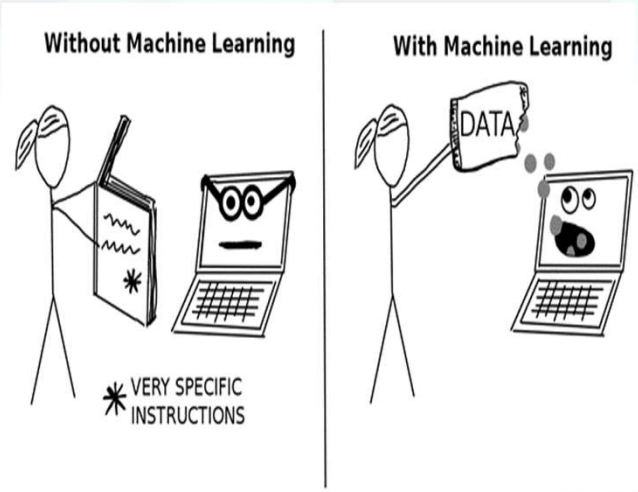
Machine Learning

- Recommend songs to each INDIVIDUAL based on:
  - previous songs played
  - other people with similar playlist
  - choice of singer, genre etc

AI ---> Machine Learning

Algorithm

- set of rules that a machine follows to achieve a particular goal
- can be considered as a recipe that defines
  - the inputs
  - the output
  - all the steps needed to get from the inputs to the output



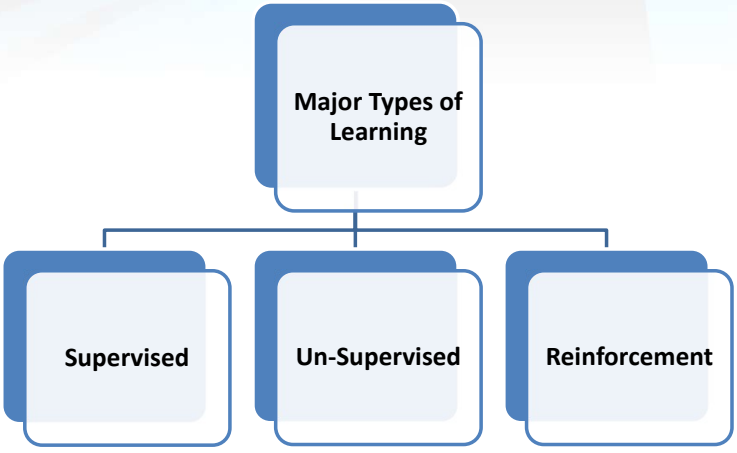
https://christophm.github.io/interpretable-ml-book/terminology.html

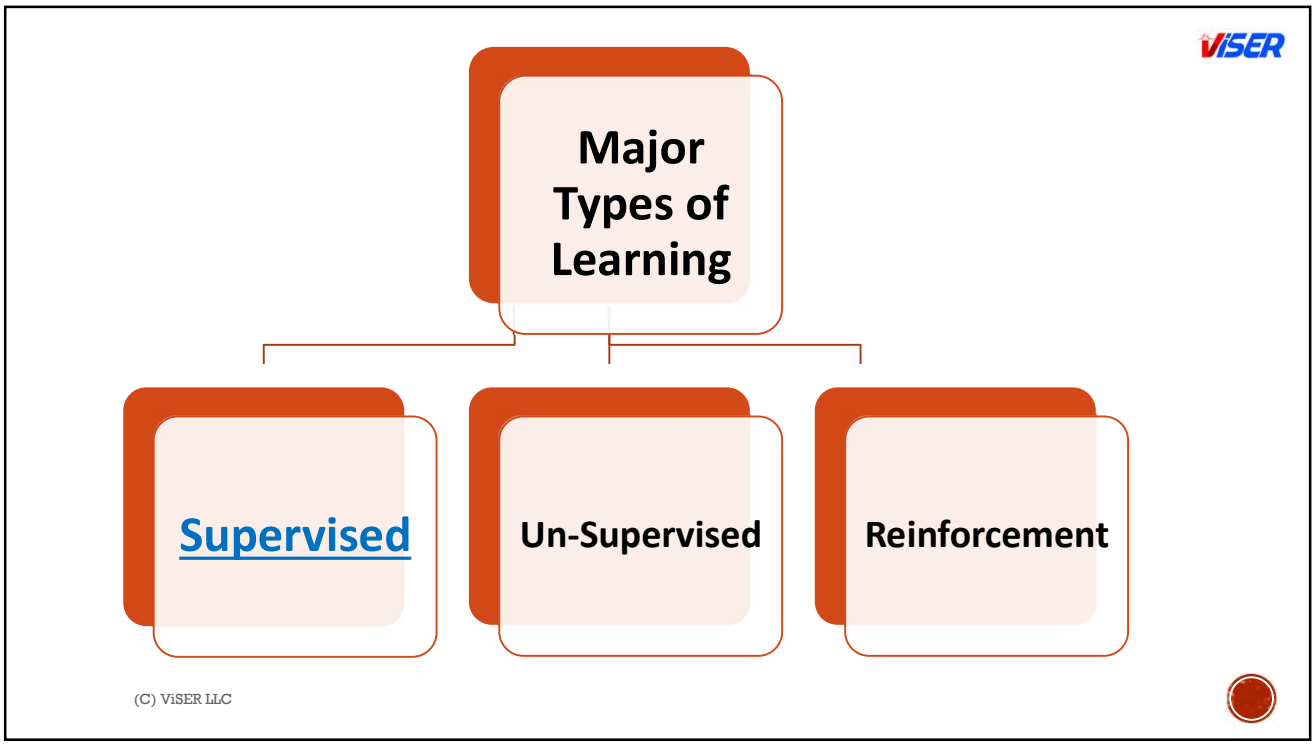
Learning Types

What is Learning for a machine?

A machine is said to be learning if:

- it's performance/efficiency for a given task improves with the experience (past data)





Types of Supervised Learning

Supervised Learning

Classification

- Task where output has defined labels(discrete value)
- Can be either binary or multi class classification.
- In **binary** classification, model predicts either 0 or 1 ; yes or no but in case of **multi class** classification, model predicts more than one class
- **Example:**
  - *Gmail classifies mails in more than one classes like social, promotions, updates, forum*
  - *Whether USA will WIN or LOSE a Soccer match?*

Regression

- Task where output has continuous value
- Goal is to predict a value as closer to actual output value in the model
- Evaluation is done by calculating error value
- smaller the error, the greater the accuracy of regression model
- *Example"*
  - *Trend in stock market prices, Weather forecast, etc.*

Example of Supervised Learning

User ID	Gender	Age	Salary	Purchased
15624510	Male	19	19000	0
15810944	Male	35	20000	1
15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	1
15728773	Male	27	58000	1
15598044	Female	27	84000	0
15694829	Female	32	150000	1
15600575	Male	25	33000	1
15727311	Female	35	65000	0
15570769	Female	26	80000	1
15606274	Female	26	52000	0
15746139	Male	20	86000	1
15704987	Male	32	18000	0
15628972	Male	18	82000	0
15697686	Male	29	80000	0
15733883	Male	47	25000	1

Figure A: CLASSIFICATION

Temperature	Pressure	Relative Humidity	Wind Direction	Wind Speed
10.69261758	986.882019	54.19337313	195.7150879	3.278597116
13.59184184	987.8729248	48.0648859	189.2951202	2.909167767
17.70494885	988.1119385	39.11965597	192.9273834	2.973036289
20.95430404	987.8500366	30.66273218	202.0752869	2.965289593
22.9278274	987.2833862	26.06723423	210.6589203	2.798230886
24.04233986	986.2907104	23.46918024	221.1188507	2.627005816
24.41475295	985.2338867	22.25082295	233.7911987	2.448749781
23.93361956	984.8914795	22.35178837	244.3504333	2.454271793
22.68800023	984.8461304	23.7538641	253.0864716	2.418341875
20.56425726	984.8380737	27.07867944	264.5071106	2.318677425
17.76400389	985.4262085	33.54900114	280.7827454	2.343950987
11.25680746	988.9386597	53.74139903	68.15406036	1.650191426
14.37810685	989.6819458	40.70884681	72.62069702	1.553469896
18.45114201	990.2960205	30.85038484	71.70604706	1.005017161
22.54895853	989.9562988	22.81738811	44.66042709	0.264133632
24.23155922	988.796875	19.74790765	318.3214111	0.329656571

Figure B: REGRESSION

https://www.geeksforgeeks.org/ml-types-learning-supervised-learning/

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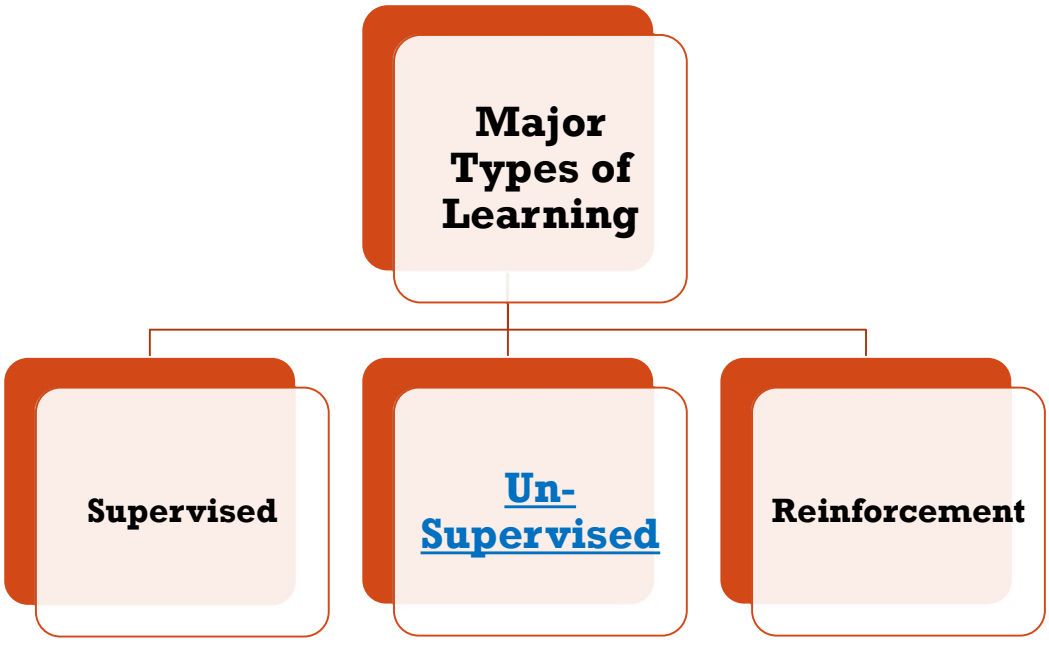
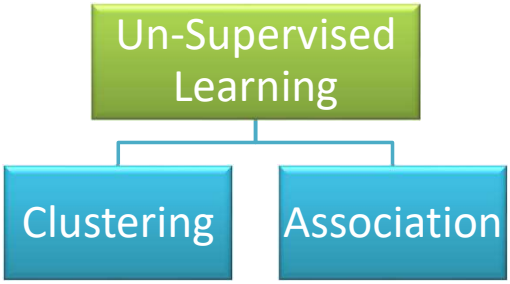


Types of Un-Supervised Learning



- **Clustering**
  - where we want to discover the inherent groupings in the data
  - *Example: such as grouping customers by purchasing behavior*
- **Association**
  - where we want to discover rules that describe large portions of the data
  - *Example: people that buy X also tend to buy Y*

https://www.geeksforgeeks.org/ml-types-learning-supervised-learning/

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Reinforcement Learning

- Taking suitable action to maximize reward in a particular situation
- Employed by various software and machines to find the best possible behavior or path it should take in a specific situation
- In the absence of training dataset, it is bound to learn from its experience

https://www.geeksforgeeks.org/what-is-reinforcement-learning/

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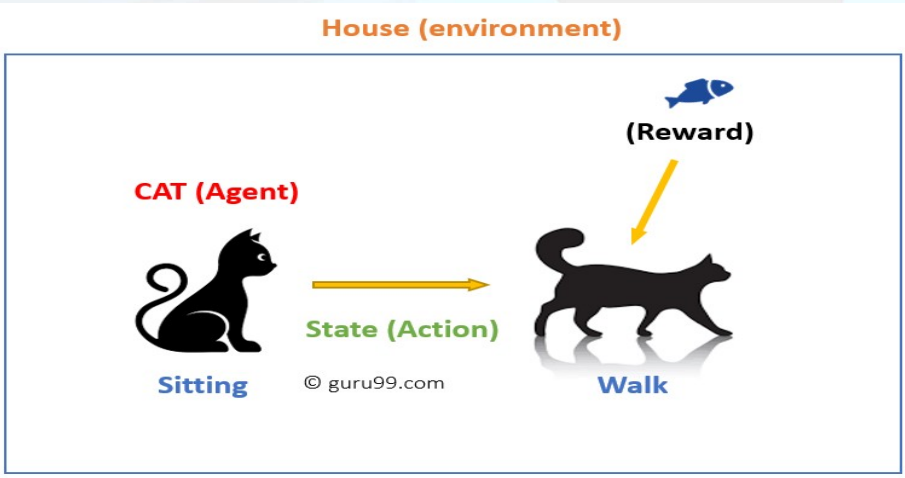
Simple Example Reinforced Learning

Agent: Cat
Reward: Fish
State: Sit, walk, run
Environment: House

Agent is supposed to find the best possible path to reach the reward

Agent reacts by performing an action transition from one "state" to another "state"

After transition, they may get a reward or penalty in return



https://www.guru99.com/reinforcement-learning-tutorial.html

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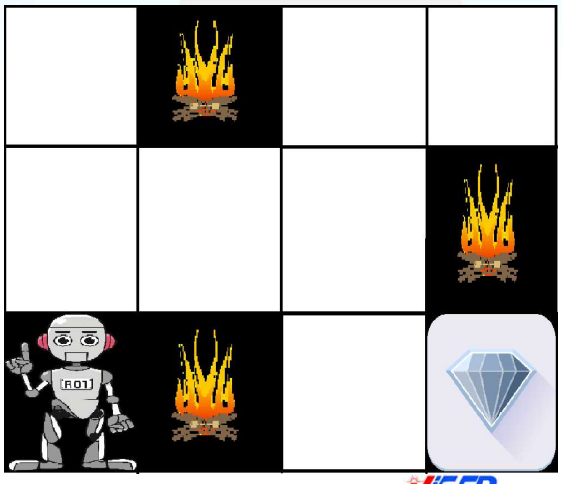
Example Reinforced Learning

Example : The problem is as follows: We have an agent and a reward, with many hurdles in between. The agent is supposed to find the best possible path to reach the reward.

- **Goal:** get the reward that is the diamond
- **avoid:** hurdles that is fire
- **Reinforcement learning:**
  - trying all the possible paths and then choosing the path which gives him the reward with the least hurdles
  - Each right step will give the robot a reward and each wrong step will subtract the reward of the robot
  - total reward will be calculated when it reaches the final reward that is the diamond



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Reinforcement Learning Applications

- Can be used in robotics for industrial automation
- Can be used in machine learning and data processing
- Can be used to create training systems that provide custom instruction and materials according to the requirement of students

https://www.geeksforgeeks.org/ml-types-learning-supervised-learning/

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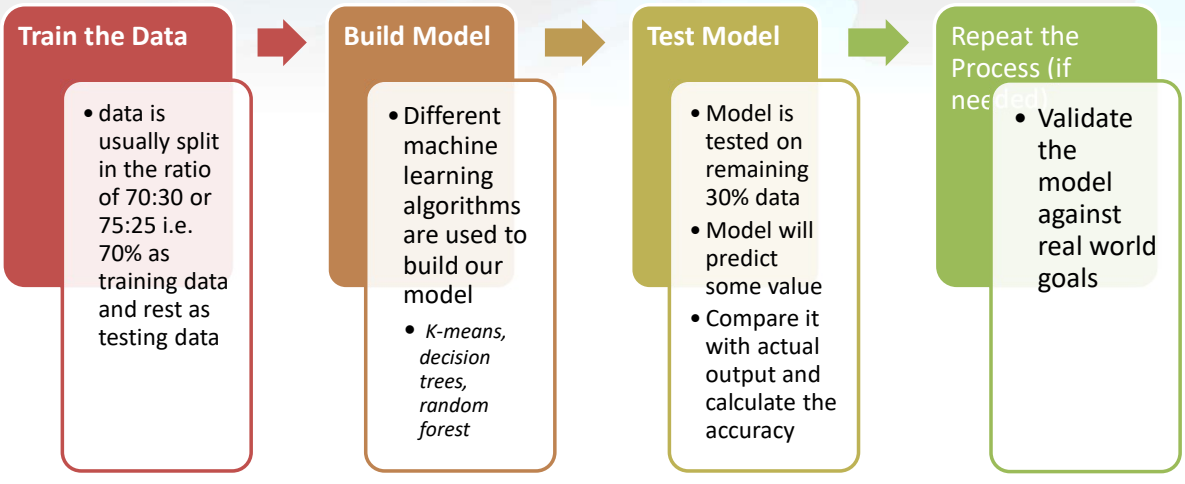
Steps in Machine Learning



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Machine Learning Steps Simplified

X	Y
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	15
9	18
10	20
11	21
12	24
13	26
14	30
15	30
16	32
17	34
18	36
19	33
20	41

- A dataset with 20 entries
- Step 1: Split the data(randomly) into 75% and 25% into:
  - training set (in RED)
  - test set (in BLACK)
- Step 2: Build the model (X=2Y) -- apply ML algorithms
- Step 3: Validate the model on test data

X	Y (Actual)	Y (Model)	Difference
1	2	2	0
7	14	28	0
9	18	36	0
12	24	24	0
19	33	38	5

- Average error = (0+0+0+0+5)/5 = 1
- Test the model for new values like X = 24
- In real world problems, the calculations and steps are more complex

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Quiz time

https://forms.gle/BdTguXbfAnM5s4Jt7

(Time : 5 min)

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Why Machine Learning ?

- Can estimate the price of a house based on experience and knowledge of the market
- May take probably few years to master the art of estimate the price of a house
- Expertise gets better and better after each sale

Can be trained to translate the knowledge of an expert into features. The features can be:

- characteristics of a house (number of bedrooms, area, flooring etc)
- Neighborhood
- economic environment etc.

that makes the price difference

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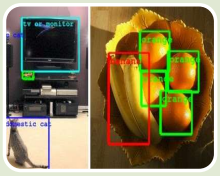
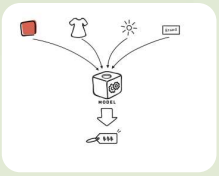
Some Machine Learning Applications





Speech recognition

translation of spoken words into the text

ex: voice search, voice dialing etc

Image recognition

Recognizing the digital image and compare it with existing database

ex: tag people in FB

Recommendation

Recommending products and services on the basis of user's interaction with the website/app, past purchases, items liked or added to cart, brand preferences etc.

Searching, Classification

ex: Google Search, email filtering (junk, spam etc)

Prediction

ex: to compute the probability of a loan default

google images

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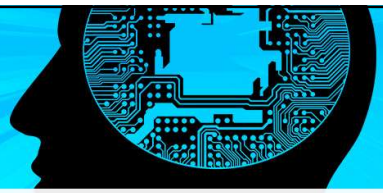
Hands on Experience on AI and ML



- Visit *Machinelearningforkids.co.uk*
  - Do the program "**Journey to School"** (Supervised learning, Classification problem)
- https://experiments.withgoogle.com/collection/ai
- https://aidemos.microsoft.com/

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DATA DEFINITION AND TYPES

What is Data?

- ***Set of observations or information***
  - example: height of 5 students in a class
    height(in cm) 155,160,130,156, 158
  - example: weather of a city in 5 consecutive days
    weather: warm, sunny, cloudy, warm, humid

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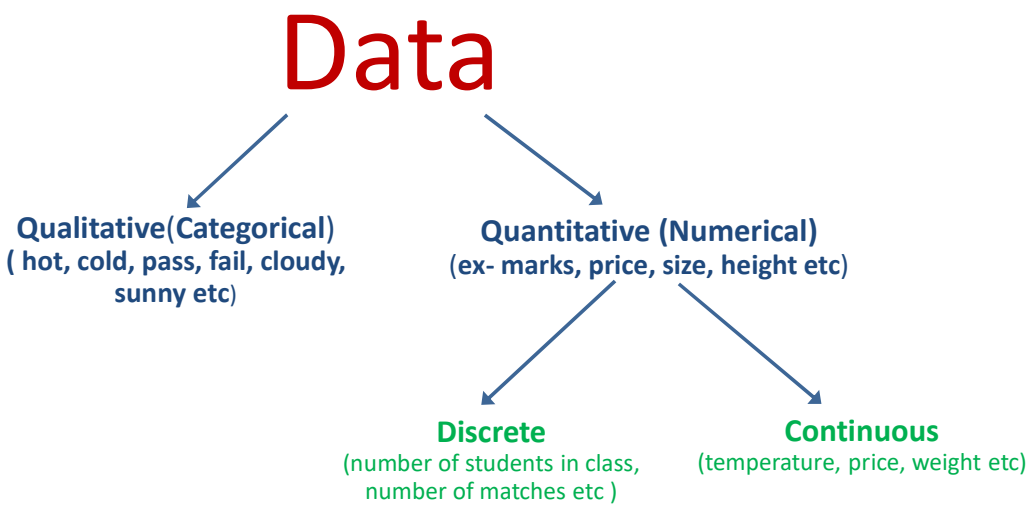
Types of Data



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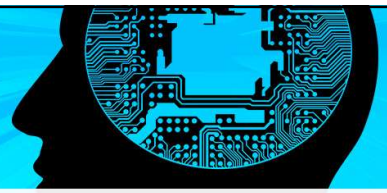
Data Definitions



ROW

User ID	Gender	Age	Salary	Purchased
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15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	1
15728773	Male	27	58000	1

COLUMN

- Column Names (User ID, Gender, Age, Salary, Purchased)
- Columns are also called "features" or "fields"

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BASICS OF PYTHON PROGRAMMING

Introduction

- Created by *Guido van Rossum* and first released in 1991
- Meant to be an easily readable
  - often uses English keywords
- Top programming language (IEEE – 2018 and 2019)
  - simple to use
  - vast application in Data Analysis and other fields (Machine Learning)
  - salary and job openings in 2019 (codeplatoon.org)
- Easy to debug
- Extensive support libraries
  - many programs are already embedded in libraries and reduce the length of the code
- Open source language
  - freely available for the programmers to download and distribute for commercial use
- Cross-platform
  - supports all the major platforms such as windows, Linux, Macintosh

Comments

- Hash(#) is used to write a comment in Python
  - Example -- #This is my first program
  - Python ignores everything after the hash mark and up to the end of the line
- Comments can be inserted anywhere in the code, even inline with other code
  ex : print("This will be printed.") # This won't run
- For multiline comments, triple quotes are used
  """ This comment span
  many lines and it can be done
  using triple quotes
  """
- One of the distinctive features of Python is its use of indentation to highlight the blocks of code

Data types

Integer(int), Decimal (float), Text or string (str), Boolean(bool)

```
>>> type(1)
<class 'int'>
>>> type(1.0)
<class 'float'>
>>> type("1")
<class 'str'>
>>> type("True")
<class 'str'>
>>> type(True)
<class 'bool'>
```

```
>>> float(10)
10.0
>>> float(10.5)
10.5
```

```
>>> int(10)
10
>>> int(-10)
-10
>>> int(10.5)
10
```

```
>>> str("10")
'10'
>>> str(10)
'10'
>>> str(-10.5)
'-10.5'
```


Variables and Operators

variable_name = value

- must start with a letter
- can only contain letters, numbers and the underscore character _
- can not contain spaces or punctuation
- not enclosed in quotes or brackets

```
>>> a = 5
>>> print(a)
5
>>> print("The value of a is:", a)
The value of a is: 5
```

ARITHMETIC OPERATOR	DESCRIPTION	SYNTAX
+,-	Addition / Subtraction	x + y, x-y
*	Multiplication	x * y
/	Division (float)	x / y
//	Division (floor)	x // y
%	Modulus: returns the remainder when first operand is divided by the second	x % y
RELATIONAL OPERATOR	**DESCRIPTION**	**SYNTAX**
>	Greater than	x > y
<	Less than	x < y
==	Equal to	x == y
!=	Not equal to	x != y
>=	Greater than or equal to	x >= y
<=	Less than or equal to	x <= y
LOGICAL OPERATOR	**DESCRIPTION**	**SYNTAX**
and	Logical AND: True if both the operands are true	x and y
or	Logical OR: True if either of the operands is true	x or y
not	Logical NOT: True if operand is false	not x

Loops -- *"for"*

for index_var in sequence:
statements(s)

```
count = 0
for i in range (1, 4):
    count = count + i
    print(count)
```

1
3
6

```
# nested for loops in Python
for i in range(1, 5):
   for j in range(i):
      print(i, end=' ')
   print()
```

1
2 2
3 3 3
4 4 4 4

```
for index_var in sequence:
    # execute these statements
else:
    # execute these statements

for index in range(0,3):
   print (index)
else:
   print ("Inside Else Block")
```

0
1
2
Inside Else Block

Conditional Statements - *if*

IF conditions (single)

- Equals: a == b
- Not Equals: a != b
- Less than: a < b
- Less than or equal to: a <= b
- Greater than: a > b
- Greater than or equal to: a >= b

IF conditions (multiple)

AND (example- if a > b and c > a:)
OR (example- if a > b or a > c:)

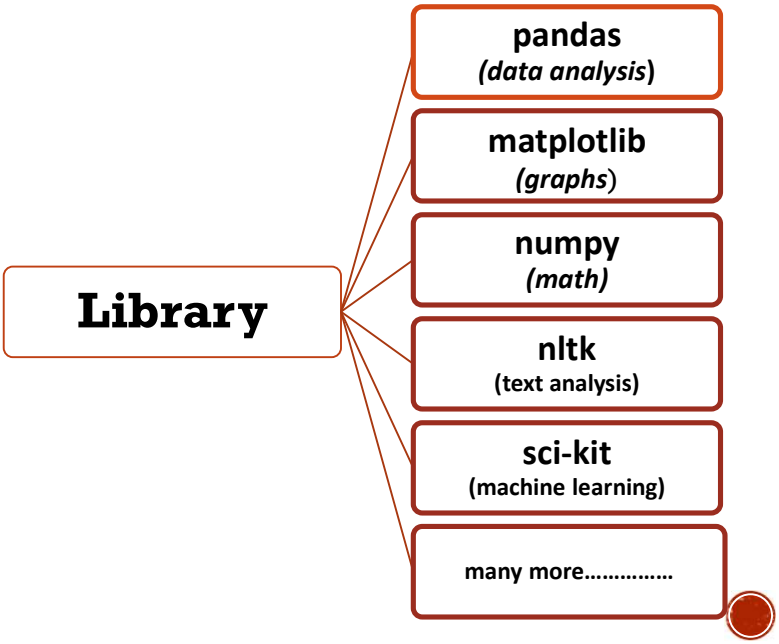
Nested If

if statements inside if statements is called *nested* if statements.

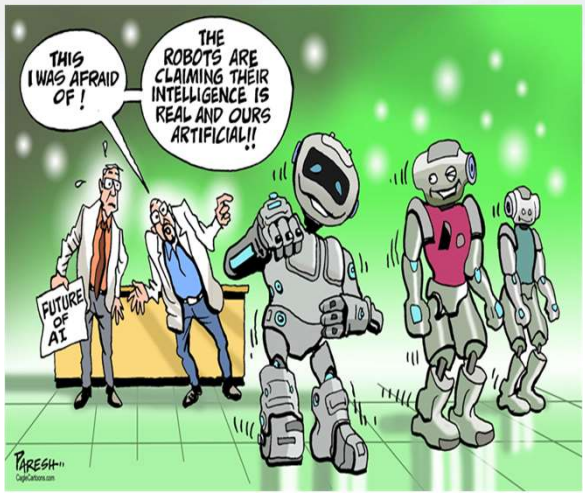
```
if condition 1 is true:
    # execute these statements
elif condition 2 is true:
    # execute these statements
elif condition 3 is true:
    # execute these statements
.
.
.
.
else:
    # execute these statements
```


Library / Package

- A reusable block of code that can be included in programs/ projects as needed
- Library consists of a lot of functions
  - function is a block of organized, reusable code that is used to perform a *single, related action -- mean, sum etc*
- *built-in functions like print(), input* etc.
- *user-defined functions*- created by user as per need



Humor with AI

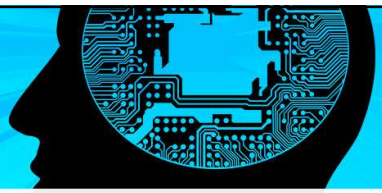


https://www.cagle.com/paresh-nath/2019/01/artificial-intelligence

"Artificial intelligence **is when you get a college degree, but you're still stupid when you graduate."**

https://henrykotula.com/2018/10/12/cartoon-artificial-intelligence-defined/

Handouts



- Will be available after the class
- Email will be sent with link to the resources:
  - handouts
  - program files
  - other resources

VISER

THANK YOU!

SEE YOU NEXT SATURDAY AT 3:00 PM