INT254
Fundamentals of Machine Learning

Lecture #0

Agenda, Roadmap & Expectations

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Course details

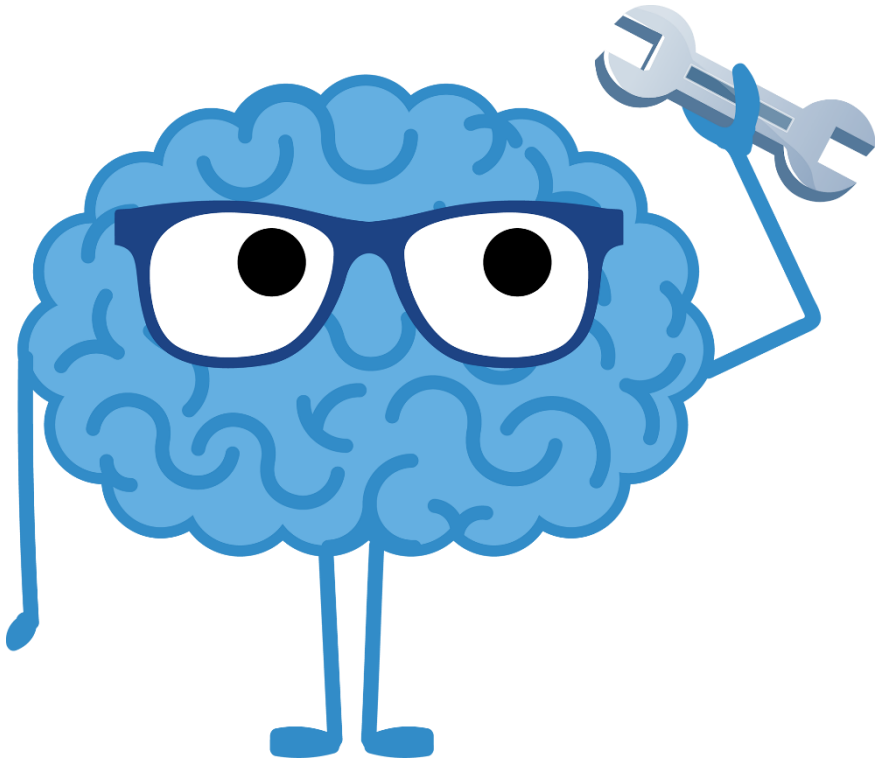
- **LTP – 2 0 2**
- **Credits – 3.0**
- **Mode – BYOD**
- **Text Book**
  - **Mathematics for Machine Learning**
- **~** A. ALDO FAISAL, CHENG SOON ONG.

  Soft Computing using MATLAB
- **~** N.P. PADHY & S. P. SIMON,

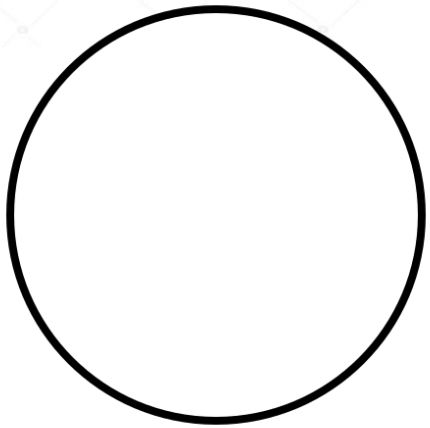
Course Assessment Model

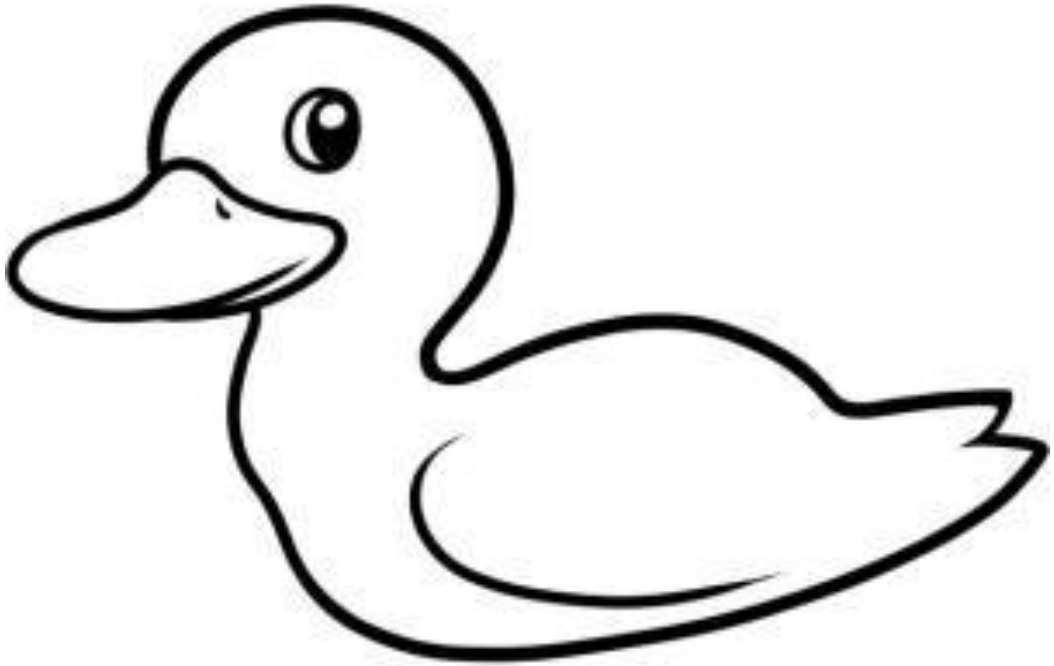
- **Marks break up***
- **Attendance** 5
- **CA** 25
  - Project
  - 1 Best out of 2 Code based Test
- **MTT** **20**
- **ETT** 50
- **Total** **100**

Machine Learning



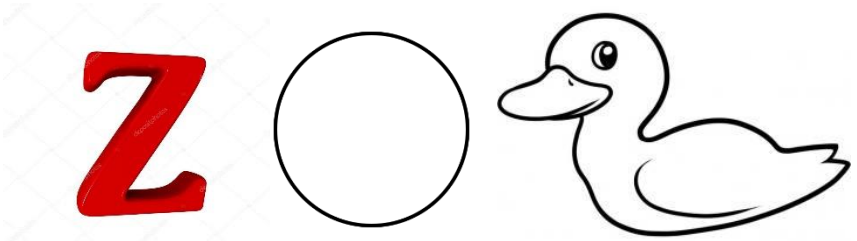
Learning – Aspect #1





Discrete/Labeled dataset

- **You used prior learnings of -**
  - **Shapes**
  - **Patterns**
  - **Categories**
  - **Weighed them to MOST nearing entity**



- **And finally classified it into ANSWER!!!**

What is Machine Learning

- Machine learning, the application and science of algorithms that makes sense of data, using self learning Algorithms we can turn data into knowledge.

- When most people hear “Machine Learning” they picture a robot depending on who you ask
  i.e. Optical Character Recognition

Cont.

- Machine Learning is the science of programming computers so they can learn from data.

For example, your spam filter is a Machine Learning program that can learn to flag spam/Ham.

Use of Machine Learning

- First you would look at what spam typically looks like. You might notice that some words or phrases (such as “Lottery,” “credit card,” “free,”) tend to come up a lot in the subject. Perhaps you would also notice a few other patterns in the sender’s name and so on.
- You would write a algorithm for each of the patterns, and your program would flag emails as spam if a number of these patterns are detected.

Cont.

- Moreover, if spammers notice that all their emails containing “4U” are blocked, they might start writing “For U” instead. A spam filter using traditional programming techniques would need to be updated to flag “For U” emails.

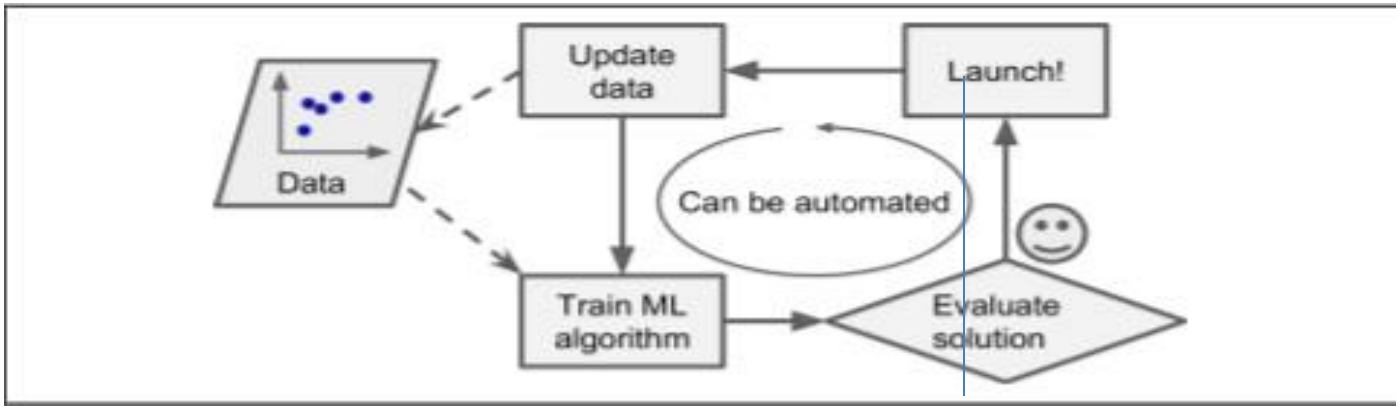
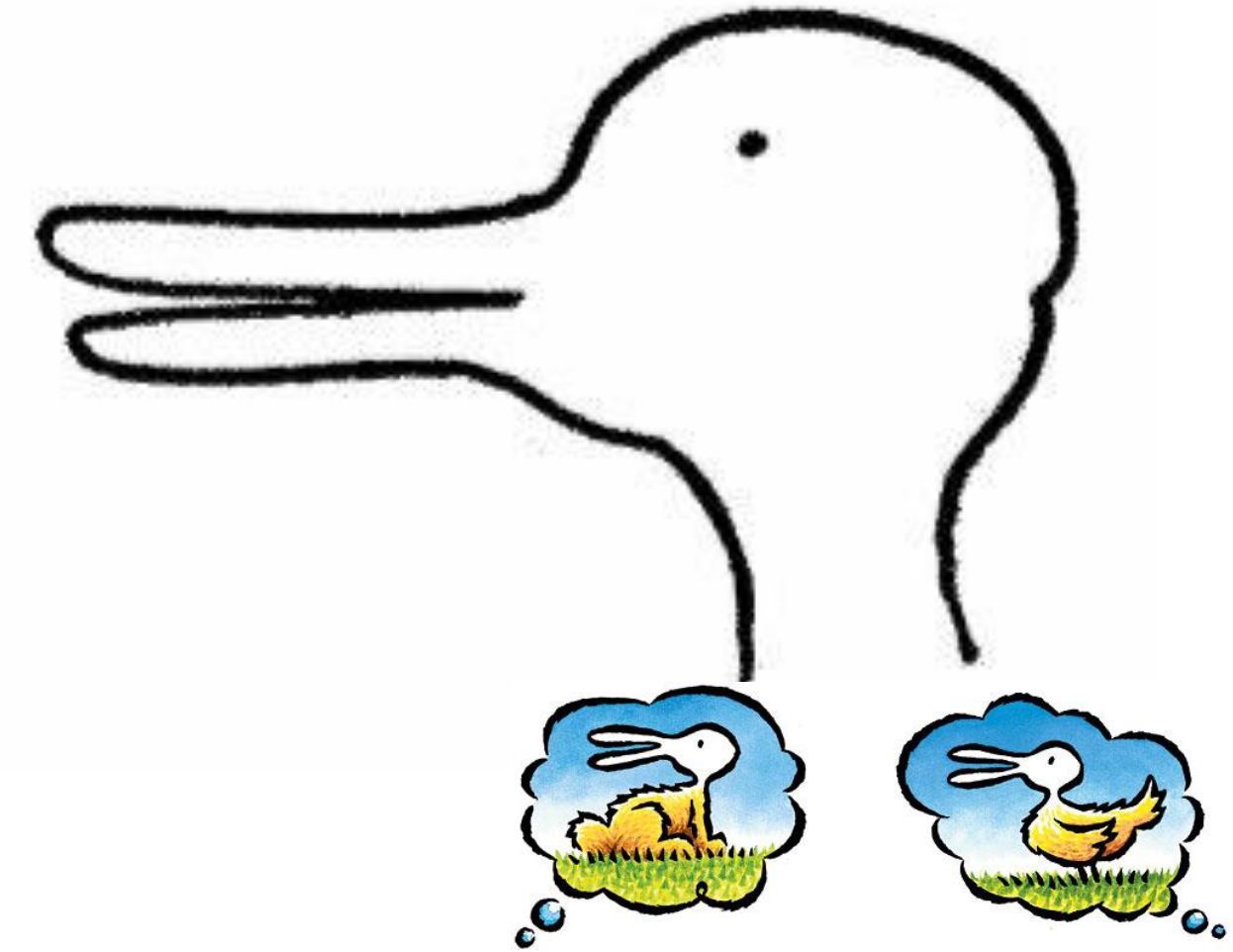


Fig:- Automatically adapting to change

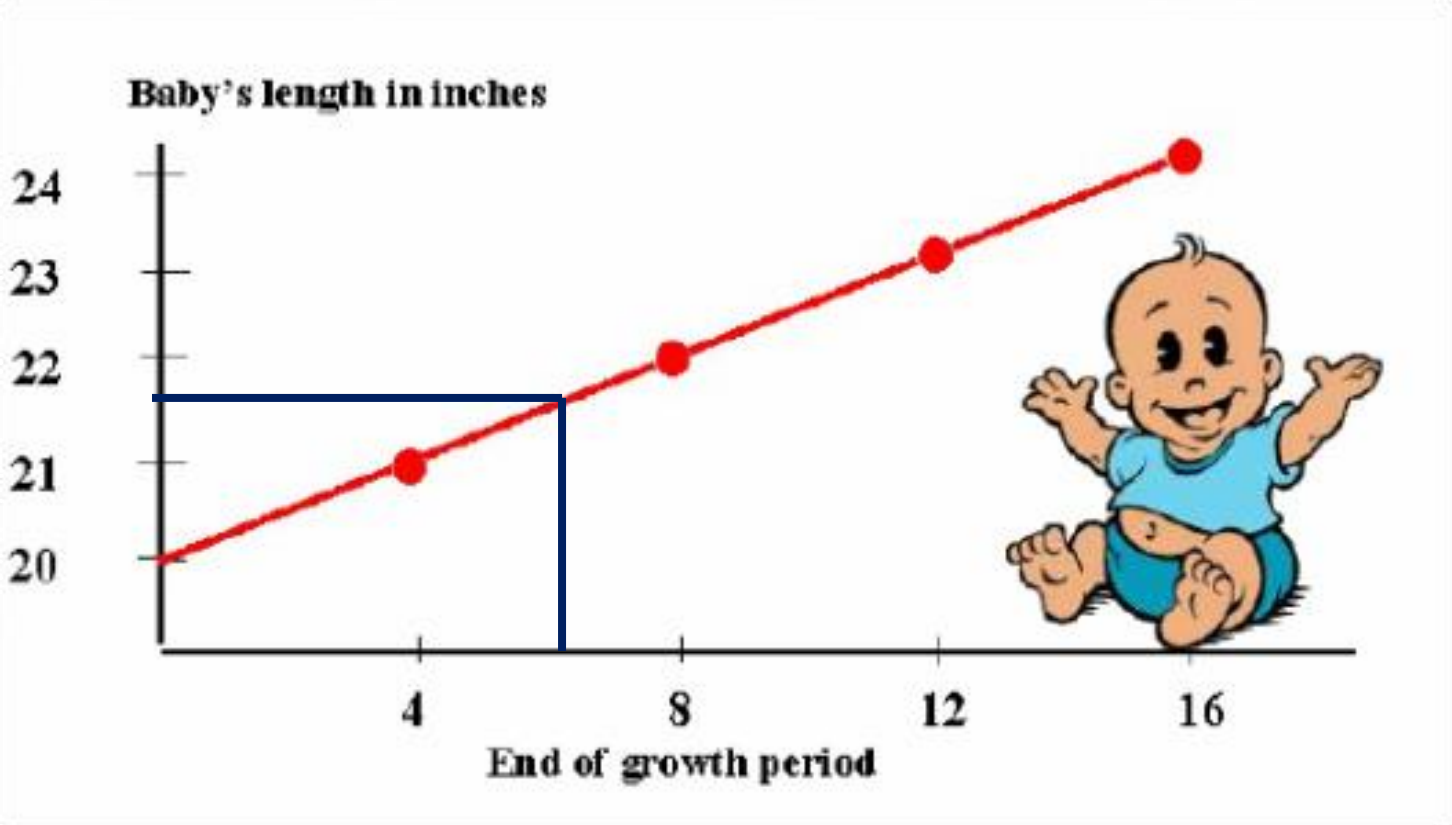
Types of Machine Learning

- There are so many different types of Machine Learning systems that it is useful to classify them in broad categories based on:
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

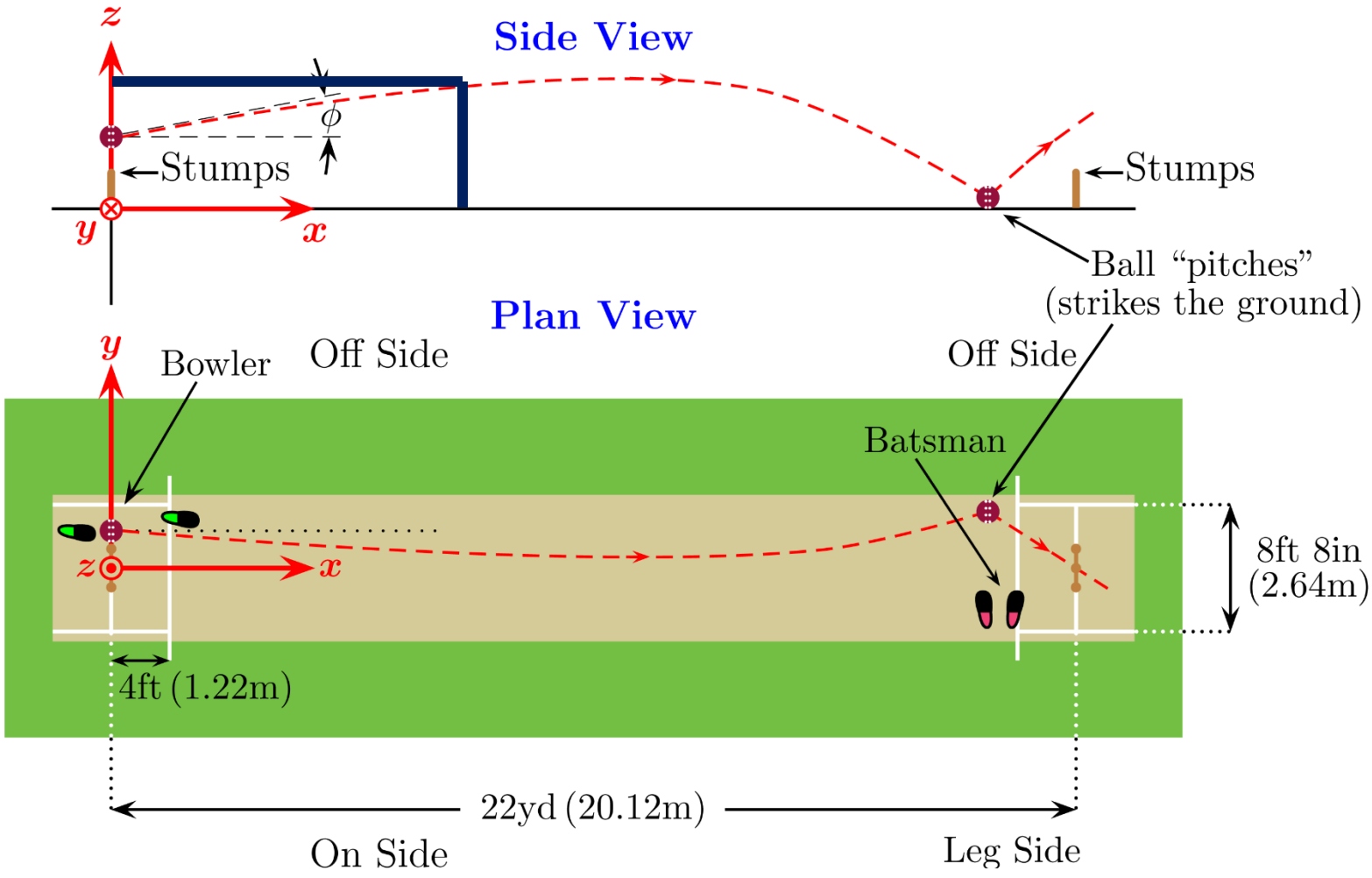
Aspect #1 Challenge



Learning – Aspect #2



Learning – Aspect #2



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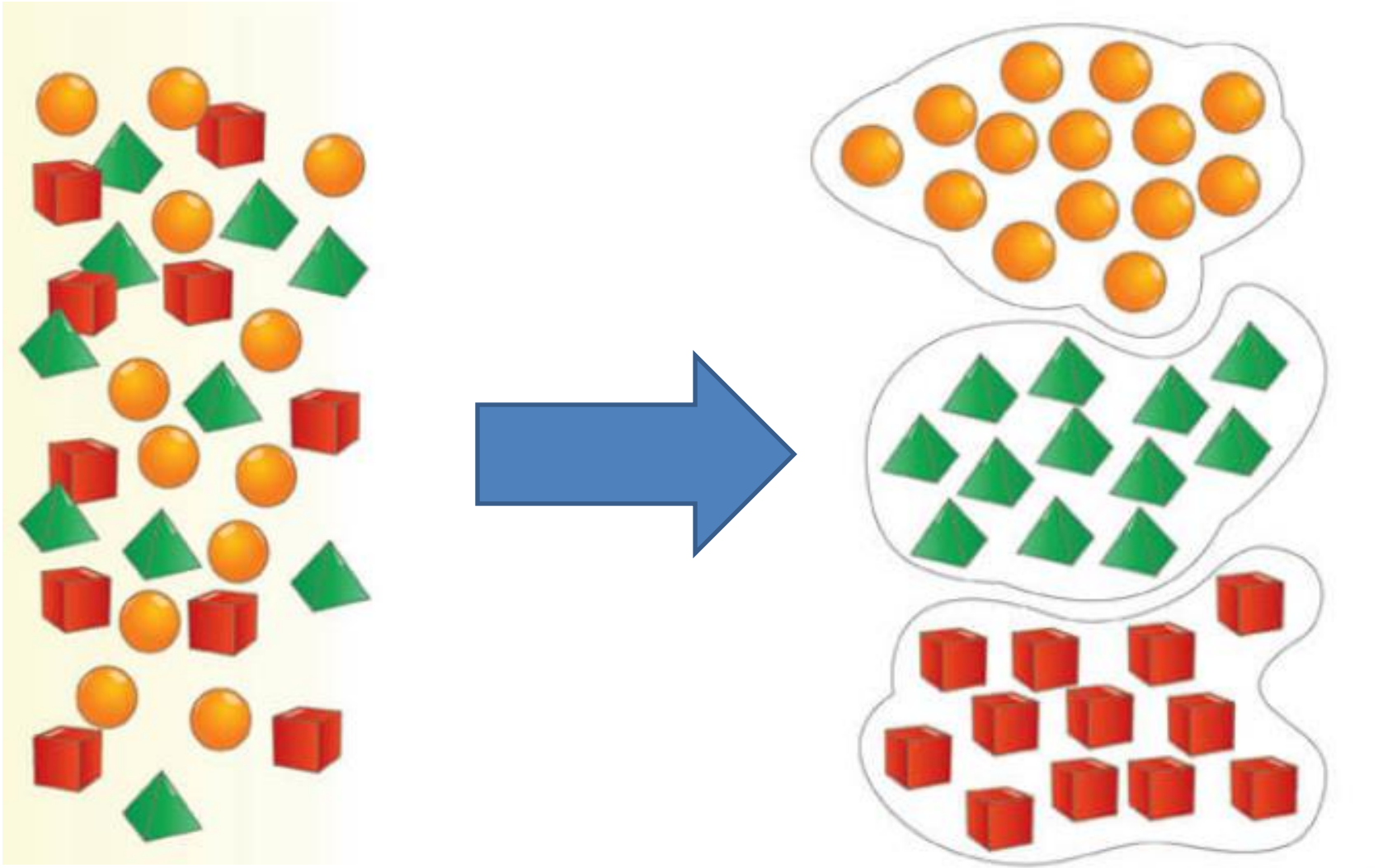
Continuous dataset

- **You used prior learnings of -**
  - **Variability**
  - **Coordinate geometry**
  - **X – Y correlation**
  - **Plot reading**

- **And finally build the ANSWER!!!**

Learning – Aspect #3



Learning – Aspect #3

Unknown dataset

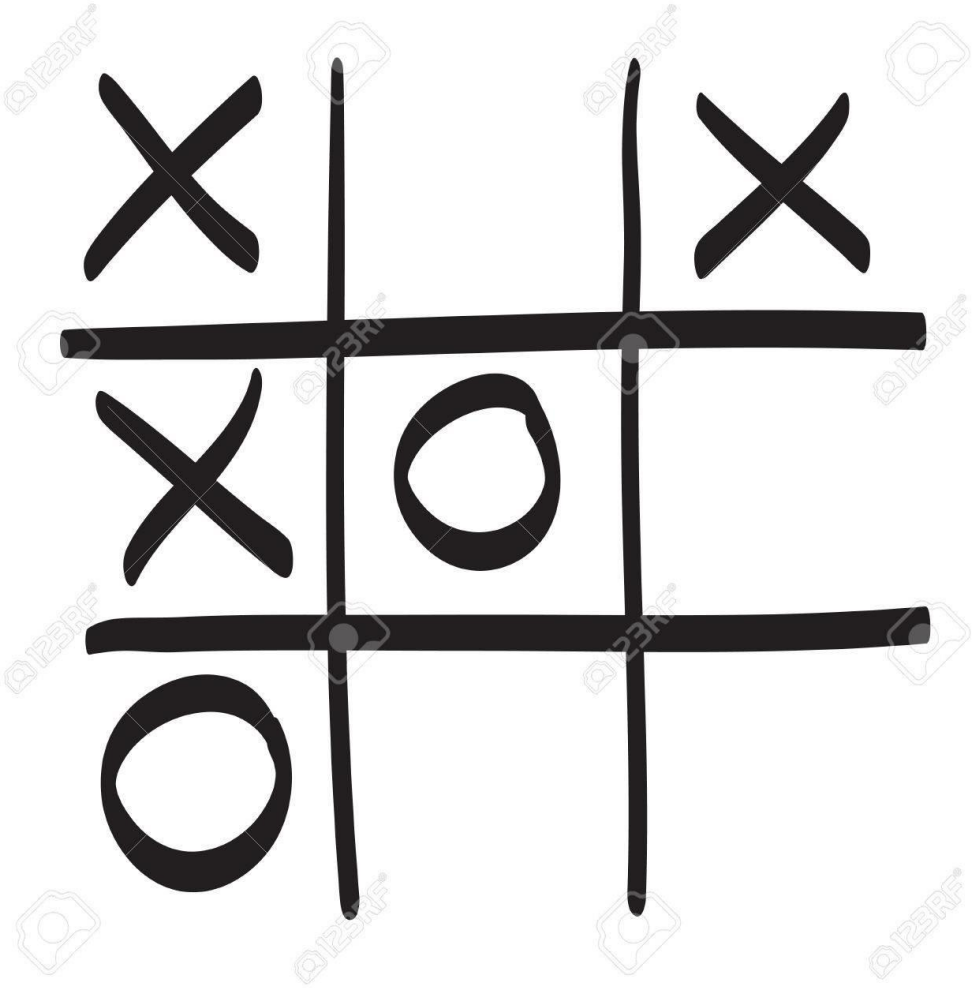
- **You used prior learnings of -**
  - **Grouping objects**
  - **Extracting meaningfulness**
  - **Associating conjectures**

- **And finally build the Clusters!!!**

Learning – Aspect #4

4	3		
1	2	3	
		2	
2	1		

Learning – Aspect #4



Iterative revisit

- **You played keeping**
- **NEXT MOVE(s)**
- **Probability of losing with a said move**
- **Back tracking earlier opponent moves**

- **And finally moved!!!**

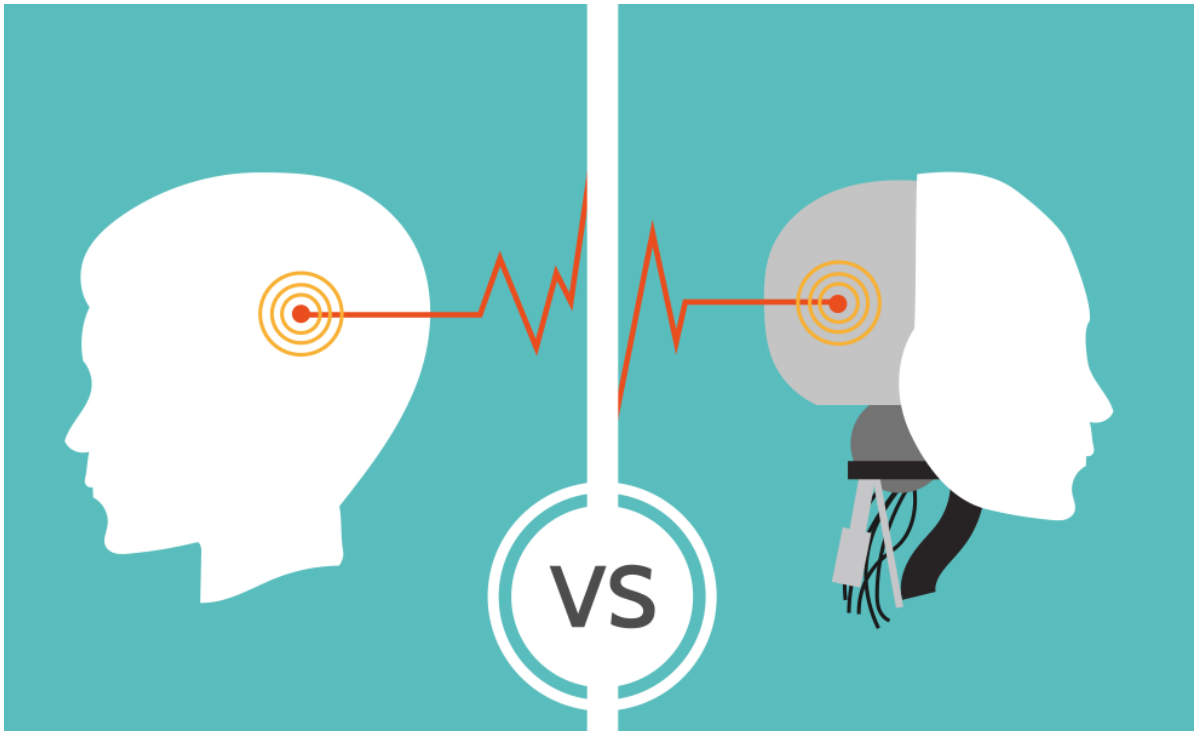
Aspect summary

- **#1 and #2**
  - **Prior information available to build answers**
- **#3**
  - **Meaningful grouping of unknown and cluttered data**
- **#4**
  - **Reiteration and loop back on pre and post information**

Aspect summary

- **#1 and #2** — Supervised
  - **Prior information available to build answers**
- **#3** — Unsupervised
  - **Meaningful grouping of unknown and cluttered data**
- **#4** — Reinforcement
  - **Reiteration and loop back on pre and post information**

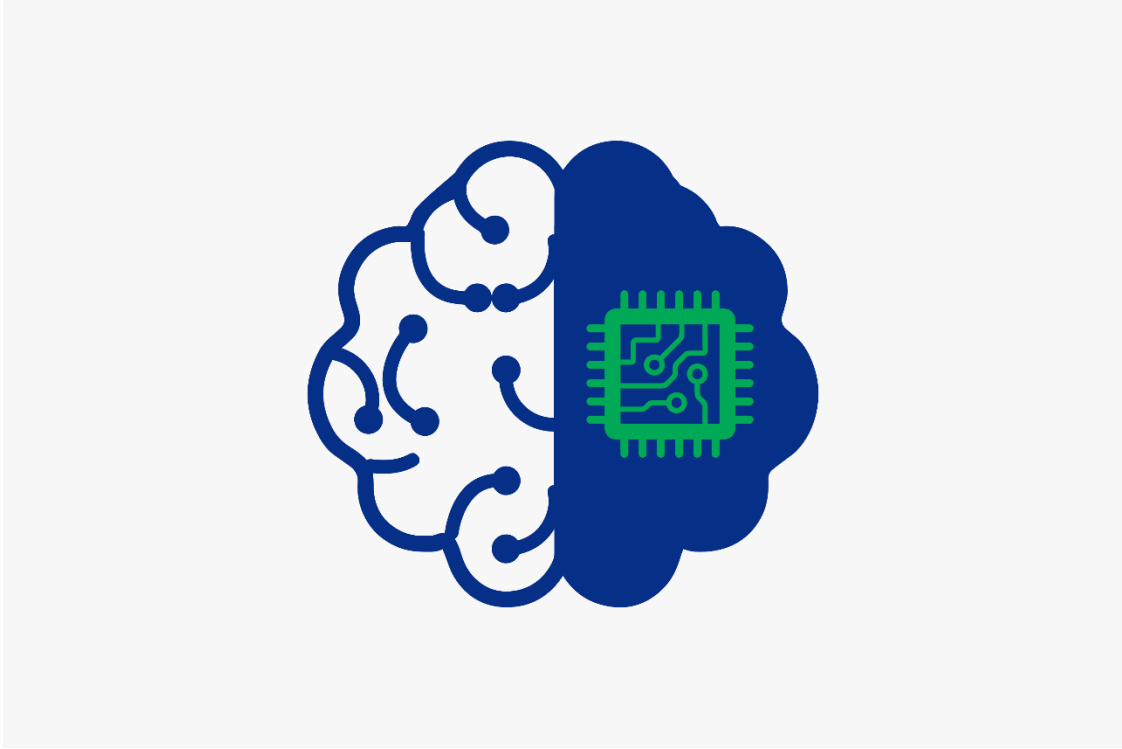
Human v/s Computers



- Everything is a PATTERN
- Natural ability to learn, unlearn and relearn

- Everything is DATA
- Will need code to understand data, visualize data and extract meaning

Machine Learning



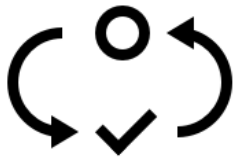
TYPES OF MACHINE LEARNING

Supervised Learning

Train an algorithm to perform classifcation and regression with a labelled data set.

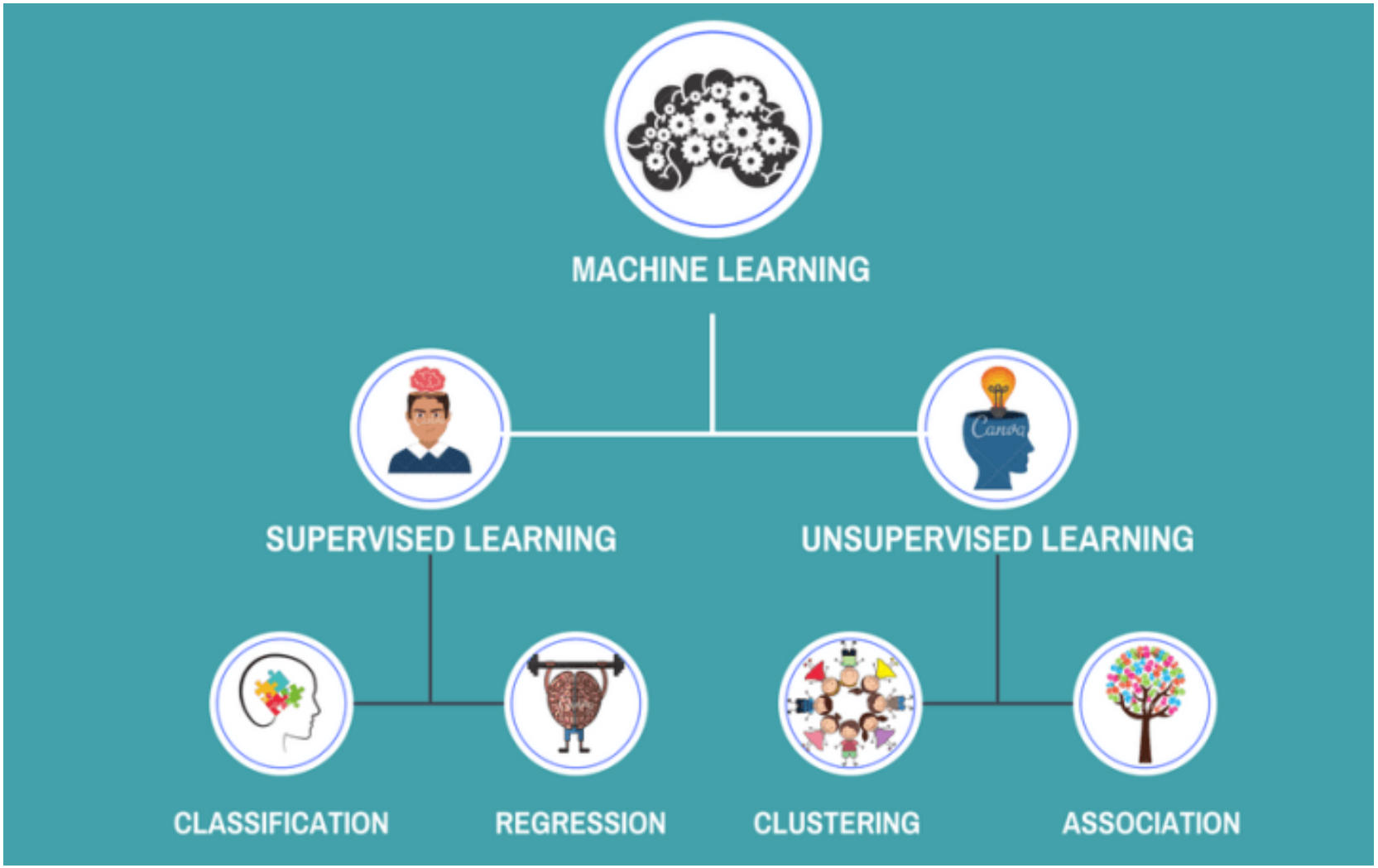
Unsupervised Learning

Train an algorithm to find clusters and associations in an unlabelled data set.



Reinforcement Learning

Train an agent to take certain actions in an environment without a data set.


MACHINE LEARNING
SUPERVISED LEARNING
UNSUPERVISED LEARNING
CLASSIFICATION
REGRESSION
CLUSTERING
ASSOCIATION

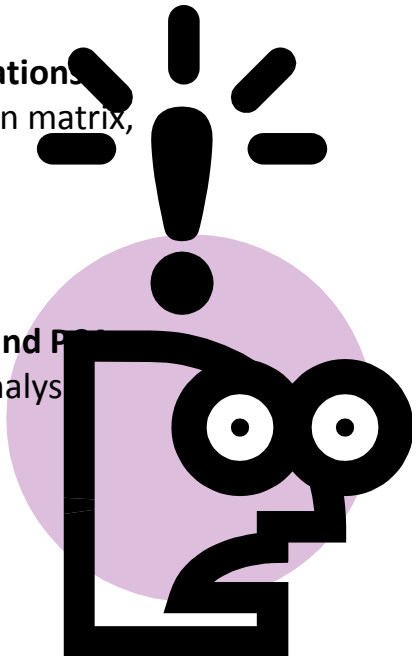
The course contents

Linear algebra : Introduction to linear algebra, operations with vectors, modulus and inner product, cosine and dot product, projection, changing basis, matrices, solving simultaneous equation problems, types of matrix transformation, determinants and inverses, matrices changing basis, orthogonal matrices, eigen values and eigen vectors

Multivariate calculus : Introduction to multivariate calculus, definition of a derivative, differentiation examples & special cases,, product rule, chain rule, differentiate with respect to anything, The Jacobian, The Hessian, multivariate chain rule, building approximate functions, power series, linearisation, multivariate taylor

Data handling and visualization using python : types of data, reading the data, math operations for data analysis, handling missing values, Converting data into numerical format, correlation matrix, data visualization using different graphs

Dimensionality Reduction : statistics of dataset, orthogonal projections, problem setting and P objective, finding the coordinates of the projected data, steps of PCA, linear discriminant analys kernel PCA



The course contents

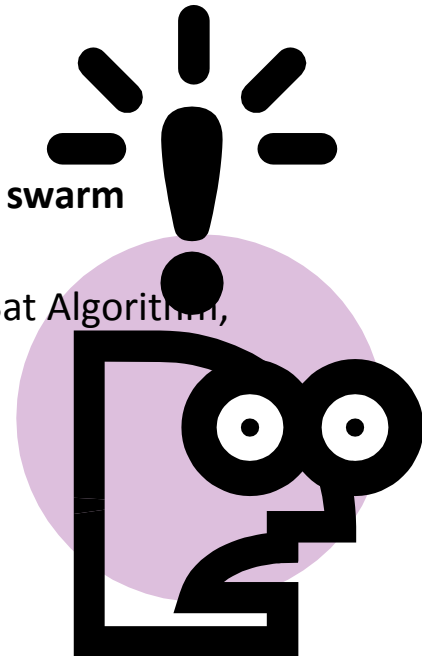
Fuzzy logic : basic definition and terminology, set-theoretic fuzzy operations, fuzzy sets and operations on fuzzy sets, fuzzy relations, fuzzy rules and fuzzy reasoning, fuzzy inference system, fuzzification and defuzzification methods, fuzzy based expert system

Genetic algorithms : introduction to genetic algorithms, genetic operators, working of genetic algorithm, applications of genetic algorithm, genetic programming

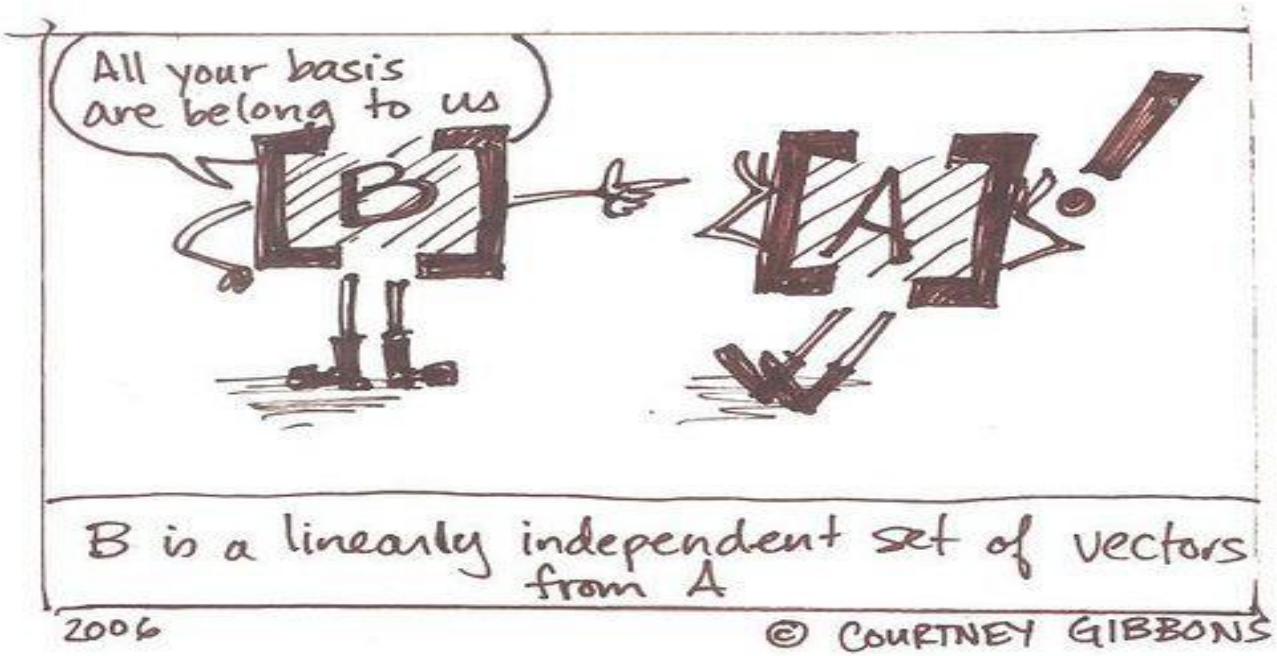
Swarm optimization techniques : swarm intelligence, ant colony optimization, swarm intelligence

in bees, cuckoo search, Firefly Algorithm, Crow Search Algorithm, Hybrid Wolf-Bat Algorithm, Whale

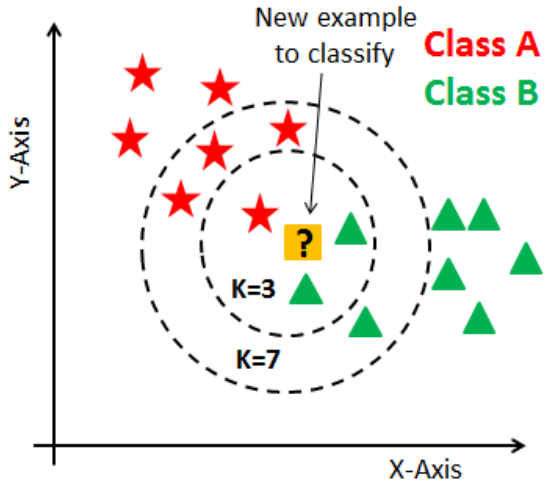
Search Algorithm, grasshopper optimization



Linear Algebra



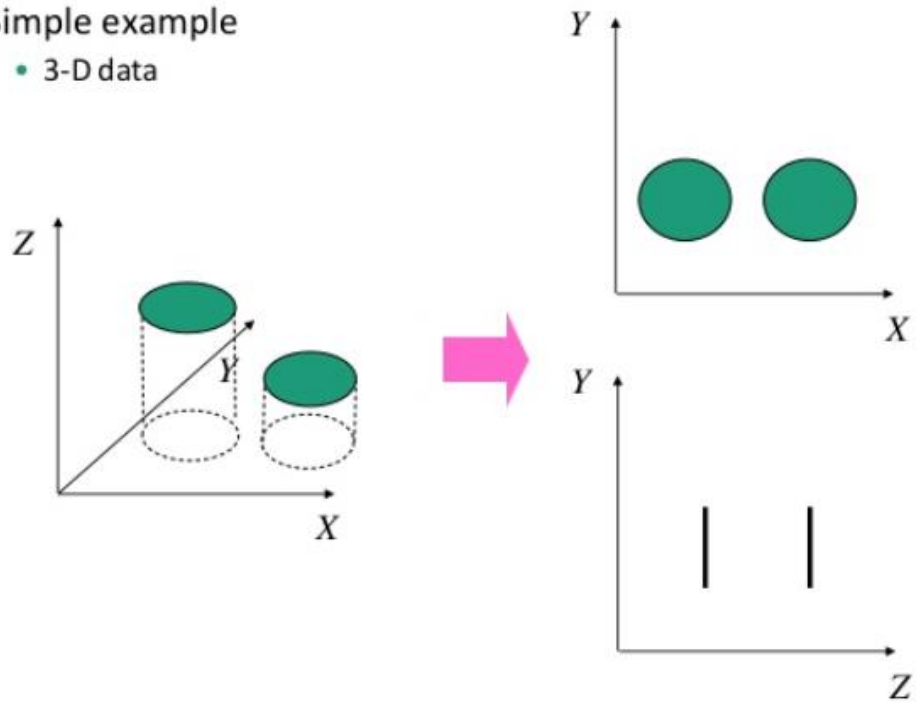
Data handling and visualization

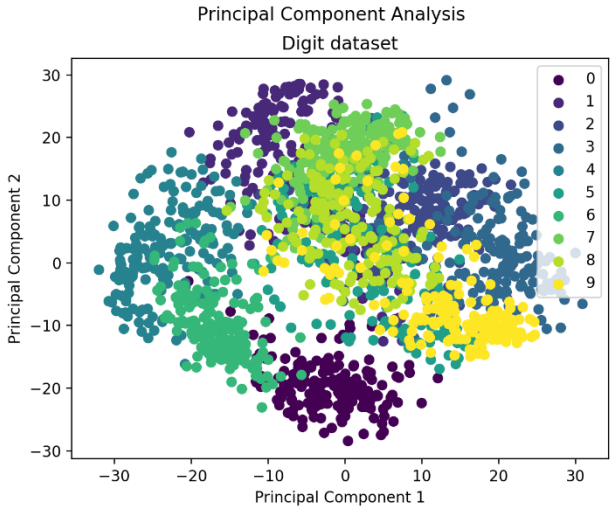


Pandas,Numpy and Matplot Libraries

Dimension Reduction

- Simple example
  - 3-D data





Principle Component Analysis

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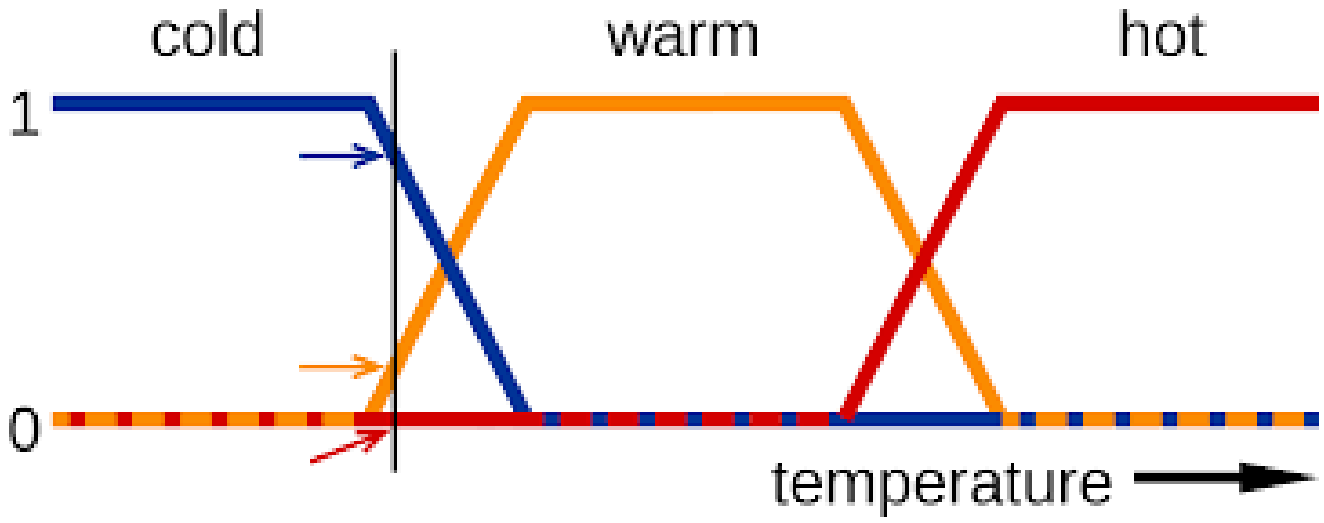
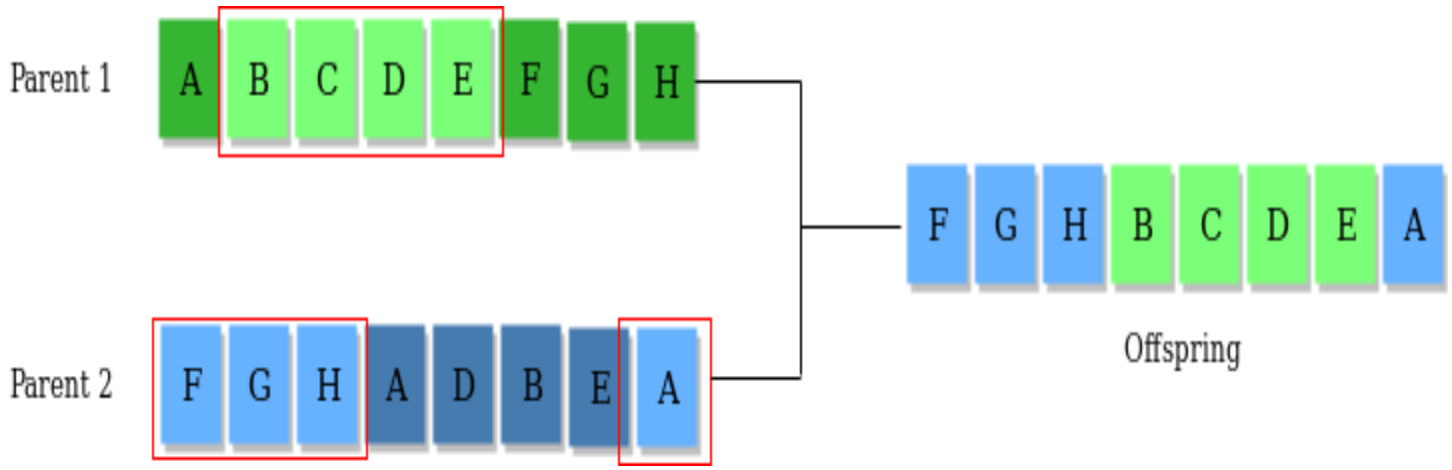
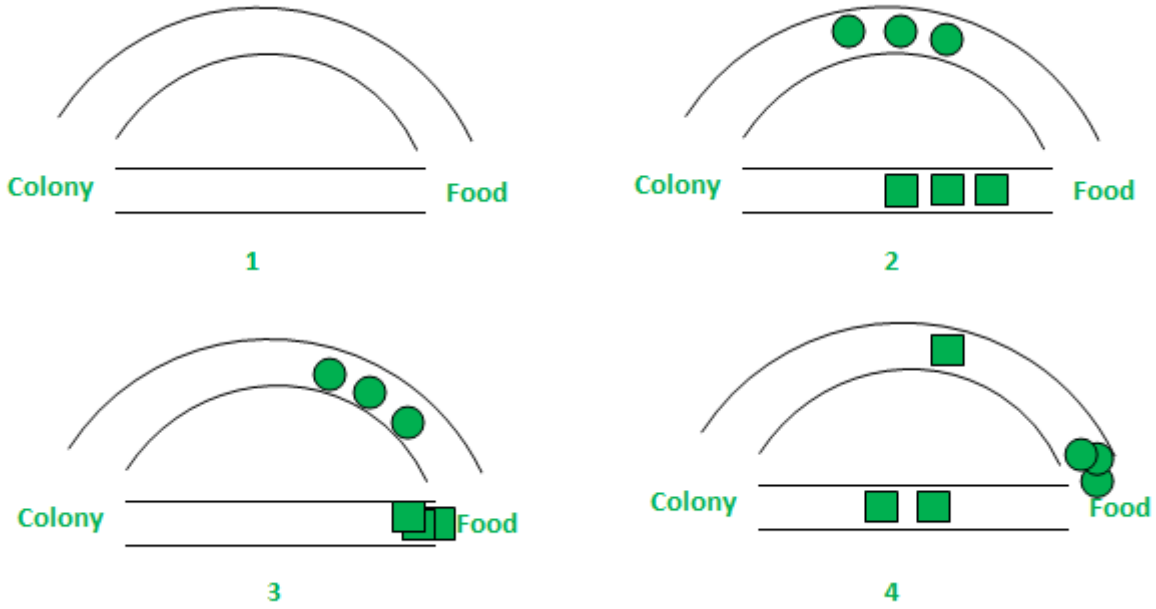
Fuzzy Logic



Genetic Algorithms



Swarm optimization Techniques



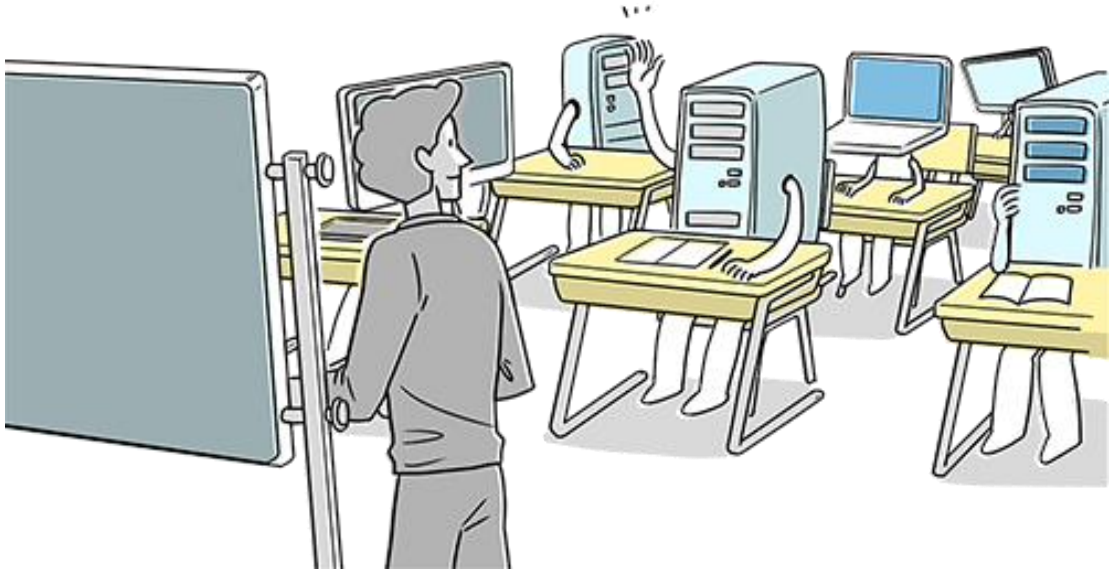
The course outcome…

The course INT254: Fundamentals of Machine Learning will…

- Define the concepts of linear algebra and multivariate calculus
- Demonstrate the usage of various python libraries for data handling and visualization
- Explain the concepts of dimensionality reduction using PCA
- Make use of fuzzy logic to handle uncertainity in data
- Solve the optimization problems using genetic algorithms
- Examine the various swarm optimization techniques to solve optimization problems

Get Set Go!!!

Get trained to TRAIN systems…



Build futuristic solutions…

Assessment expectations & example