Deep Learning

Week No. 1

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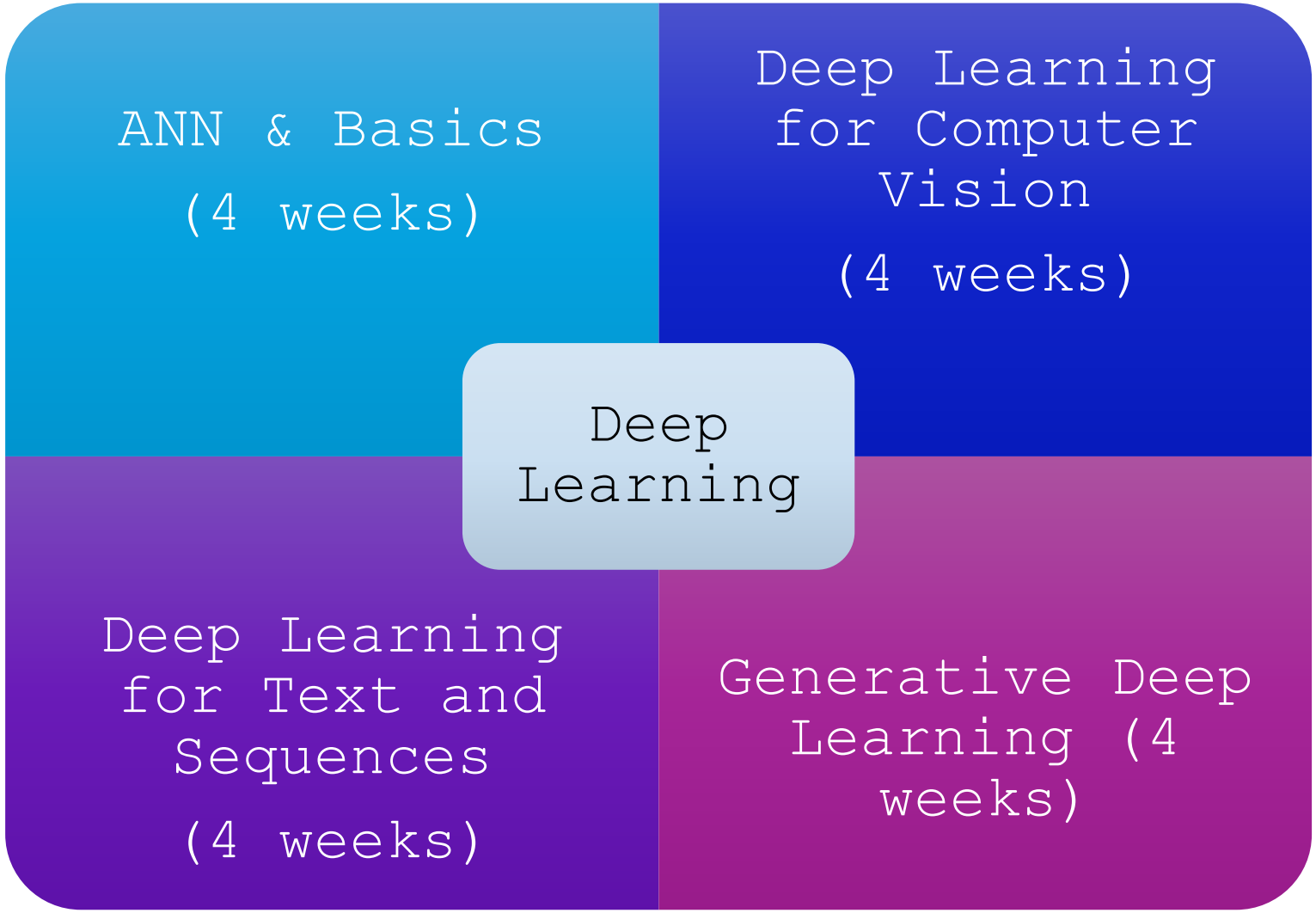
Slides Credit: Dr Ghulam Mujtaba Shaikh

Agenda

- Introduction - knowing Each Other
- About Course
- Course Assessment Criteria
- Course Modules
- Basics of Deep Learning
- Recap

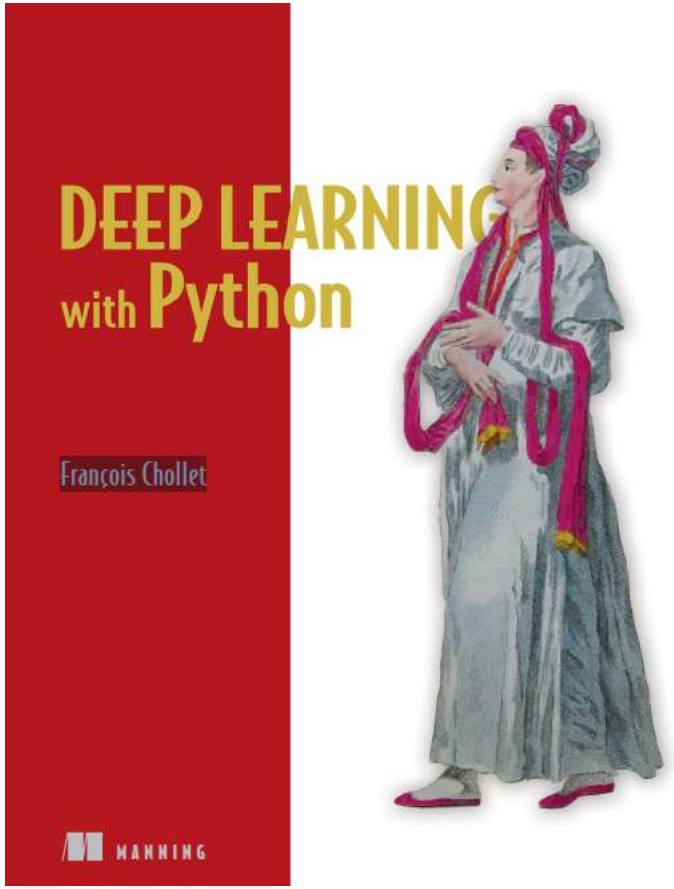
About Course

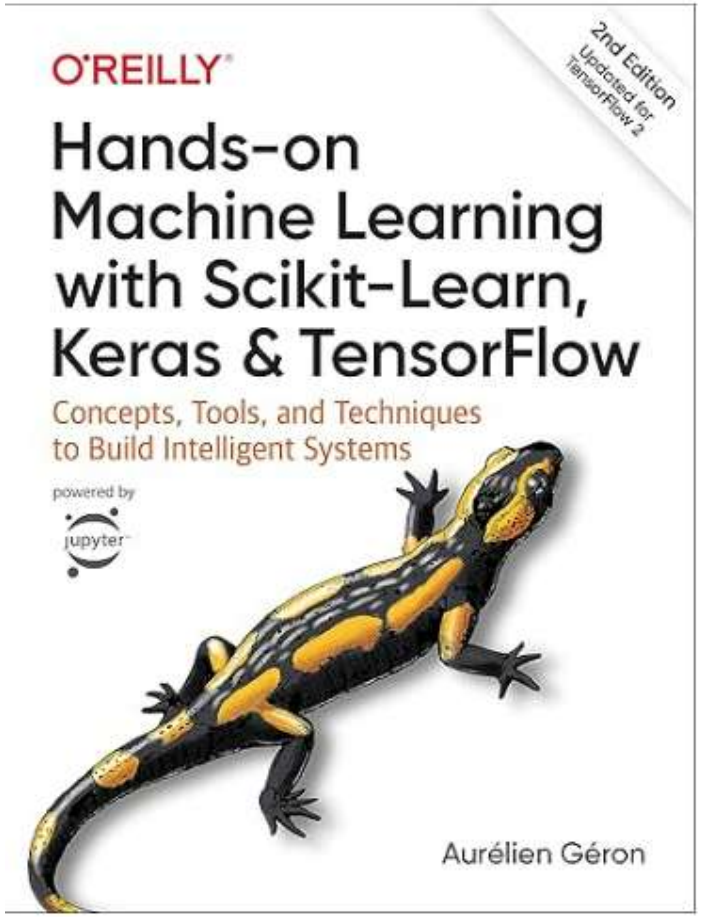


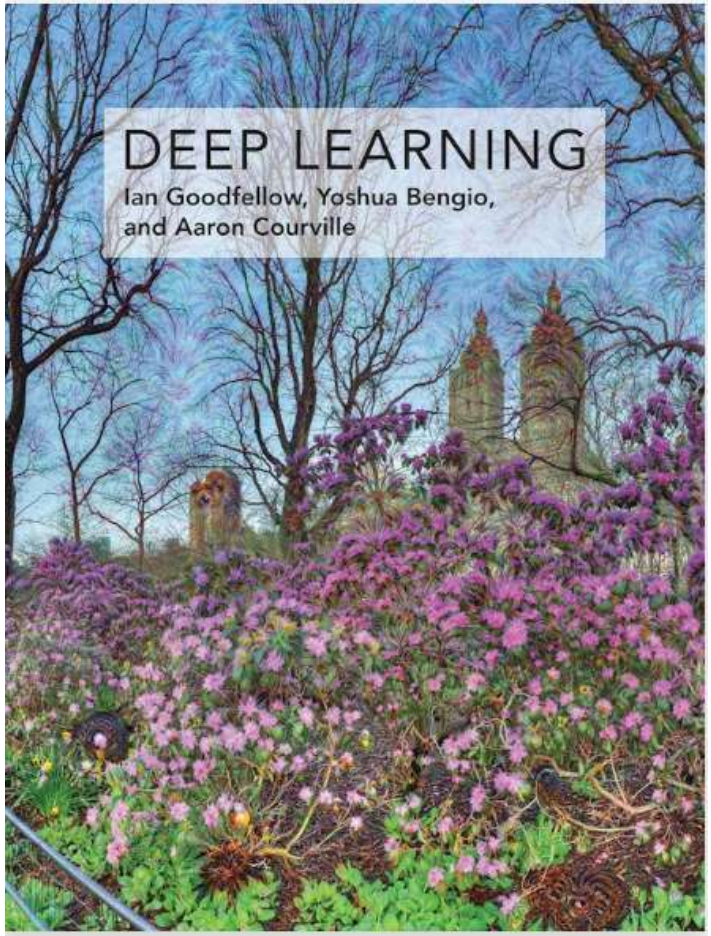
Marks Distribution

Category	Category Weight
Mid Term	30%
Final Term	50%
Assignments and Quizzes	10%
Semester Project & Class Participation	10%

Course Books







Course Expectation

- Assignments should be submitted in due time.
- No extra time will be given for assignment submission
- Quizzes may be either announced or unannounced
- Project submission is the most critical deliverable of this course
- Project report with screenshot is required for the project submission
- Project code should be shared with instructor via GitHub
- Project submission is a group-based activity. Team must comprise of either 1, 2, or 3

Week No. 1
Basics of Deep Learning

Introduction

- AI is the new Electricity.
- Electricity had once transformed countless industries: transportation, manufacturing, healthcare, communication, and more.
- AI will now bring about an equally big transformation.
- Advancement of AI from:
  - Rule-based algorithms
  - Machine Learning Algorithms
  - Deep Learning Algorithms
  - Transformers
  - Gen AI
  - XAI

What is Machine Learning

- Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed.

- A computer program is said to learn from experience *E* with respect to some task *T* and some performance measure *P*, if its performance on *T*, as measured by *P*, improves with experience E.

Generalities

- Virtually all learning problems can be formulated as (complex) mappings between inputs and outputs
  - We are trying to learn what is the best output ***o*** to produce for each possible input ***i***
  - Mathematically speaking, we search for a «good» function **F: I → O**, where **I** is the set of possible inputs, and **O** the set of possible outputs

Generalities - Examples

	Input ***i***	Output ***o***
Spam filtering	An email	{spam, non-spam}
Face recognition	An image	Identified faces
Machine translation	A sentence in language A	A sentence in language B
Speech recognition	A speech signal	A (text) sentence
Data mining	A financial transaction	{fraud, non-fraud}
Robot motion	Sensory data	Motor control

Learning Methods

- But how do we learn this mapping?
- The learning method depends on the kind of data that we have at our disposal
  - We can have examples of data where we have both the inputs and outputs: (***i***,***o***)
  - For some data, we only have the inputs ***i***

Learning Methods

- But how do we learn this mapping?
- The learning method depends on the kind of data that we have at our disposal
  - We can have examples of data where we have both the inputs and outputs: (***i***,***o***) → supervised learning
  - For some data, we only have the inputs ***i*** → unsupervised learning

Types of Machine Learning

Supervised

- Regression
- Classification

Unsupervised

- Clustering

Semi-Supervised

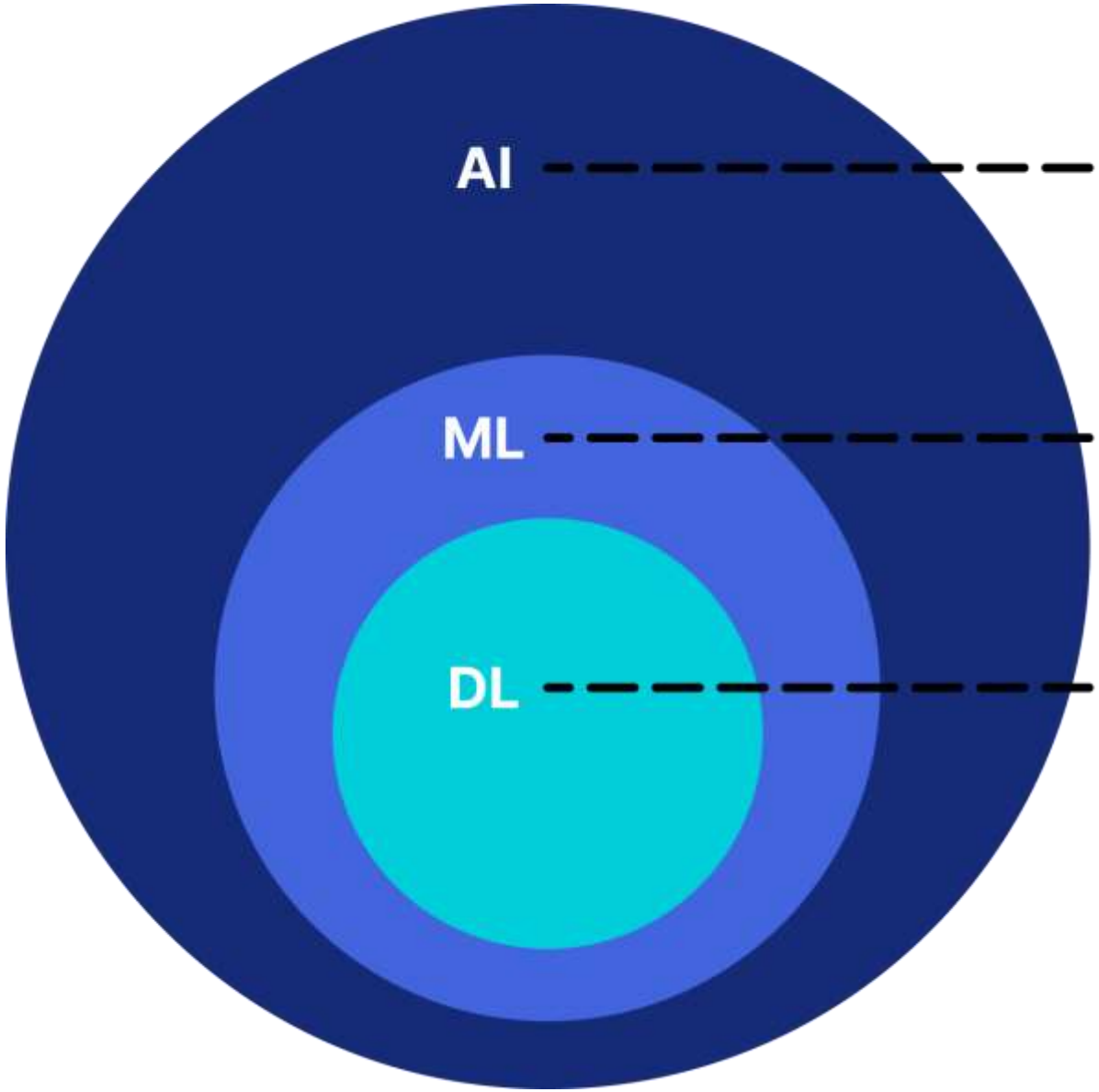
- Active Learning

Case-Based Reasoning

Reinforcement Learning

How Machines Learn?

- Data
  - Email Data
  - Bank Transaction Data
  - Twitter Tweets
  - Emails
  - Hospital Reports
  - Patient Images
- Computational Power
- Algorithms
  - Machine Learning Algorithms (NB, DT, SVM, ANN)
  - Deep Learning Algorithms (CNN, RNN, Transformers)



Artificial Intelligence
Engineering of making intelligent machines and programs.

Machine Learning
Ability to learn without being explicitly programmed.

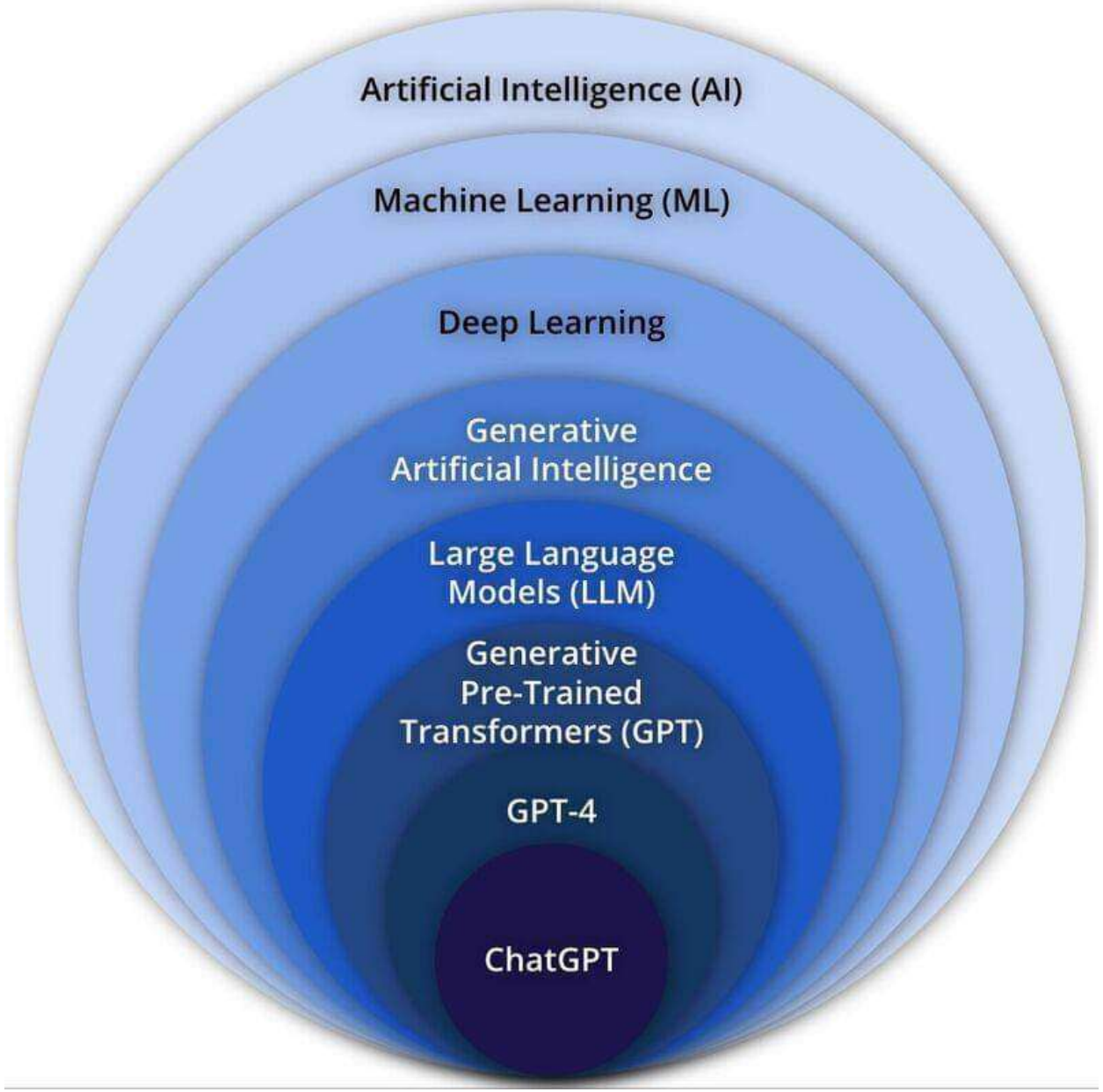
Deep Learning
Learning based on deep neural networks.

neurosnap.ai

Types of AI

- Narrow AI (Week AI)
- Artificial General Intelligence (AGI)
  - Super AI
- Explainable AI (XAI)
- Generative AI (Gen AI)

Evolution of Deep Learning



Applications of Deep Learning

- Deep Learning in Medicine
- Deep Learning in Education
- Deep Learning and Robotics
- Deep Learning in Agriculture
- Deep Learning in Climate Change
- Deep Learning in Gaming
- Deep Learning in Credit Granting
- Deep Learning for Text Generation
- Deep Learning for Image Generation

AI and its usage

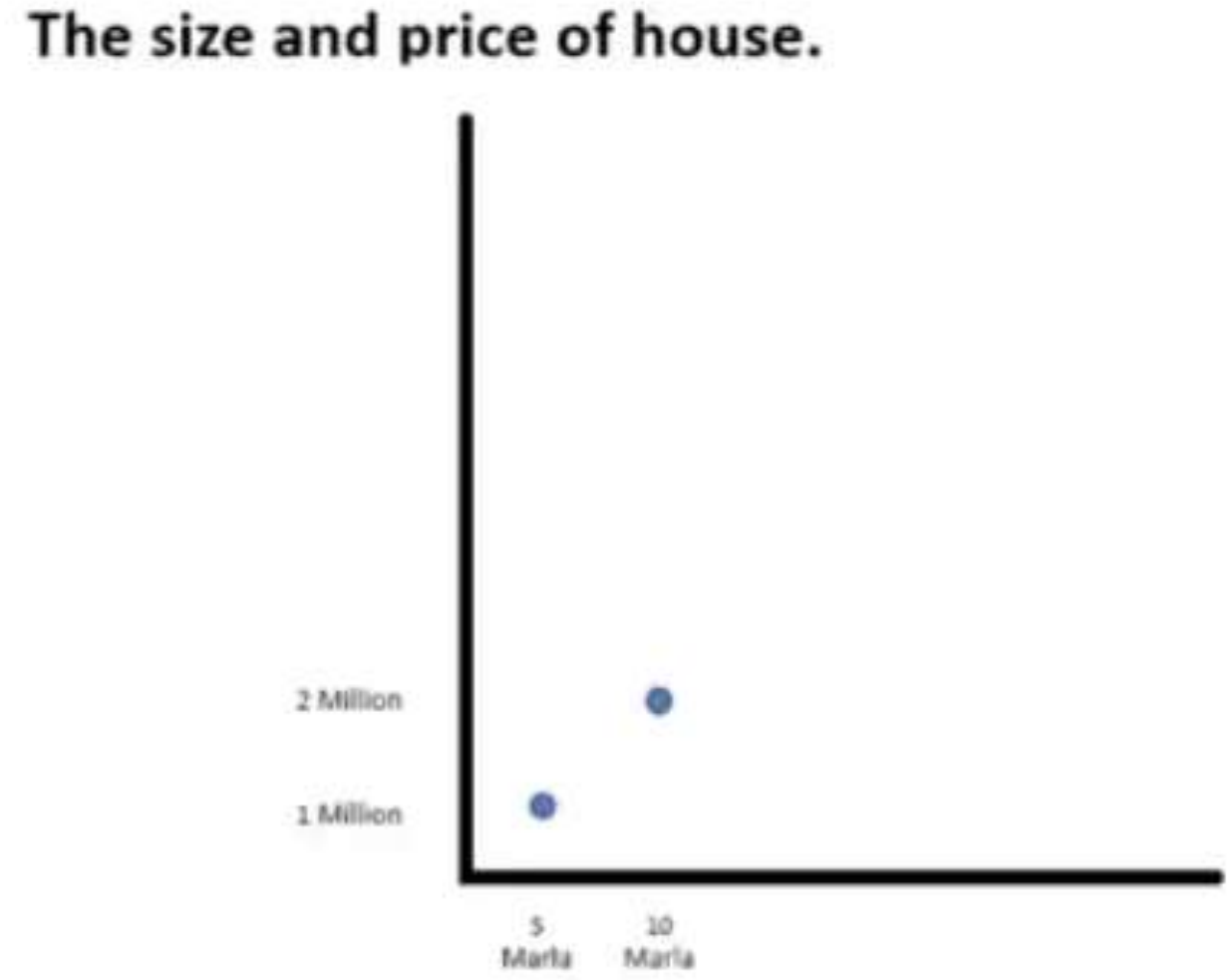
- NLP
- Computer Vision
- Speech Signals

How machines learn?

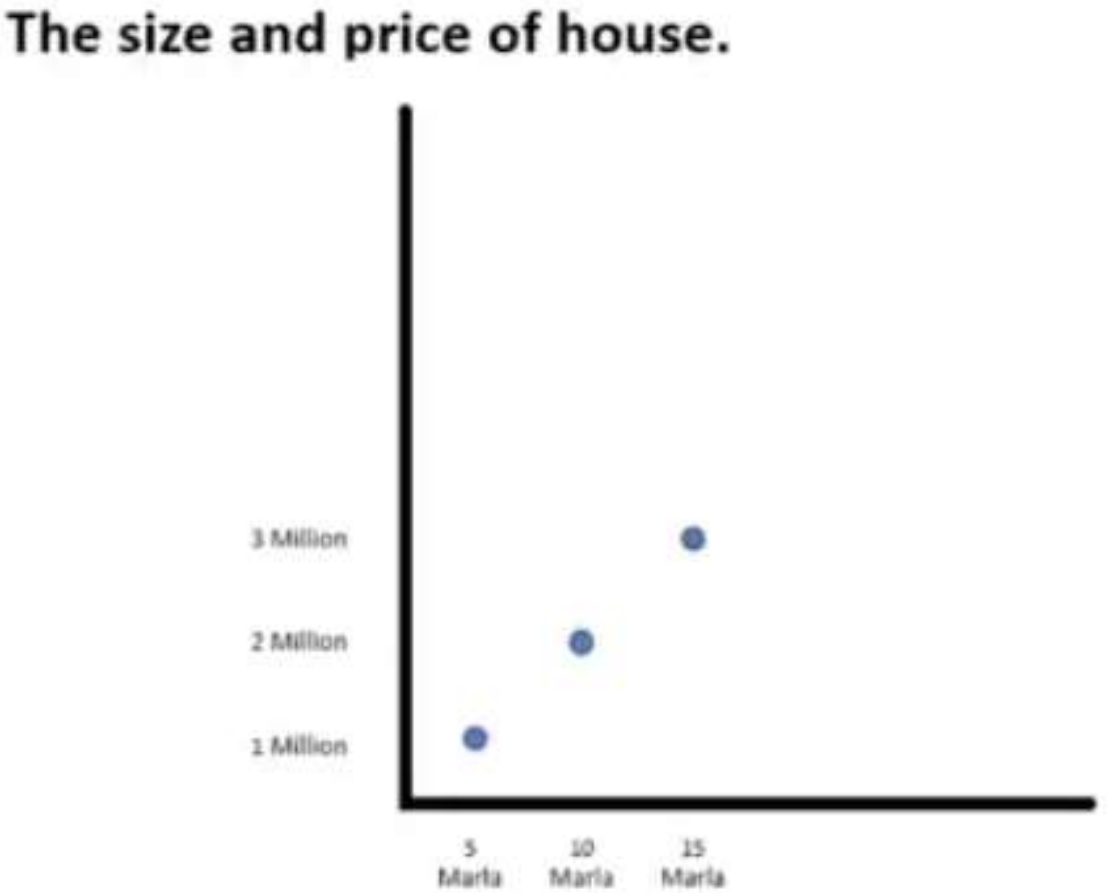
How machines learn?

How machines learn?

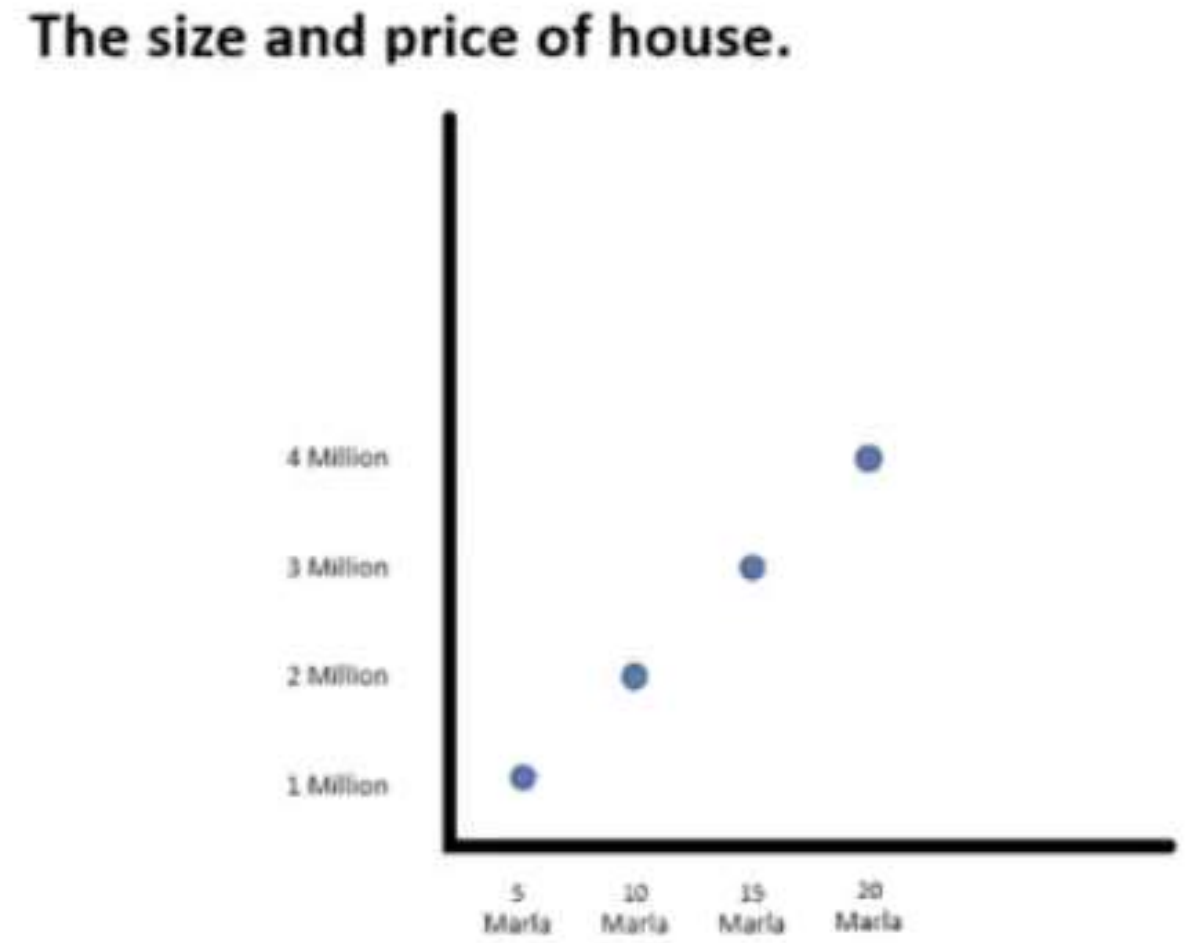
Example


The size and price of house.
2 Million
1 Million
5 Marla
10 Marla

How machines learn?



How machines learn?



How machines learn?

How machines learn?

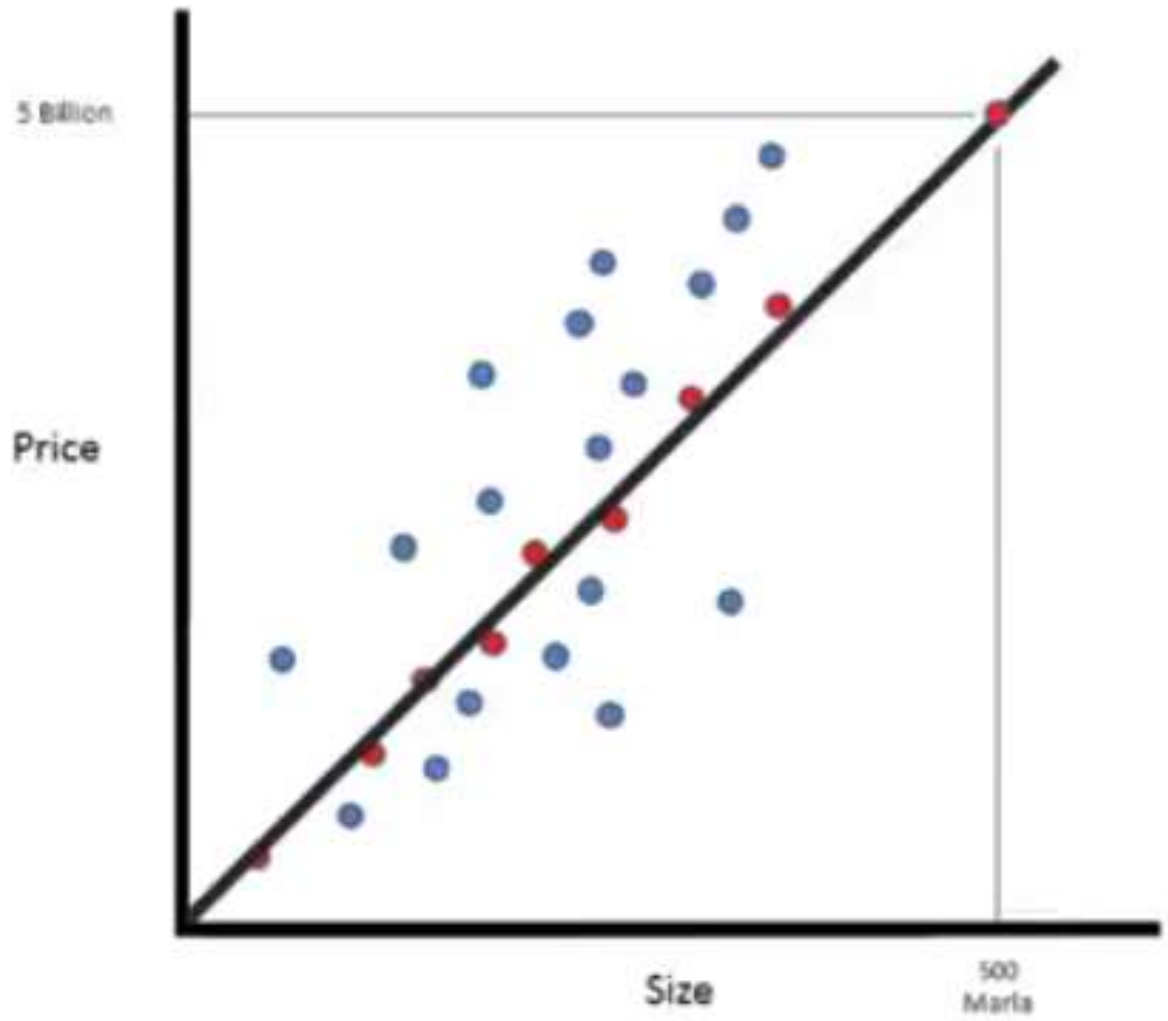
$$y = m * x + b$$

x = input
y = output
m = slope
b = intercept
x = y intercept

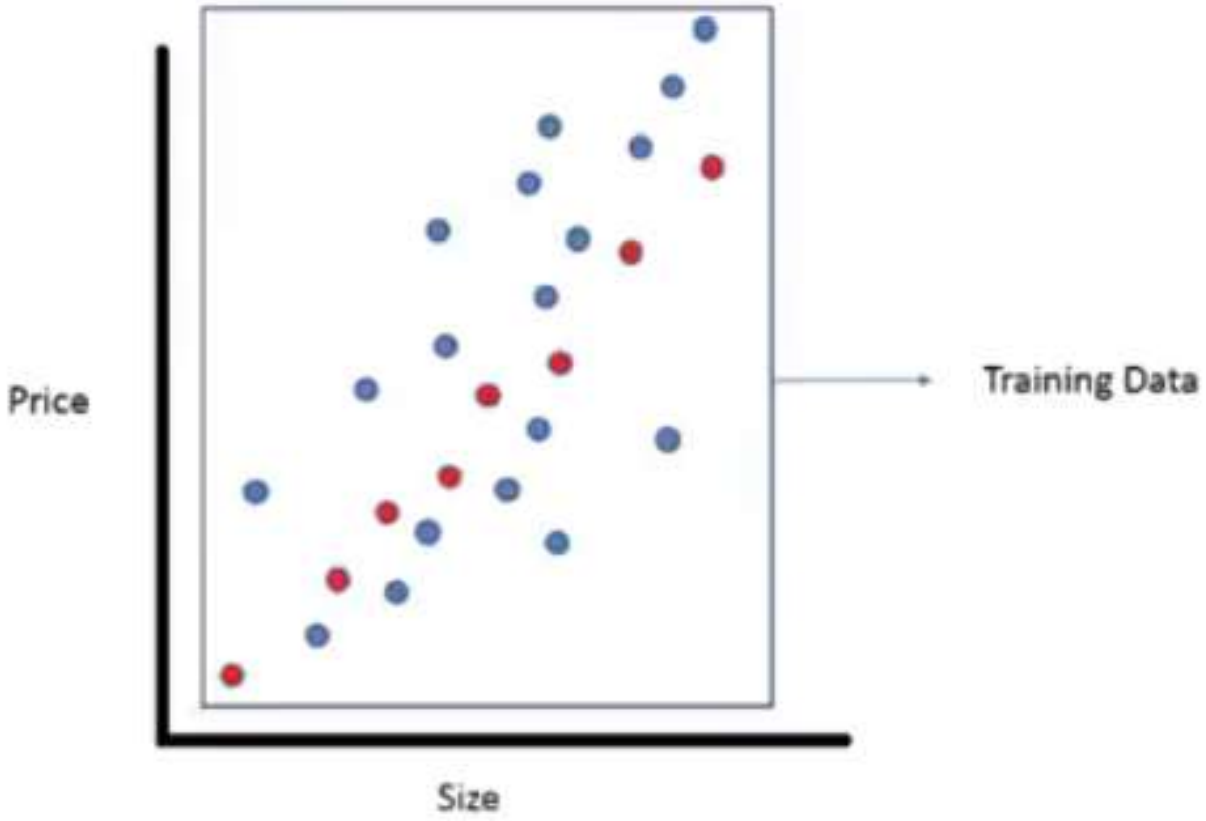
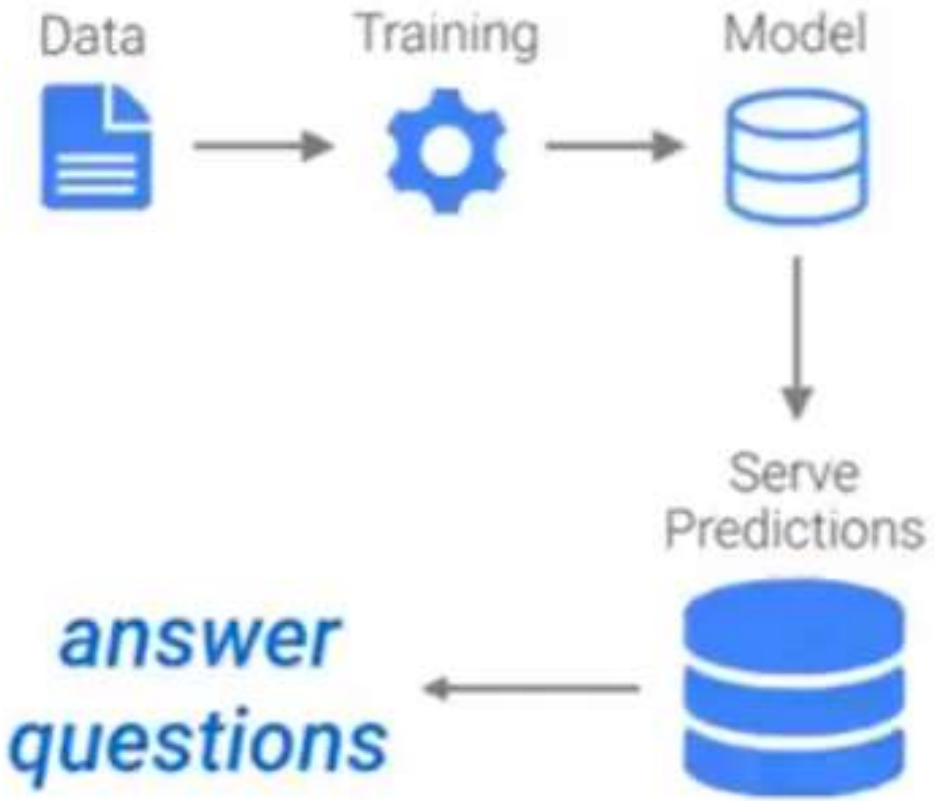
How machines learn?

Prediction on best fit line

How machines learn?



Training data



Process of training and prediction or ML