Introduction to Machine Learning

Unit V

Outline

- Introduction
- Types of Machine Learning
- Supervised Vs Unsupervised Vs Reinforcement Learning

What is Learning?

- *Learning denotes changes in a system that ... enable a system to do the same task … more efficiently the next time."* - Herbert Simon

- *"Learning is constructing or modifying representations of what is being experienced."* - Ryszard Michalski

- *"Learning is making useful changes in our minds."* - Marvin Minsky

- ***Machine Learning is a subset of AI which provide machines the ability to learn automatically & improve from experience without being explicitly programmed.***

  "Machine learning refers to a system capable of the autonomous acquisition and integration of knowledge."

  To Learn: to get knowledge of by study, experience or being taught.

Why Machine Learning?

- No human experts
  - industrial/manufacturing control
  - mass spectrometer analysis, drug design, astronomic discovery
- Black-box human expertise
  - face/handwriting/speech recognition
  - driving a car, flying a plane
- Rapidly changing phenomena
  - credit scoring, financial modeling
  - diagnosis, fraud detection
- Need for customization/personalization
  - personalized news reader
 - movie/book recommendation

Related Fields
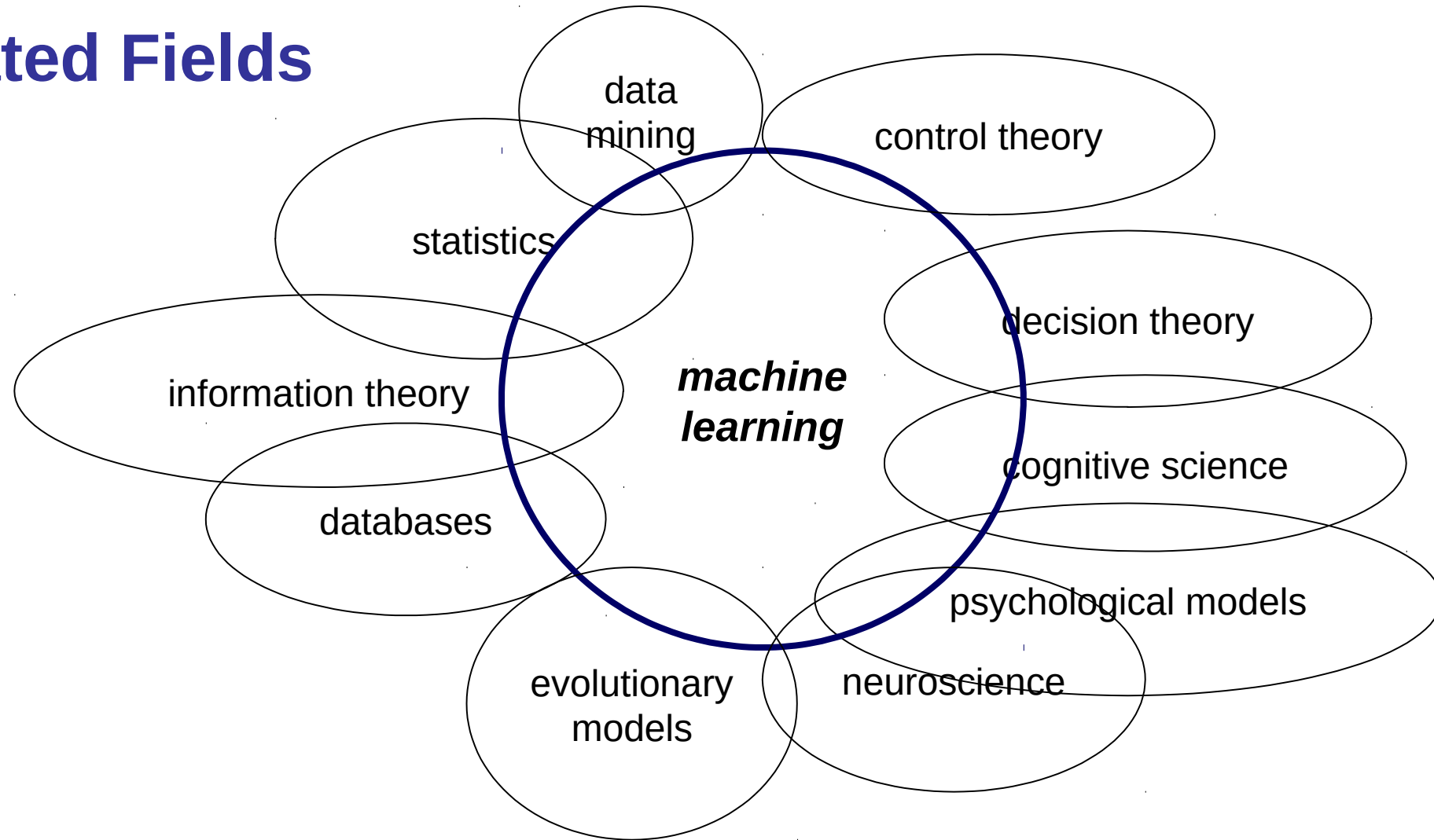
Machine learning is primarily concerned with the accuracy and effectiveness of the *computer system*
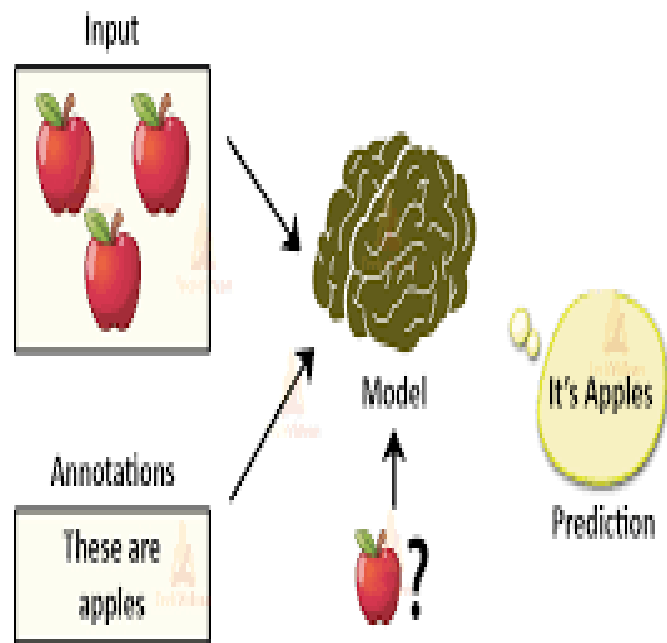
Types of Learning

- Supervised (machine Learns under guidance)
  - Learn an input and output map
  - Classification: Categorical output
  - Regression: Continuous Output

- Unsupervised (without anybody's supervision)
  - Discover Pattern in the data
  - Clustering: Cohesive grouping
  - Association: frequent cooccurrence

- Reinforcement Learning (agent interacts with environment, gets trained)
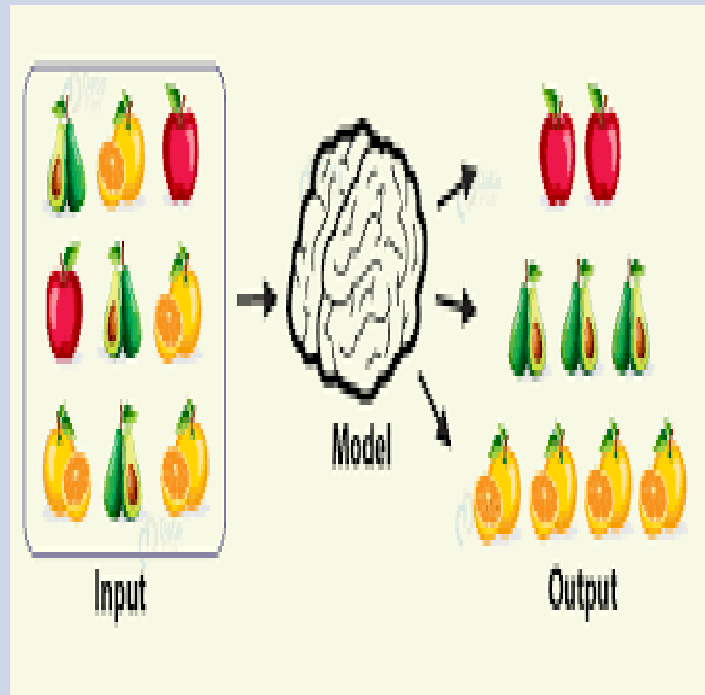 - Learning Control
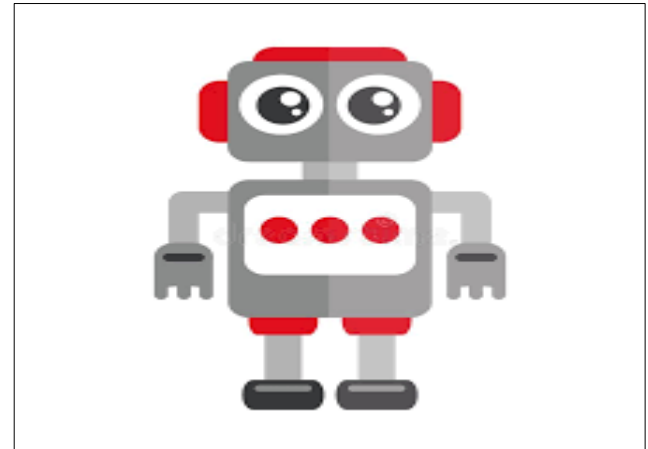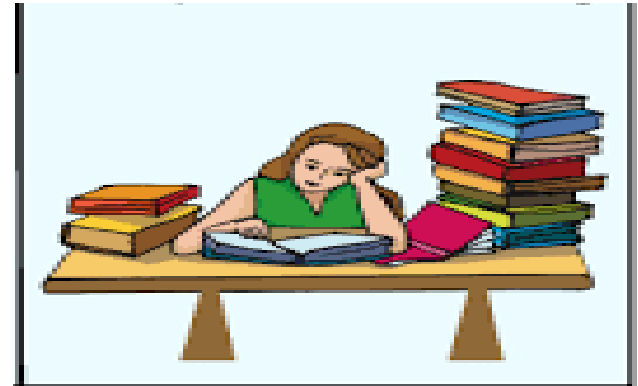
Definition

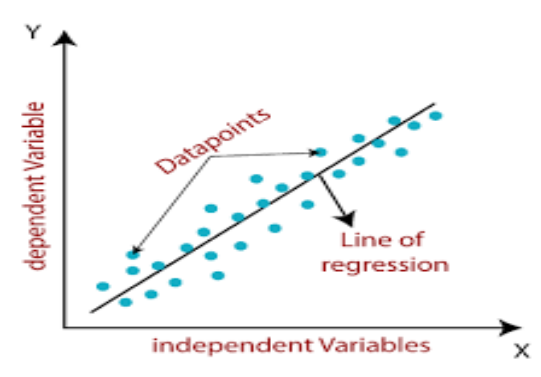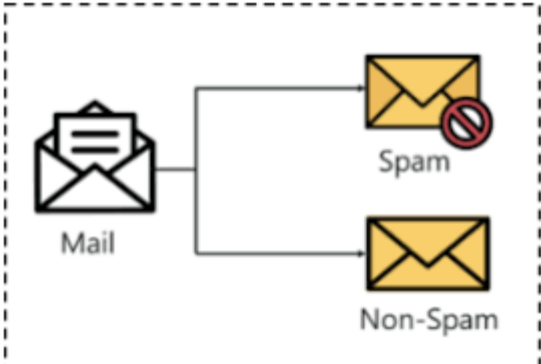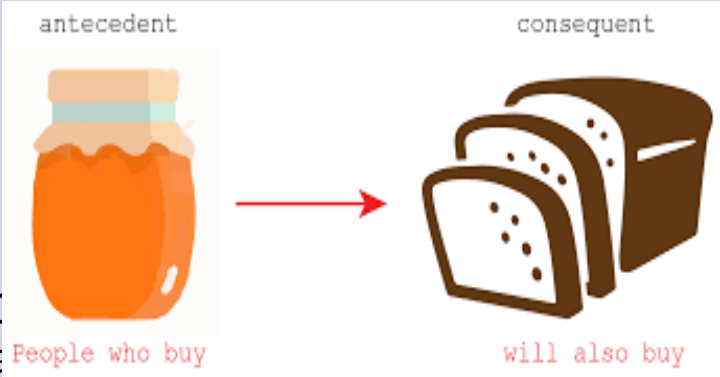| Supervised Learning	Unsupervised Learning	Reinforcement Learning
Method in which we teach the machine using labelled data	The machine is trained on unlabeled data without any guidance	An agent interacts with its environment by producing actions & discovers errors or rewards
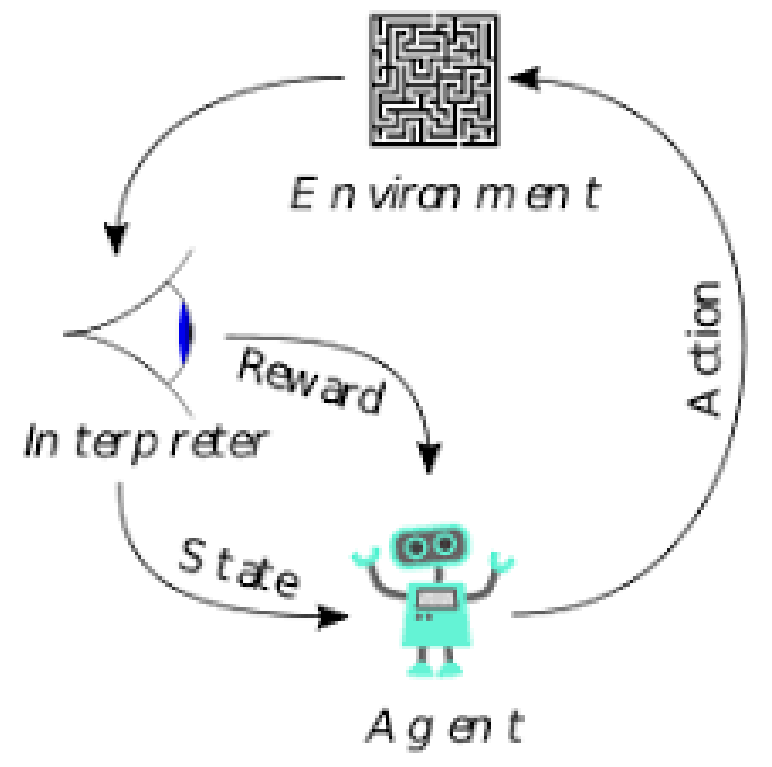
Types of Problems

Supervised Learning	Unsupervised Learning	Reinforcement Learning
Regression: Predicting continuous quantity (weight)	Association: Discovering pattens in data	Robotics Leans from actions For every action reward or punishment

Class

C
a
(unusual behavior)

antecedent → consequent

People who buy → will also buy

Introduction to Clustering

I can see a pattern

100101110110
110101010100
011110000101

Environment

Interpreter

Reward

Action

State

Agent

	Supervised Learning	Unsupervised Learning	Reinforcement Learning
Type of Data	Labelled Data	Unlabeled Data	No specified data, input depends on action taken by agent
Training	**External supervision (student guide)**	**No supervision (no mentor)**	**No supervision (training and testing)**
Aim	Forecast outcomes	Discover underlying pattern	Learn series of action (new born baby)
Approach	Map Labelled input to know output Labelled Input -> Training -> Algorithm ->Know Output	Understand patterns and discover output Unlabeled Input -> Explore Patten & trends -> Algorithm -> Output	Follow trail and error method

	Supervised Learning	Unsupervised Learning	Reinforcement Learning
Algorithms	Linear Regression, Logistic Regression, Support Vector Machine, K Nearest Neighbor, Random Forest	K-Means, Apriori, C-Means	Q Learning, SARSA
Applications	Risk Evaluation, Forecast Sales	Recommendation Systems, Anomaly Detection	Self Driving Cars, Gaming
Feedback	Direct Feedback	No Feedback	Reward System

Problem Statements

- Study a bank credit dataset and make a decision about whether to approve the loan of an applicant based on his profile: (KNN) Supervised

- To establish a mathematical equation for distance as a function of speed, so you can use it to predict distance when only the speed of the car is known: Linear Regression (Supervised)

To cluster a set of movies as either good or average based on their social media out reach: K-means (Unsupervised)

To perform market basket analysis by finding association between items bought at the grocery store: Association rule mining & Apriori Algorithm (unsupervised)

Gaming Problem: (Reinforcement)