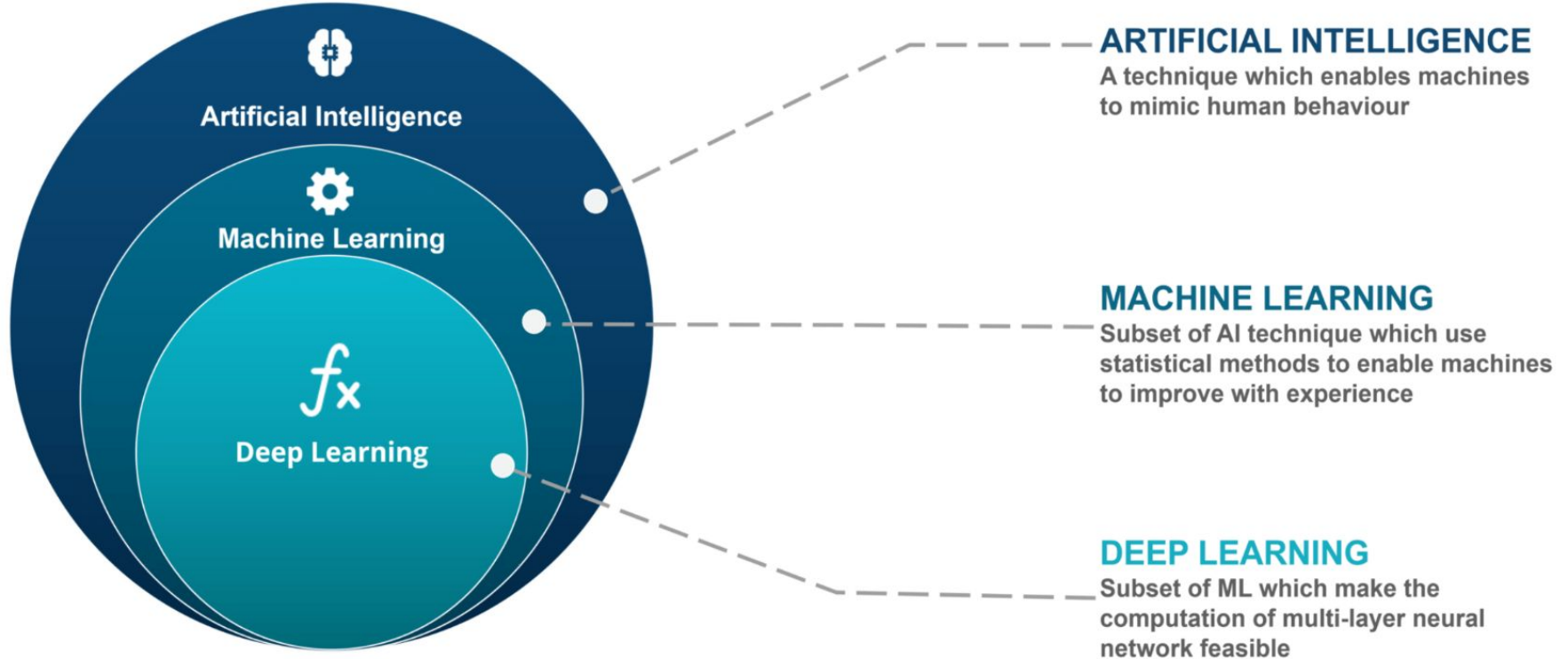




What is Machine Learning?

**Presented By:
Dr.Mydhili K
Nair**

Artificial Intelligence, Machine Learning and Deep Learning





Machine learning is the subfield of computer science that gives computers the ability to learn without being explicitly programmed.

~ Arthur Samuel
(Paraphrased and attributed)

1959 - Arthur Samuel coined the word “Machine Learning”

A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T , as measured by P , improves with experience E .

~ Tom Mitchell



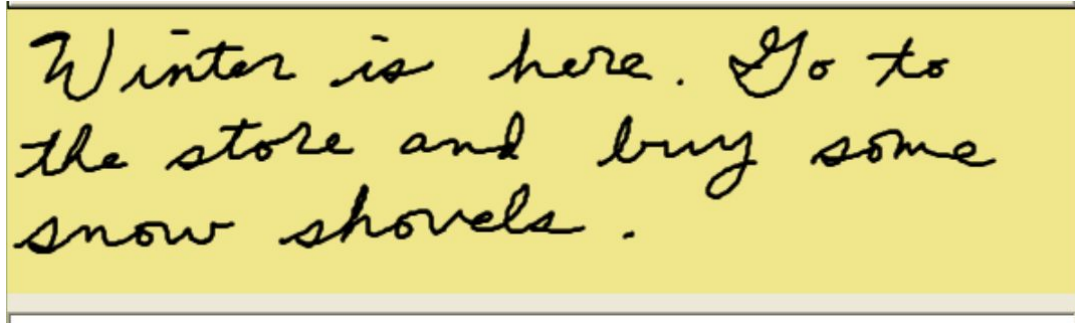
Born in 1951 - **Tom Mitchell** is an American computer scientist and Professor at the Carnegie Mellon University(CMU). He is a former Chair of the Machine Learning Department at CMU. Mitchell is known for his contributions to the advancement of machine learning, artificial intelligence, and cognitive neuroscience and is the **author of the textbook *Machine Learning***, and is the **founder of the world's first Machine Learning Department**.

Three features in a “*well-defined learning problem*”:

- the class of tasks, **T**
- the measure of performance to be improved, **P**
- the source of experience, **E**

A handwriting recognition learning problem:

- **Task T** : Recognizing and classifying handwritten words within images
- **Performance measure P** : Percent of words correctly classified
- **Training experience E** : A database of handwritten words with given classifications



Winter is here. Do to the stone and bury some snow shovels.

Winter is here. Do to the stone and buy some snow shovels.

Winter is here. Do to the store and buy some snow shovels.

Winter is here. Go to the store and buy some snow shovels





T: Driving on four-lane highways using vision sensors

P: Average distance travelled before a human-judged error

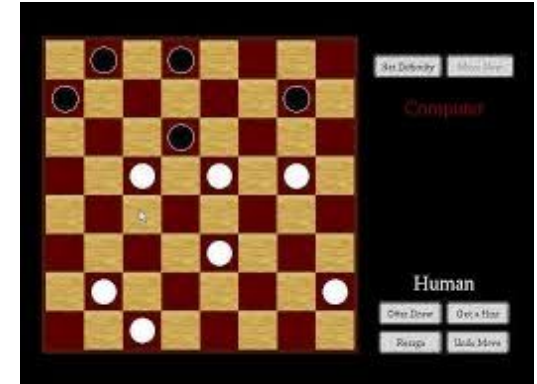
E: A sequence of images & steering commands recorded while observing human driver.



T: Playing checkers

P: Percentage of games won against an arbitrary opponent

E: Playing practice games against itself





T: Categorize email messages as spam or legitimate

P: Percentage of email messages correctly classified

E: Database of emails, some with human-given labels

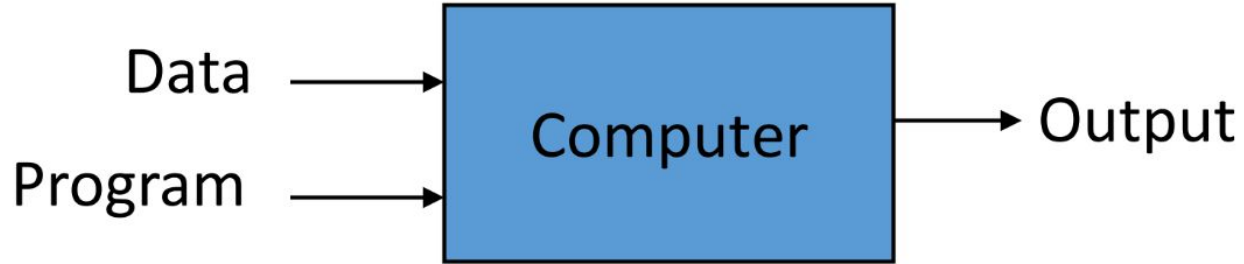


How are ML Algorithms different?

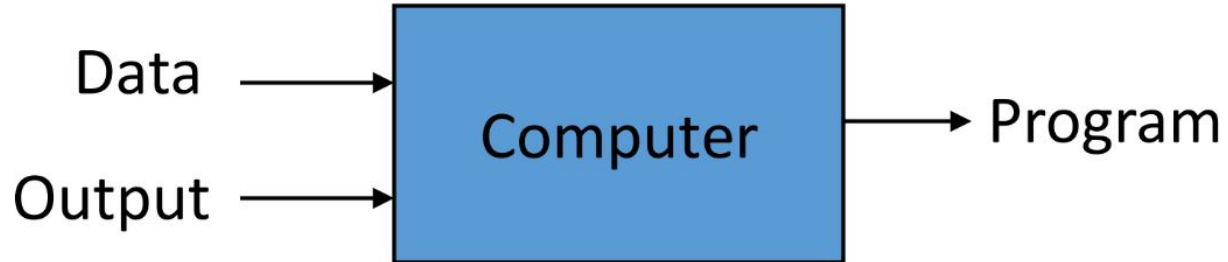
- ML is used when we *do not know the algorithm* to achieve our goal.
- We would want *the computer to figure out the algorithm* from the data we input.
- We have lots of data / examples of what we want as output / goal.

But, we are *not very clear how to define an algorithm* which will help us achieve the desired output.

Traditional Programming



Machine Learning



When to use ML?

(Some Use Cases)



- Human expertise does not exist (E.g. Navigating on Mars)
- Humans are unable to explain their expertise (E.g. Speech recognition)
- Solution changes in time (E.g. Routing on a computer network)
- Solution needs to be adapted to particular cases (E.g. User biometrics)

When to use ML?

(Some Use Cases that will be realized in near future)



- *Computers learning from medical records* which treatments are most effective for new diseases.
- *Our Homes learning from experience* to optimize energy costs based on the particular usage patterns of their occupants.
- *Personal software assistants* learning the evolving interests of their users in order to highlight especially relevant stories from the online morning newspaper.

How will the computer “learn” the algorithm from data given?

- It will look for patterns in the given data to find out relationships between the end goal and the said pattern.
- It will apply probability and statistics methods to figure out how a given pattern / set of patterns is more likely to help us get a desired output compared to others.

(You will learn some of these in Unit 1)

When to use which algorithm in ML?

These are the 5 questions which can be answered in data science.



When to use Classification Algo?

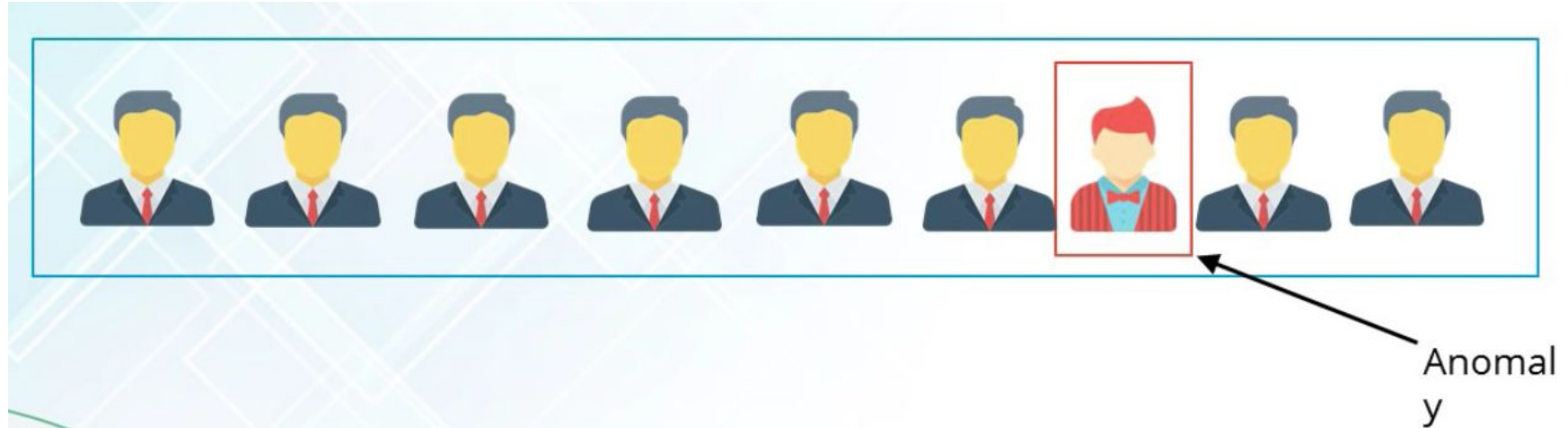
Is it cold?

Yes or No

Will you go to work today?

Yes, No or Maybe

When to use Anomaly Detection Algo?



In real life, your credit card company uses Anomaly Detection Algo and flags “out of ordinary” transactions - which does not adhere to the pattern of history of transactions!!

When to use Regression Algo?

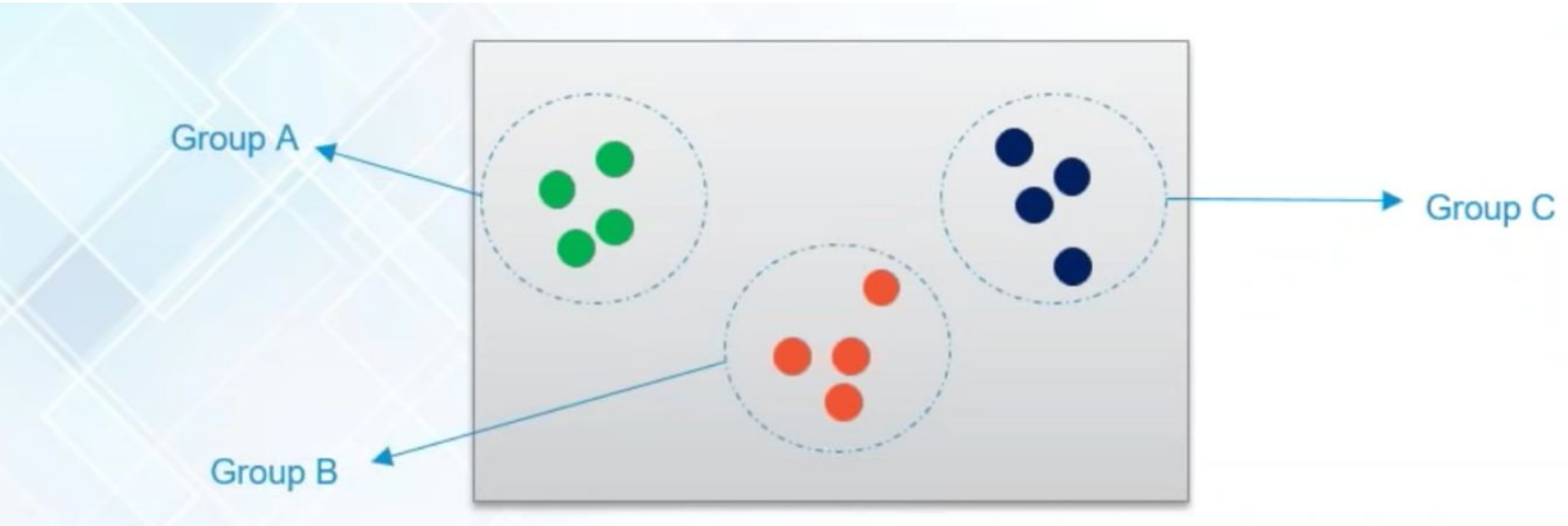
What will the temperature be tomorrow?



How much discount can you give on a particular item?



When to use Clustering Algo?



NOTE: Understand the difference between Classifications and Clustering.

When to use Reinforcement Learning Algo?

A system which plays chess

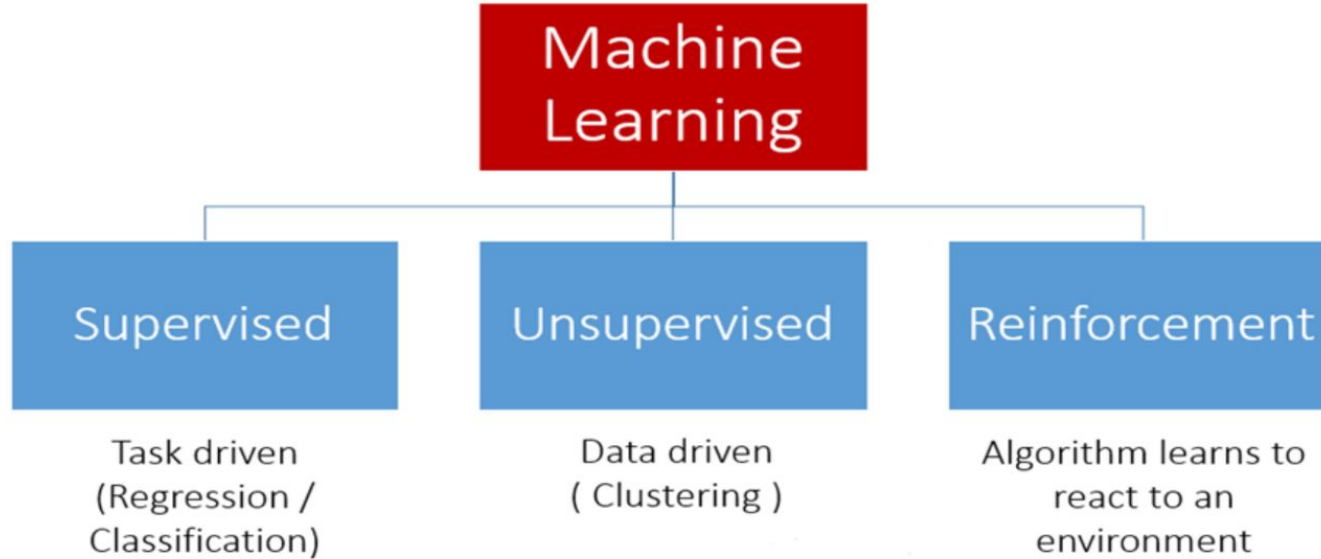


A temperature control system, when it has to decide whether temperature should be increased or decreased



NOTE: Understand the importance of “Agents” and its environment to reinforcement learning.

Types of Machine Learning



- Supervised Learning – Train Me!
- Unsupervised Learning – I am self sufficient in learning
- Reinforcement Learning – My life My rules! (Hit & Trial)

ML Applications - Supervised Learning (Labelled Data)

- Buy Idli Batter with Chutney Powder **Learning Associations.**
- **Classification**
 - Face Recognition
 - Medical Diagnosis (Cancer or not)
 - Speech Recognition
 - Natural Language Processing
 - Machine Translation
 - Biometric (Accept or Reject)
 - Classify to take decisions (Low Risk vs High Risk customers for loan processing, Which performance bracket will students fall into, performance slabs of stock and commodity prices)
 - Knowledge Extraction (Inference - target low risk customers for advertising)
- **Regression**
 - Predict price of a property / commodity
 - Navigation of a robot (E.g. Angle at which the steering wheel must be turned each time without hitting an obstacle. Training Data is collected by monitoring and recording the actions of a human driver)

- Buy Idli Batter with Chutney Powder
- **Clustering -- Hierarchical and Density Estimation**
 - Customer Segmentation - CRM
 - Document Clustering
 - Bioinformatics
- **Dimensionality Reduction**
 - Eigen Faces
 - Sentimental Analysis using “Bag of Words”
 - Email Spam Filtering
 - Predictive Modeling

ML Applications - UnSupervised Learning (Unlabelled Data)

Process Flow in ML

