Nishant Raj

University Roll No. - 13030823129

Registration No. – 231300121019

Subject- Deep Learning

Subject Code - PCCAIML 602

Dept.- CSE AIML (B)

YEAR : 3rd

Semester : 6th

Introduction to Deep Learning

- **What is Deep Learning?**
  - Deep Learning is a subset of Machine Learning that uses neural networks with multiple layers to model complex patterns in data.
  - Inspired by the structure and function of the human brain.

- **Importance of Deep Learning:**
  - Powers modern AI applications like image recognition, speech processing, and autonomous systems.
  - Works efficiently with large datasets and high-dimensional data.

- **Objective of the Presentation:**
  - Understanding different paradigms of learning problems with real-world examples and diagrams.

Learning Paradigms in Deep Learning

Deep learning models can be trained using different learning paradigms, which define how the system learns from data.

- **Supervised Learning**
- **Unsupervised Learning**
- **Semi-Supervised Learning**
- **Reinforcement Learning**
- **Self-Supervised Learning**

Supervised Learning

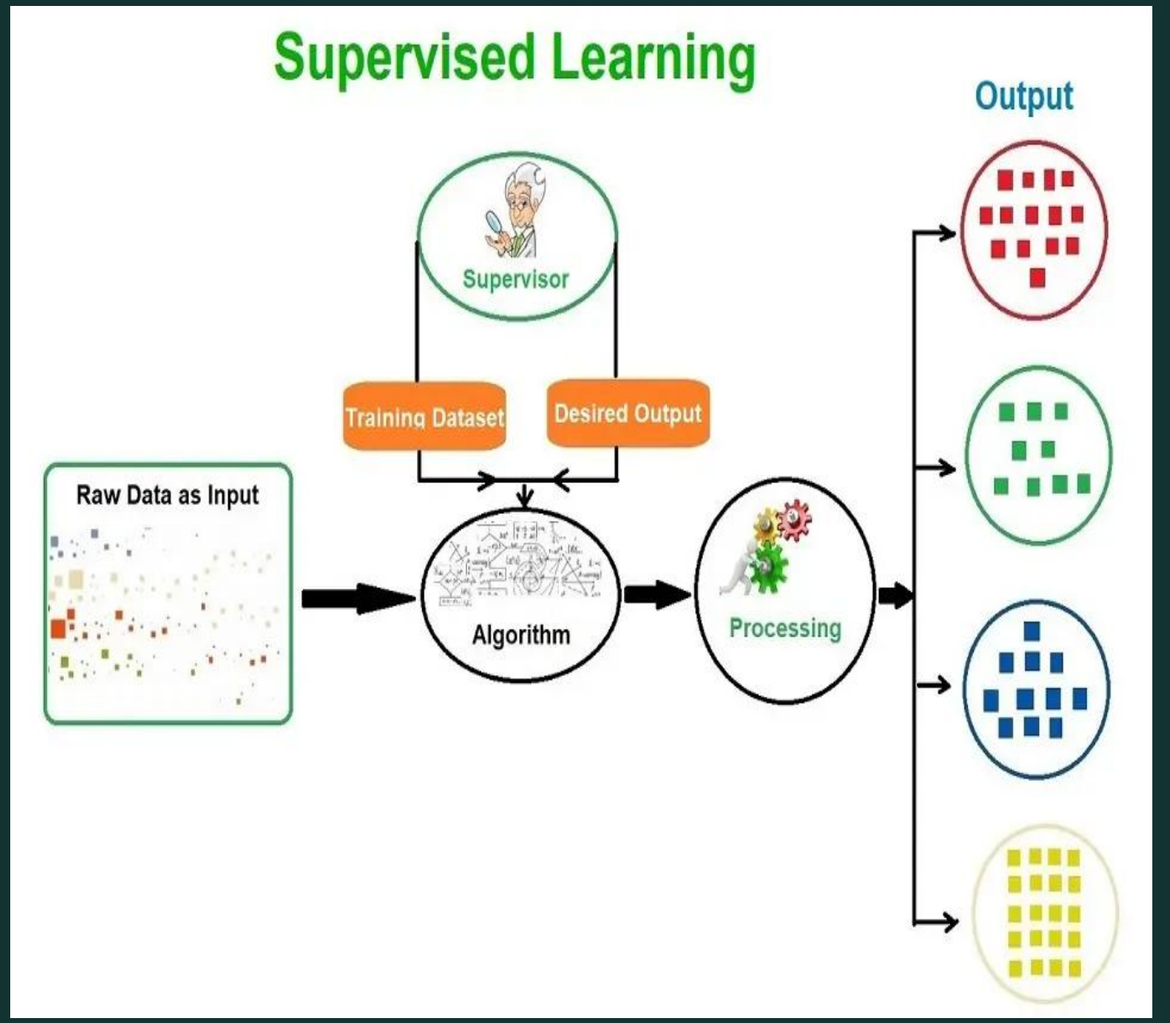
•**Definition:** The model is trained on labeled data, where input-output pairs are provided.

•**How it Works:**

- The model learns to map inputs to outputs using a loss function that measures error.
- Uses labeled datasets for training.

•**Examples:**

- **Image Classification:** Identifying cats and dogs in images.
- **Spam Detection:** Classifying emails as spam or not spam.
- **Speech Recognition:** Converting spoken words into text.



Unsupervised Learning

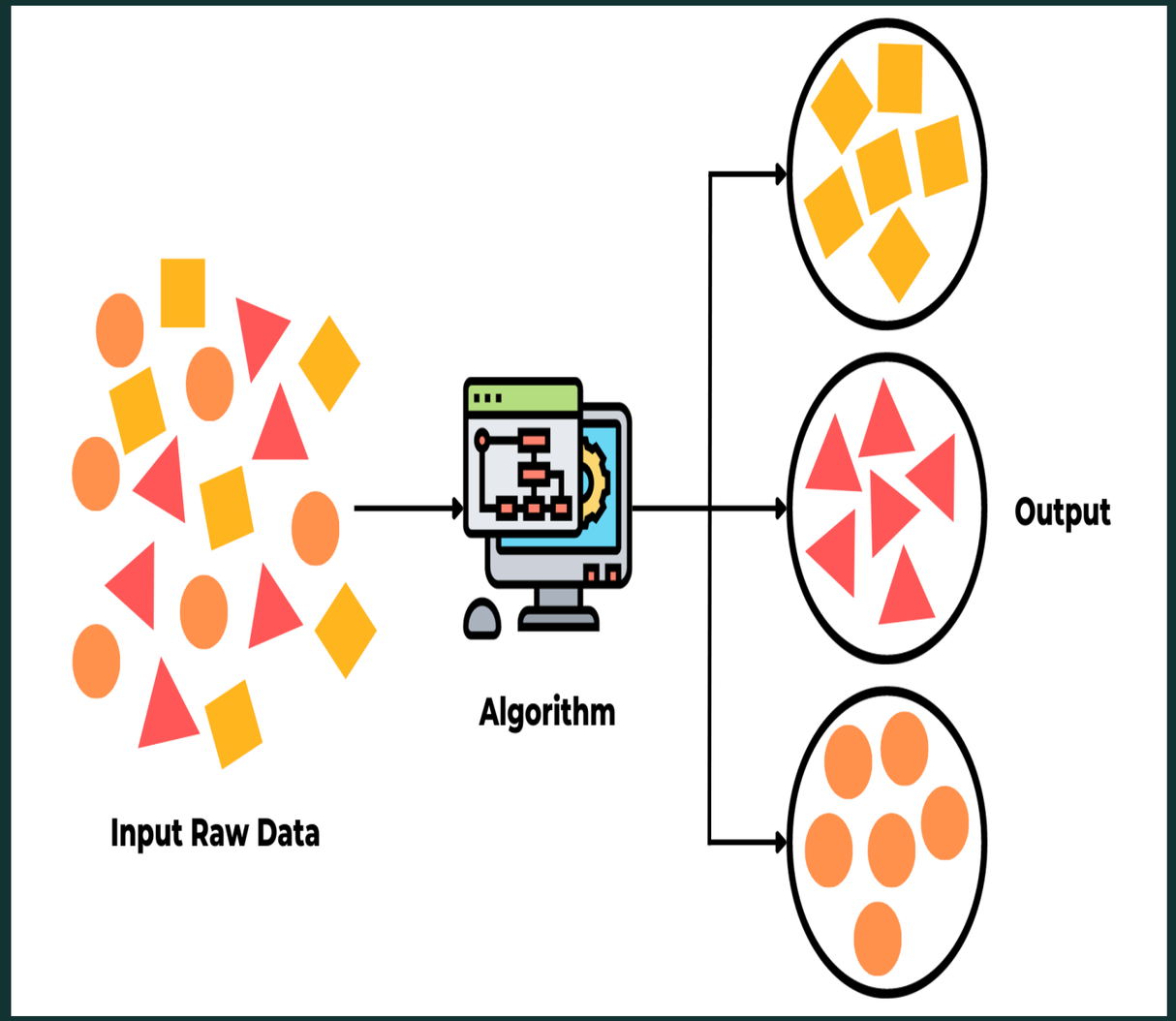
•**Definition:** The model is trained on unlabeled data to find hidden structures or patterns.

•**How it Works:**

- No explicit labels; the model groups or clusters similar data points.
- Often uses clustering or dimensionality reduction techniques.

•**Examples:**

- **Customer Segmentation:** Grouping customers based on purchasing behavior.
- **Anomaly Detection:** Identifying fraud in credit card transactions.
- **Topic Modeling:** Discovering topics in a collection of documents.



Semi-Supervised Learning

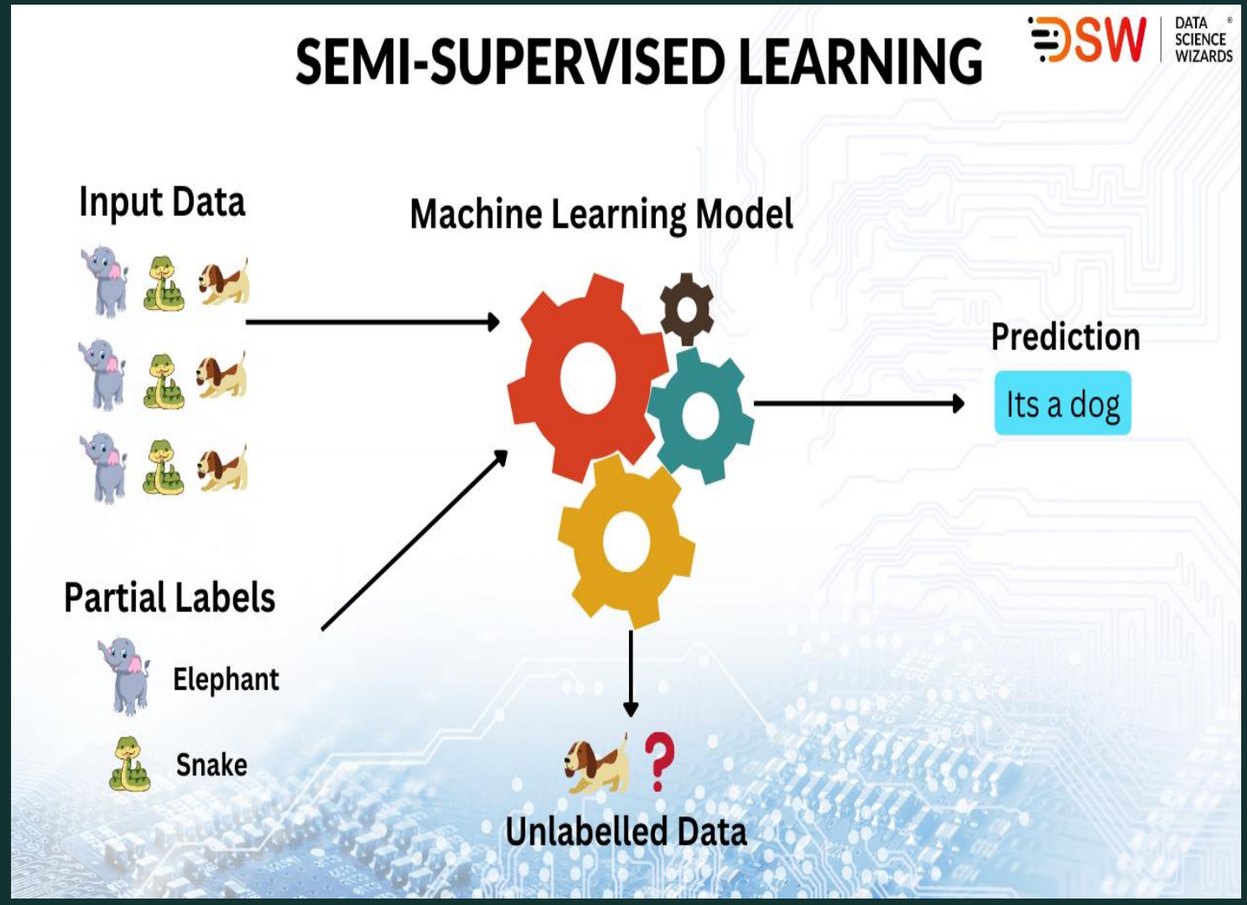
•**Definition:** A combination of supervised and unsupervised learning where a small amount of labeled data is used along with a large amount of unlabeled data.

•**How it Works:**

- The model leverages the small labeled dataset to make sense of the unlabeled data.
- Commonly used in scenarios where labeling data is expensive or time-consuming.

•**Examples:**

- **Medical Diagnosis:**. Using a few labeled X-rays to classify thousands of unlabeled images
- **Web Page Classification:** Categorizing web pages with minimal human annotation.
- **Speech Analysis:** Training voice assistants with a mix of labeled and unlabeled recordings.



Reinforcement Learning

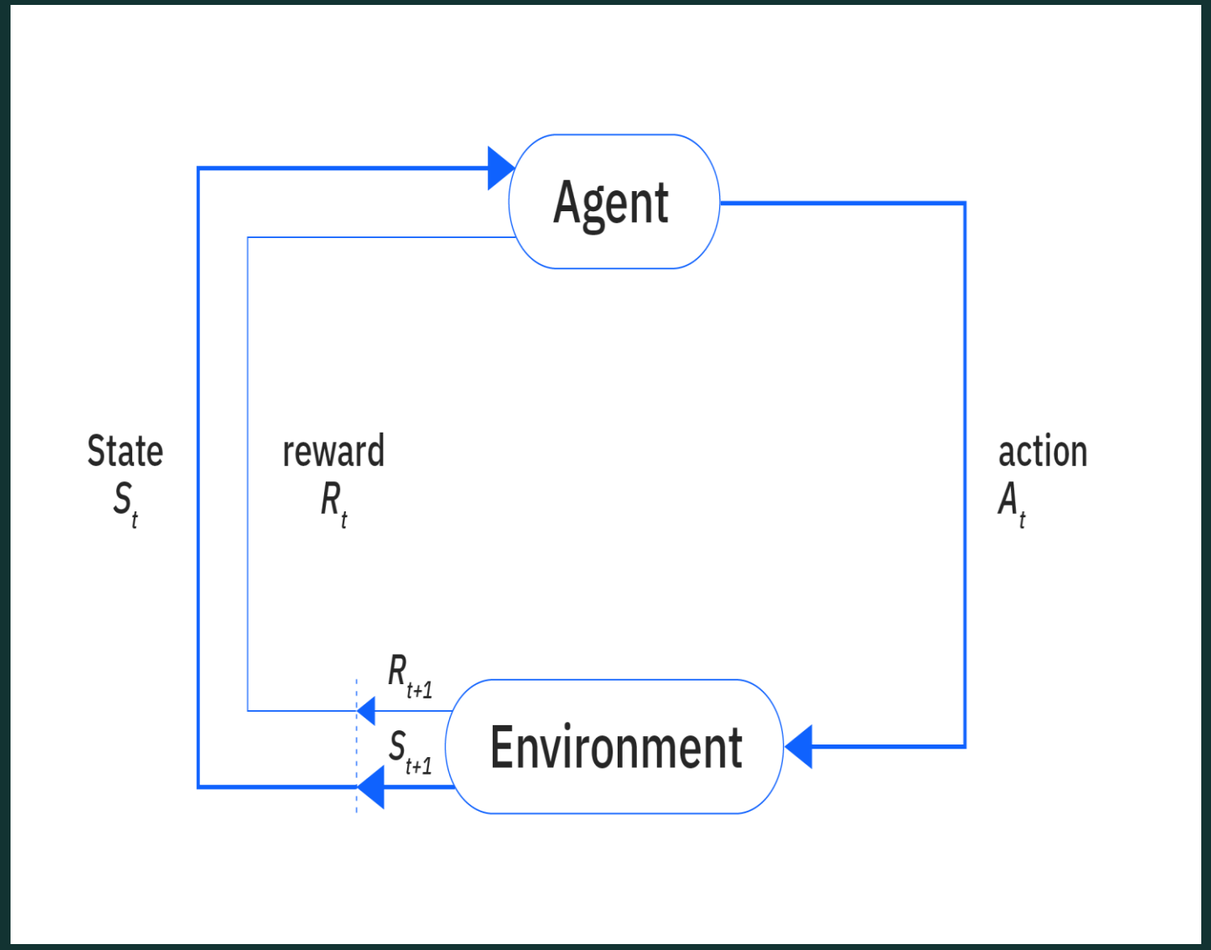
•**Definition:** The model learns by interacting with an environment and receiving rewards or penalties.

•**How it Works:**

- Uses a trial-and-error approach to maximize cumulative rewards.
- Often modeled as an agent making decisions in a dynamic environment.

•**Examples:**

- **Game Playing:** AI playing chess or Go (e.g., AlphaGo).
- **Robotics:** Training robots to walk or grasp objects.
- **Autonomous Driving:** Cars learning to navigate without human intervention.



Self-Supervised Learning

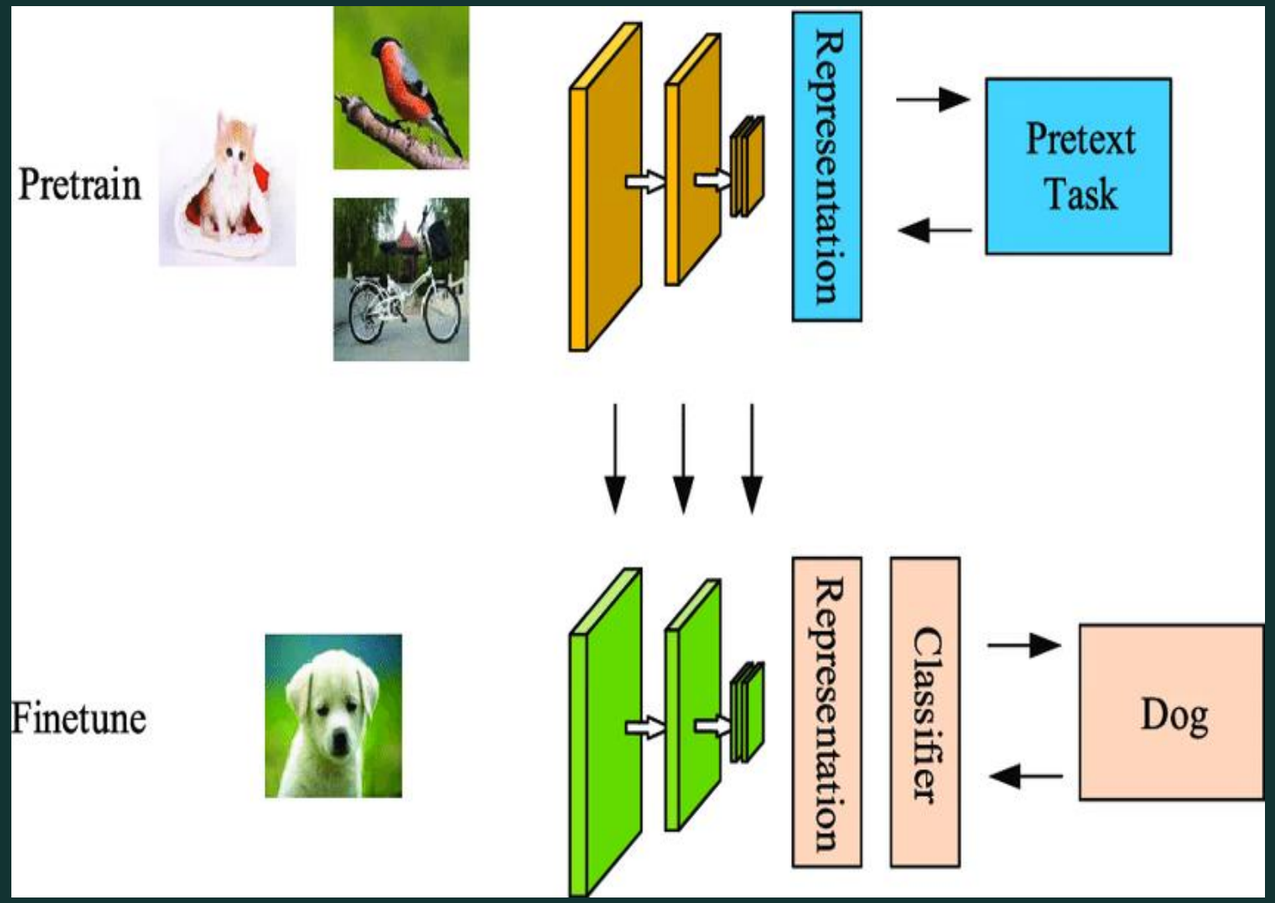
•**Definition:** The model generates its own labels from data and learns to predict missing information.

•**How it Works:**

- Uses pretext tasks like predicting the next word in a sentence or recovering missing parts of an image.

•**Examples:**

- **Natural Language Processing:** Pre-training language models like GPT.
- **Computer Vision:** Training models to inpaint missing image regions.
- **Speech Recognition:** Learning representations from audio without explicit transcription.



Conclusion

•Deep learning relies on various learning paradigms to tackle different types of problems.

•**Key Takeaways:**

- **Supervised Learning:** Best for classification and regression tasks.
- **Unsupervised Learning:** Useful for clustering and anomaly detection.
- **Semi-Supervised Learning:** Balances labeled and unlabeled data for better results.
- **Reinforcement Learning:** Ideal for decision-making and control systems.
- **Self-Supervised Learning:** Advances pre-training models for AI.

•Future advancements in deep learning will likely involve a blend of these paradigms to improve model efficiency and generalization.

Thank you!