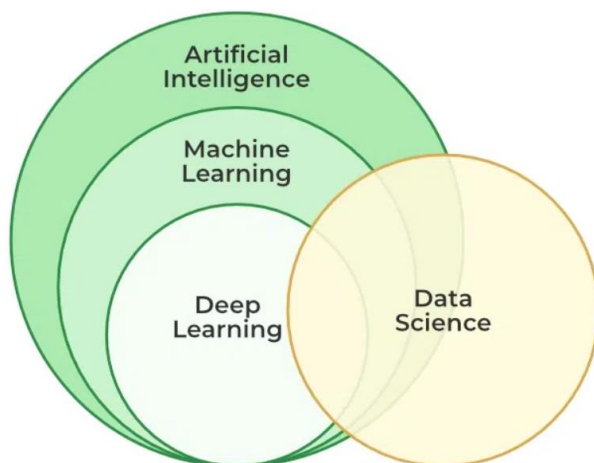


Deep Learning

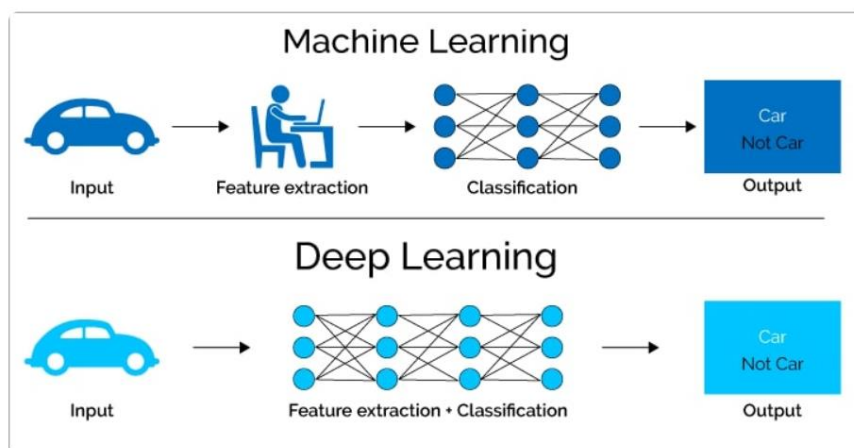


- ❖ Deep learning is a branch of machine learning using artificial neural networks (ANNs) to learn complex patterns and relationships in data.
- ❖ ANNs are inspired by the human brain and learn from large amounts of data without explicit programming.
- ❖ Deep learning uses deep neural networks with multiple layers, enabling them to discover intricate data patterns.
- ❖ Unlike traditional machine learning, deep learning automatically learns and improves through data, reducing manual feature engineering.
- ❖ Deep learning has achieved success in areas like image recognition, natural language processing, speech recognition, and recommendation systems.
- ❖ Popular deep learning architectures include CNNs, RNNs, and DBNs.
- ❖ Training deep neural networks requires significant data and computing power, but cloud computing and GPUs have made it more accessible.



Machine Learning vs Deep Learning

Aspect	Machine Learning	Deep Learning
Data Volume	Hundreds or thousands of data	Millions of data
Computational Cost	ML model doesn't need a lot of computational power (Using CPU is often sufficient)	DL model needs a lot of computational power (The use of GPU is often necessary)
Training Time	ML model takes less time to train	DL model takes more time to train
Feature Engineering	Needs to be done explicitly by human	DL model can automatically learn important feature during training
Interpretability	ML models' behavior are easier to interpret	DL models' behavior are more difficult to interpret
Application Examples	Customer segmentation, Recommendation system, Fraud detection	Natural Language Processing, Computer Vision



Types of Deep Learning Networks



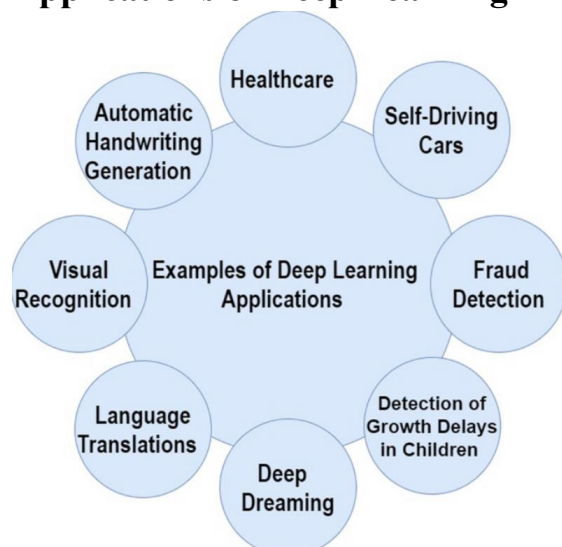
Advantages of Deep Learning:

- **Robustness:** Can handle novel data and focus learning on specific tasks.
- **Flexibility:** Can learn any kind of system, linear or nonlinear, with few or many weights.
- **High Dimensionality:** Allows creation of more complex learning models with additional neural network layers.
- **Unsupervised Learning:** Enables studying the world as a non-structured system.
- **Fast Insights:** Gains insights quickly and tackles traditionally tricky problems.
- **Efficient Information Retention:** Retains information even with limited or poorly known data.
- **Multi-channel Learning:** Learns from multiple information sources and sees more than one thing at a time.
- **Scalability:** Handles large, complex, and repetitive datasets.
- **Small Network Efficiency:** Achieves learning with small networks and lower learning costs.

Disadvantages of Deep Learning:

- **Difficult Comparison:** Hard to compare against hand-crafted methods.
- **Real-world Performance:** Evaluating performance in real-world applications is challenging.
- **Imperfect Efficiency:** Not 100% efficient and faces certain difficulties.
- **Large Data Requirements:** Needs vast amounts of data for training (e.g., thousands of images).
- **Approximate Results:** Outputs approximate statistics, not always accurate data.
- **Difficult Evolution Tracking:** Learning happens autonomously, making evolution tracking hard.
- **Limited Learning Speed and Memory:** Not as fast-learning or memory-efficient as other methods.
- **Complexity and Lack of Understanding:** Highly complex and not fully understood yet.
- **Computational Cost:** Computationally expensive, requiring vast memory and resources.
- **Transferability Issues:** Transferring to other problems can be difficult.
- **Optimization Challenges:** Requires advanced optimization techniques for good results.
- **Costlier and Data-heavy:** Can be more expensive and require larger datasets with more features.

Applications of Deep Learning



History Of Deep Learning

