3.0 Types of Neural Networks, History of Deep Learning, And Real-World Applications

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1) TYPES OF NEURAL NETWORK :-

There are many types of neural networks, rather than a fixed number, with new architectures constantly being developed.

However, common types include:

1) Multi-layer Perceptron (MLP)
2) Convolutional Neural Networks (CNN) (Transformed visual networks)
3) Recurrent Neural Networks (RNN)
4) Auto Encoders
5) GANs

1) MULTI-LAYER PERCEPTRON :-

- Simplest type of neural network
- Have multiple perceptrons are organized in layers. Game is input layer, followed by one/more hidden layers and finally ending up with an output layer
- MLP can be used in any of the supervised machine learning problems (mainly regression & classification. Not performs well.)
- They are good at capturing non-linear relationships

2) CONVOLUTIONAL NEURAL NETWORKS :-

- Designed for spatial data (images, videos).
- Extracts local patterns (edges, textures) automatically.
- Majorly used in **image recognition, object detection, face recognition**.

3) RECURRENT NEURAL NETWORK :-

- Designed for sequential data (time series, speech, text).
- Retains information through hidden states.
- Limitation: suffers from vanishing gradient.

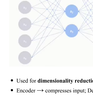
Long Short-Term Memory (LSTM)

- A special type of RNN.
- Can capture **long-term dependencies**.
- Used in **speech recognition, machine translation, stock predictions**.

4) AUTO ENCODERS :-

- Used for **dimensionality reduction, denoising, and data compression**.
- Encoder → compresses input; Decoder → reconstructs input.

5) GENERATIVE ADVERSARIAL NETWORKS (GANS) :-



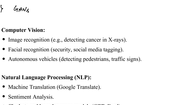
- Two networks: Generator vs Discriminator.
- Generator creates synthetic data; Discriminator distinguishes real vs fake.
- Used for **image generation, video upscaling, super-resolution, art creation**.

6) HISTORY OF DEEP LEARNING :-

- **1958:** *Perceptron* introduced by Frank Rosenblatt.
  - Could classify simple linear problems.
  - Limitation: could not solve **non-linear problems (e.g., XOR problem)**.
- **1969:** Marvin Minsky & Seymour Papert published *Perceptrons* book.
  - Highlighted limitations (e.g., XOR unsolvable).
  - Led to **AI Winter** (funding and interest dropped).
- **1980s:** Introduction of **Backpropagation algorithm** (by Rumelhart, Hinton, and Williams).
  - Allowed training of multilayer perceptrons.
  - Brought neural networks back into research.
- **1990s–2000s:**
  - Limited progress due to lack of **data and computing power**.
  - Shallow networks dominated.
- **2012:** Breakthrough with **AlexNet (CNN)** in ImageNet competition.
  - Used GPUs + large datasets.
  - Achieved massive improvement in image recognition.
- **2014 onwards:**
  - GANs introduced (Ian Goodfellow).
  - RNNs and LSTMs became standard for sequence tasks.
  - Deep Learning started powering **Google Translate, Siri, Alexa, self-driving cars, healthcare AI**.
- **2017+:**
  - **Transformers (Vaswani et al.)** changed NLP forever.
  - Models like **BERT, GPT** scaled up with billions of parameters.
  - Today: Deep Learning powers **chatbots, recommendation systems, medical diagnosis, robotics**.

6) APPLICATIONS OF DEEP LEARNING :-

1) SELF-DRIVING CARS :- Low with Lidar



2) GAME PLAYING AGENTS: Deep learning + Reinforcement learning = Deep Reinforcement learning

3) VIRTUAL ASSISTANCE

4) TRANSLATION

5) LEARNING PATTERNS TO SYLLABI WORDS.

6) IMAGE CAPTION GENERATION

7) TEXT TRANSLATION

8) IMAGE RESTORATION

9) OBJECT DETECTION AND IDENTIFICATION

10) GENIUS

- **Computer Vision:**
  - Image recognition (e.g., detecting cancer in X-rays).
  - Facial recognition (security, social media tagging).
  - Autonomous vehicles (detecting pedestrians, traffic signs).
- **Natural Language Processing (NLP):**
  - Machine Translation (Google Translate).
  - Sentiment Analysis.
  - Chatbots and large language models (GPT, Bard).
  - Real-time speech-to-text and text-to-speech.
- **Healthcare:**
  - Medical imaging (CT, MRI).
  - Predicting diseases from patient data.
  - Drug discovery & protein folding (DeepMind's AlphaFold).
- **Finance:**
  - Fraud detection.
  - Stock market predictions.
  - Credit scoring and risk analysis.
- **Entertainment:**
  - Content recommendation (YouTube, Netflix, Spotify).
  - Deepfake generation.
  - Music & art creation using GANs.
- **Robotics:**
  - Human-robot interaction.
  - Industrial automation.
  - Drone navigation.
- **Other Sectors:**
  - Agriculture: crop monitoring, pest detection.
  - Education: personalized learning systems.
  - Cybersecurity: detecting anomalies & intrusions.

7) WHY DEEP LEARNING BECAME TRENDS RECENTLY :-

Several factors contributed to the recent boom:

- **Big Data:** Explosion of digital data (social media, sensors, healthcare, IoT).
- **Computing Power:** GPUs and TPUs made large-scale training feasible.
- **Algorithms:** Backpropagation, optimization (Adam, SGD), better architectures (CNN, RNN, Transformers).
- **Open-Source Ecosystem:** Frameworks like TensorFlow, PyTorch made DL accessible.
- **Industry Demand:** Tech giants (Google, Facebook, Microsoft) invested heavily.
- **Success Stories:** Breakthroughs in ImageNet, AlphaGo beating world champion in Go, ChatGPT, etc.