Experiment 1: Review of Deep Learning Techniques and Applications.

1. Introduction

Deep Learning (DL) is a branch of Machine Learning that uses **neural networks with multiple layers** to automatically learn data representations. It powers technologies like **image recognition, NLP, healthcare analytics, and autonomous vehicles**.

2. Key Deep Learning Techniques

- **ANN (Artificial Neural Network):** Basic network of neurons; used for simple prediction tasks.
- **CNN (Convolutional Neural Network):** Best for image/video data; used in facial recognition, medical imaging.
- **RNN (Recurrent Neural Network):** Handles sequential data like text and time series; used in speech recognition.
- **LSTM (Long Short-Term Memory):** Overcomes RNN limitations; used for translation and forecasting.
- **GAN (Generative Adversarial Network):** Generates realistic data; used in image synthesis and data augmentation.
- **Autoencoder:** Learns compressed data representation; used for anomaly detection and noise reduction.
- **Transformer:** Uses self-attention for NLP; basis of models like GPT and BERT.

3. Applications

Domain	**Use Case**	**Example**
Computer Vision	Image classification, object detection	Self-driving cars

NLP	Translation, summarization	ChatGPT, Google Translate
Healthcare	Disease detection	X-ray, MRI analysis
Finance	Fraud detection, risk scoring	Banking systems
Autonomous Systems	Navigation, control	Tesla Autopilot

4. Challenges

- High data and computation needs
- Model interpretability issues
- Overfitting and bias risks

5. Future Directions

- Explainable AI (XAI)
- Federated and energy-efficient learning
- Quantum and multimodal deep learning

6. Conclusion

Deep learning drives modern AI innovations across multiple sectors. With continuous advancements, it promises smarter, more efficient, and human-like systems while facing ongoing challenges of transparency and fairness.