UNIT-1

1. What is Deep Learning?

Answer: Deep Learning is a type of machine learning that uses multiple layers of algorithms called neural networks. These networks can learn from vast amounts of data, making them ideal for complex tasks like image recognition or language processing.

2. What is a Multilayer Perceptron (MLP)?

Answer: An MLP is a type of neural network made up of multiple layers of neurons (units). It includes an input layer, hidden layers, and an output layer. Each layer helps process data more deeply to improve prediction accuracy.

3. Explain Feedforward Neural Network.

Answer: In a Feedforward Neural Network, information moves in one direction—from input to output—without looping back. This is the simplest type of neural network.

4. What is Backpropagation?

Answer: Backpropagation is the process used to update the weights in a neural network. It calculates errors and adjusts weights to improve the model's accuracy.

5. What is Gradient Descent?

Answer: Gradient Descent is an optimization method used to minimize the loss function in neural networks. It finds the best weights for the model by reducing error gradually.

6. What is the Vanishing Gradient Problem?

Answer: The Vanishing Gradient Problem occurs when gradients (used for learning) become too small during backpropagation. This makes it difficult for the network to learn effectively, especially in deep networks.

7. Explain the ReLU Activation Function.

Answer: ReLU (Rectified Linear Unit) is an activation function that sets negative values to zero and keeps positive values as they are. It helps the network learn faster by avoiding the vanishing gradient problem.

8. What are LReLU and EReLU?

Answer: LReLU (Leaky ReLU) and EReLU (Exponential ReLU) are variants of ReLU. LReLU allows a small, positive gradient for negative inputs, while EReLU introduces exponential growth for better training performance.

9. What are Hyperparameters?

Answer: Hyperparameters are settings in a neural network that must be set before training, like layer size, learning rate, and momentum. These affect how the network learns and performs.

10. What is Regularization?

Answer: Regularization is a technique to prevent overfitting, where the model performs well on training data but poorly on new data. Techniques include Dropout, L1, and L2 regularization, which help make the model generalize better.

UNIT-2

1. What is a Convolutional Neural Network (CNN)?

Answer: CNNs are a type of neural network mainly used for image processing. They apply filters to the input image, allowing the network to capture patterns and features like edges or shapes in the image.

2. What is the Convolution Operation?

Answer: The convolution operation applies a small matrix (filter or kernel) over a section of the input data to produce a feature map. This helps in detecting features like edges and textures.

3. What is Parameter Sharing in CNN?

Answer: Parameter sharing means using the same filter (set of weights) across different parts of the input. This reduces the number of parameters, making the model faster and more efficient.

4. Explain Equivariant Representation.

Answer: Equivariant Representation means that the feature map output changes consistently when the input is shifted. This property allows CNNs to detect features regardless of where they appear in the image.

5. What is Pooling in CNN?

Answer: Pooling is a technique to reduce the size of feature maps, making the network faster and more efficient. Common types are max pooling (taking the maximum value) and average pooling (taking the average value).

6. What are the Variants of Basic Convolution Functions?

Answer: Variants of convolution include dilated convolutions (spreading the filter) and transposed convolutions (used in upsampling). These help CNNs capture more information or create higher-resolution outputs.

7. What is the Basic Architecture of a CNN?

Answer: A basic CNN architecture includes an input layer, convolutional layers for feature extraction, pooling layers for downsampling, and fully connected layers for classification.

8. Describe AlexNet.

Answer: AlexNet is a popular CNN architecture that won the ImageNet competition in 2012. It introduced deeper layers and used ReLU, dropout, and data augmentation techniques, making CNNs widely popular for image processing.

UNIT-3

1. What is a Recurrent Neural Network (RNN)?

Answer: An RNN is a type of neural network designed for sequence data, like time series or text. Unlike traditional networks, it has connections that loop back, allowing information to persist across steps, making it useful for tasks involving sequences.

2. What are the types of RNNs?

Answer: There are several types of RNNs, including:

- **Simple RNNs**: Basic structure with one hidden state looped over time steps.
- **LSTM (Long Short-Term Memory)**: A more complex RNN that can remember information over longer periods.
- **GRU (Gated Recurrent Unit)**: A simplified version of LSTM that’s faster and uses fewer parameters.

3. How is a Feedforward Neural Network different from an RNN?

Answer: In a Feedforward Neural Network, information moves in one direction—from input to output—with no cycles. In contrast, RNNs have loops that allow them to "remember" previous inputs, making them suitable for sequence data.

4. What is Long Short-Term Memory (LSTM)?

Answer: LSTM is a special kind of RNN capable of learning long-term dependencies. It has a memory cell and gates (input, forget, and output gates) that help it keep important information over time and avoid issues like the vanishing gradient problem.

5. What is an Encoder-Decoder Architecture?

Answer: The Encoder-Decoder Architecture is used in tasks like translation. The encoder processes input data into a fixed-size context or vector, while the decoder generates output based on this vector, making it ideal for tasks with variable-length inputs and outputs.

6. What is a Recursive Neural Network?

Answer: A Recursive Neural Network is a type of neural network used mainly in tasks with hierarchical data structures, like parsing sentences in natural language. It processes inputs by combining them recursively to capture relationships in a structured form.

UNIT-4

1. What is an Autoencoder?

Answer: An Autoencoder is a type of neural network used to learn compressed representations of data, called encodings. It has two parts: an encoder that reduces the data to a lower dimension, and a decoder that reconstructs it back to its original form.

2. What is an Undercomplete Autoencoder?

Answer: An Undercomplete Autoencoder has a bottleneck (low-dimensional) encoding layer that forces the network to learn the most important features of the data by reducing redundancy.

3. What are Regularized Autoencoders?

Answer: Regularized Autoencoders add constraints to the autoencoder to prevent it from simply copying input data. Examples include Sparse Autoencoders, Denoising Autoencoders, and Contractive Autoencoders.

4. Explain Sparse Autoencoders.

Answer: Sparse Autoencoders have an additional constraint that forces some neurons in the encoding layer to stay inactive. This helps the model learn features more selectively and avoid overfitting.

5. What are Stochastic Encoders and Decoders?

Answer: Stochastic Encoders and Decoders introduce randomness in encoding or decoding, making the model robust to small variations in input. This can help in tasks like image reconstruction where noise might be present.

6. What is a Denoising Autoencoder?

Answer: A Denoising Autoencoder is trained to remove noise from data. It takes in noisy data, encodes it, and then tries to reconstruct the original clean data, which improves its robustness.

7. Explain Contractive Autoencoders.

Answer: Contractive Autoencoders are regularized to make the learned features less sensitive to small changes in the input, enhancing the model's ability to capture essential patterns.

8. What are some Applications of Autoencoders?

Answer: Autoencoders are used in data compression, noise reduction, anomaly detection, and feature extraction. They are especially useful for dimensionality reduction and generating new samples similar to the training data.

UNIT-5

1. What is Representation Learning?

Answer: Representation Learning is the process of discovering the best way to represent data to make it easier for machine learning models to understand. It focuses on automatically finding useful features from raw data.

2. What is Greedy Layerwise Pre-training?

Answer: Greedy Layerwise Pre-training is a technique where layers in a deep network are trained one at a time, independently, before fine-tuning the entire network. It helps in overcoming the vanishing gradient problem and improves training efficiency.

3. What is Transfer Learning?

Answer: Transfer Learning is a method where a model trained on one task is adapted to a different but related task. This helps save time and resources, especially when there's limited data for the new task.

4. What is Domain Adaptation?

Answer: Domain Adaptation is a technique in Transfer Learning where a model trained in one domain (e.g., images of animals) is modified to work in a different domain (e.g., images of vehicles) while retaining useful knowledge.

5. What is Distributed Representation?

Answer: Distributed Representation is a way to represent data where each feature captures multiple aspects of the input. For example, words in a sentence are represented as vectors capturing their relationships, which helps in tasks like language processing.

6. What is DenseNet?

Answer: DenseNet is a CNN architecture that connects each layer to every other layer, allowing for better feature reuse and reducing the number of parameters. This helps in training deeper networks more efficiently.

UNIT-6

1. What are some common applications of Deep Learning?

Answer: Common applications of Deep Learning include image classification, social network analysis, speech recognition, recommender

systems, and natural language processing. These applications benefit from deep learning’s ability to learn complex patterns from large datasets.

2. How is Deep Learning used in Image Classification?

Answer: In image classification, deep learning models like Convolutional Neural Networks (CNNs) analyze images to identify objects, animals, or scenes. They learn visual patterns through layers of filters to categorize images with high accuracy.

3. What is the role of Deep Learning in Social Network Analysis?

Answer: Deep Learning helps in analyzing social network data by identifying user behaviors, detecting communities, and predicting connections. It can also help analyze sentiments and detect patterns in social media interactions.

4. How is Deep Learning applied in Speech Recognition?

Answer: In speech recognition, models like Recurrent Neural Networks (RNNs) and their variants (like LSTMs) are used to convert spoken language into text. These models capture sequential data patterns, making them effective for processing spoken words.

5. What is the importance of Deep Learning in Recommender Systems?

Answer: Deep Learning improves recommender systems by analyzing user preferences and behaviors. It personalizes recommendations for products, movies, or articles, as seen in platforms like Netflix or Amazon, by learning complex user-item relationships.

6. How is Deep Learning applied in Natural Language Processing (NLP)?

Answer: In NLP, Deep Learning is used for tasks like language translation, sentiment analysis, and chatbots. Models like RNNs, LSTMs, and Transformers help understand and generate human language, allowing computers to interpret and respond to text effectively.