

SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

QUESTION BANK



VII SEMESTER

AD3762 – DEEP LEARNING

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SUBJECT CODE & NAME : AD3762 & DEEP LEARNING

SEM / YEAR: VII Sem / IV Year

UNIT I – DEEP NETWORKS BASICS

Linear Algebra: Scalars - Vectors - Matrices and tensors; Probability Distributions - Gradient based Optimization – Machine Learning Basics: Capacity - Overfitting and underfitting - Hyperparameters and validation sets - Estimators - Bias and variance - Stochastic gradient descent - Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization - Optimization.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is Supervised Learning?	BTL 1	Remember
2.	Define Overfitting.	BTL 1	Remember
3.	What is Deep Learning?	BTL 2	Understand
4.	Differentiate supervised and unsupervised deep learning procedures.	BTL 1	Remember
5.	Define Bayes error.	BTL 1	Remember
6.	What is stochastic gradient descent?	BTL 1	Remember
7.	What is the difference between Deep Learning and a rule-based system?	BTL 2	Understand
8.	Define Machine Learning and Deep Learning.	BTL 1	Remember
9.	List the layers in a Feed Forward Neural Network.	BTL 1	Remember
10.	State the formula for conditional probability.	BTL 1	Remember
11.	What is a Support Vector Machine (SVM)?	BTL 1	Remember
12.	State the formula for variance.	BTL 1	Remember
13.	Name the default activation function used in modern neural networks.	BTL 1	Remember
14.	Why is probability theory important in Deep Learning?	BTL 2	Understand
15.	State the formula for an unbiased sample covariance matrix.	BTL 1	Remember
16.	What is a Tensor?	BTL 1	Remember
17.	Define Identity Matrix.	BTL 1	Remember
18.	What is meant by linear dependence of vectors?	BTL 2	Understand
19.	Differentiate scalar and vector.	BTL 2	Understand
20.	Give example of a feed forward neural network.	BTL 2	Understand
21.	List out the special kind of matrices.	BTL 1	Remember
22.	What is representation learning?	BTL 1	Remember
23.	State the Bayes rule.	BTL 1	Remember
24.	What is Deep Feed Forward Networks?	BTL 1	Remember

PART – B			
1.	Explain the operations of deep feed forward network with a diagram.	BTL 3	Apply
2.	i) Discuss the Bias – Variance trade off. (8) ii) Discuss overfitting and underfitting with an example. (8)	BTL 4	Analyze
3.	What is gradient based method in optimization? Outline the steps in the gradient-based method with an example.	BTL 3	Apply
4.	Describe the steps of stochastic gradient descent and explain how learning rate affects convergence.	BTL 3	Apply
5.	Explain in detail on linear regression machine learning algorithm with examples.	BTL 3	Apply
6.	Illustrate with an example of a fully functioning feed forward network on a simple task.	BTL 3	Apply
7.	Explain cost function in gradient-based learning and learning conditional distributions using maximum likelihood.	BTL 3	Apply
8.	Explain supervised learning algorithm.	BTL 4	Analyze
9.	Importance of PCA and Support Vector Machines.	BTL 3	Apply
10.	Illustrate the role of Deep Learning in Artificial Intelligence by constructing a suitable Venn diagram and explaining the relationship among AI, Machine Learning, and Deep Learning.	BTL 3	Apply
11.	Analyze the relationship between Artificial Intelligence, Machine Learning, and Deep Learning by using a Venn diagram and discussing their key differences and interconnections.	BTL 4	Analyze
12.	Importance of PCA and Support Vector Machines.	BTL 3	Apply
13.	Develop and explain the concepts of Scalars, Vectors, and Matrices with suitable examples.	BTL 6	Create
14.	Evaluate the significance of Random Variables and Probability in Deep Learning with suitable examples.	BTL 5	Evaluate
15.	Develop a Deep Feed Forward Network.	BTL 6	Create
16.	Assess forward propagation computation.	BTL 5	Evaluate
17.	Assess difference between linear models and neural networks.	BTL 5	Evaluate
UNIT II – CONVOLUTIONAL NEURAL NETWORKS			
Convolution Operation - Sparse Interactions - Parameter Sharing - Equivariance - Pooling - Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions - Regularization - Optimizers - Gradient Computation.			
PART – A			
1.	What is a convolutional neural network?	BTL 2	Understand
2.	Write a note on dilated convolutions.	BTL 1	Remember
3.	Write the formula to find how many neurons fit for a network.	BTL 1	Remember
4.	Why is it important to place non-linearities between the layers of networks?	BTL 2	Understand
5.	What are sparse interactions in a convolutional neural network	BTL 2	Understand
6.	Present an outline of pooling layer in convolutional neural network	BTL 2	Understand
7.	What is zero padding in a convolutional network?	BTL 1	Remember
8.	Why is the output layer of a CNN computationally inexpensive?	BTL 2	Understand
9.	List three important ideas that improve ML systems.	BTL 1	Remember
10.	What is unshared convolution?	BTL 2	Understand
11.	Define Primary Visual Cortex.	BTL 1	Remember
12.	How to reduce convolution training cost?	BTL 2	Understand

13.	Discuss parameter sharing.	BTL 2	Understand
14.	Give three properties of V1.	BTL 2	Understand
15.	List three stages of CNN.	BTL 1	Remember
16.	List data formats used with CNN.	BTL 1	Remember
17.	Give example for convolution.	BTL 2	Understand
18.	What are simple and complex layers in CNN?	BTL 2	Understand
19.	List the strategies used to obtain convolution kernels.	BTL 1	Remember
20.	Define reverse correlation.	BTL 1	Remember
21.	What is a complex layer in CNN?	BTL 1	Remember
22.	Define equivariance to translation.	BTL 1	Remember
23.	What is stride in convolution?	BTL 1	Remember
24.	Define Feature Map.	BTL 1	Remember

PART - B

1.	Outline how sparse interactions, parameter sharing and pooling improve model efficiency of a convolutional neural network	BTL 4	Analyze
2.	Design a CNN architecture to classify handwritten digits (0-9) and justify your choices.	BTL 6	Create
3.	Demonstrate the back propagation concept activation function.	BTL 3	Apply
4.	Enumerate on ReLU and Sigmoid activation function. Explain in detail.	BTL 3	Apply
5.	What is a convolutional neural network? Outline transposed and dilated convolutional with an example.	BTL 3	Apply
6.	How to introduce non-linearity in a convolutional neural network? Explain with an example	BTL 3	Apply
7.	Construct graphical demonstration for sparse connectivity.	BTL 5	Evaluate
8.	Create graphical demonstration for parameter sharing.	BTL 6	Create
9.	Evaluate variants of basic convolution function.	BTL 5	Evaluate
10.	Construct CNN to demonstrate zero padding and neuroscientific basis.	BTL 6	Create
11.	Construct a table comparing the various data formats used in Convolutional Neural Networks and explain their applications.	BTL 6	Create
12.	Analyze the role of random and unsupervised features in Convolutional Neural Networks.	BTL 4	Analyze
13.	Apply the concept of unshared convolution to demonstrate its working with a suitable example.	BTL 3	Apply
14.	Demonstrate how the properties of the primary visual cortex (V1) contribute to learned invariance in Convolutional Neural Networks with suitable illustrations.	BTL 3	Apply
15.	Apply the concept of equivariant representation to explain translation equivariance in Convolutional Neural Networks with a suitable example.	BTL 3	Apply
16.	Evaluate the significance of learned invariances in improving the performance of Convolutional Neural Networks.	BTL 5	Evaluate
17.	Analyze the different variants of convolution used in Convolutional Neural Networks with suitable examples.	BTL 4	Analyze

UNIT III – RECURRENT NEURAL NETWORKS

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder -Transducer; Gradient Computation - Sequence Modelling Conditioned on Contexts - Bidirectional RNN - Sequence to Sequence RNN – Deep Recurrent Networks - Recursive Neural Networks - Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

PART – A

1.	Define a bidirectional recurrent neural network.	BTL 1	Remember
2.	What is long short term memory?	BTL 1	Remember
3.	Give a block diagram for long short term memory.	BTL 2	Understand
4.	Write a short notes on echo state networks.	BTL 2	Understand
5.	Define a recurrent neural network.	BTL 1	Remember
6.	What is LSTM? How it differs from RNN?	BTL 2	Understand
7.	List the design patterns of Recurrent Neural Networks.	BTL 1	Remember
8.	What is Encoder?	BTL 1	Remember
9.	Give decomposition blocks of RNN.	BTL 2	Understand
10.	What is unfolding in a computational graph?	BTL 1	Remember
11.	Give advantage of recursive nets.	BTL 2	Understand
12.	What is Decoder?	BTL 1	Remember
13.	What is a hidden state in an RNN?	BTL 1	Remember
14.	Define the concept of gated RNN.	BTL 2	Understand
15.	Distinguish content and location-based addressing.	BTL 2	Understand
16.	What are Leaky Units?	BTL 1	Remember
17.	Differentiate LSTM and GRU.	BTL 2	Understand
18.	List the strategies for Multiple Time Scales.	BTL 1	Remember
19.	State the advantage of Deep Recurrent Networks.	BTL 2	Understand
20.	What is gradient clipping?	BTL 1	Remember
21.	Draw the schematic diagram of a network with explicit memory.	BTL 2	Understand
22.	Draw the architecture of an Echo State Network.	BTL 2	Understand
23.	What is a Liquid State Machine?	BTL 1	Remember
24.	Define Explicit Memory.	BTL 1	Remember
PART - B			
1.	i) What is an unfolding graph? Outline the steps to construct an unfolding graph with an example. (8) ii) Present an outline of deep recurrent network. (8)	BTL 3	Apply
2.	Given a sequence-to-sequence problem, propose an RNN-based model and illustrate how to train it.	BTL 6	Create
3.	Explain how to compute the gradient in a recurrent neural network.	BTL 5	Evaluate
4.	Illustrate with an example of Encoder, Decoder or sequence-to-sequence RNN architecture.	BTL 3	Apply
5.	What is a bidirectional recurrent neural network? Explain the architecture of a bi-directional recurrent neural network with a diagram.	BTL 4	Analyze
6.	What is long short-term memory? Compare and contrast LSTM and gated recurrent units.	BTL 4	Analyze
7.	Develop an example for Unfolding Computational Graphs and describe its advantages.	BTL 6	Create
8.	Explain how to compute the gradient in a Recurrent Neural Network.	BTL 5	Evaluate
9.	Explain modeling sequences conditioned on contexts using RNNs.	BTL 5	Evaluate
10.	Evaluate the performance of Simple RNN, LSTM, and GRU for sequence modeling applications with suitable justification.	BTL 5	Evaluate
11.	Explain various Gated RNNs.	BTL 5	Evaluate
12.	Explain Skip Connections and Leaky Units.	BTL 4	Analyze
13.	Explain Optimization for Long-Term Dependencies.	BTL 5	Evaluate
14.	Illustrate Gradient Clipping and Information Flow.	BTL 3	Apply

15.	Evaluate the challenges posed by long-term dependencies in Recurrent Neural Networks and discuss the techniques used to overcome them.	BTL 5	Evaluate
16.	Analyze the features of Echo State Networks and explain their significance in sequence modeling.	BTL 4	Analyze
17.	Assess the challenges of training deep recurrent neural networks and evaluate the techniques used to overcome them.	BTL 5	Evaluate

UNIT IV - MODEL EVALUATION			
Performance metrics - Baseline Models - Hyperparameters: Manual Hyperparameter - Automatic Hyperparameter - Grid search - Random search - Debugging strategies.			
PART – A			
1.	Define Accuracy.	BTL 1	Remember
2.	What is a hyperparameter in deep learning?	BTL 1	Remember
3.	Name the various tasks that can be done by probabilistic models.	BTL 1	Remember
4.	What is Independent Component Analysis (ICA)?	BTL 1	Remember
5.	What is a baseline model in deep learning?	BTL 1	Remember
6.	Define Random Search.	BTL 1	Remember
7.	What is a confusion matrix?	BTL 1	Remember
8.	Define Precision.	BTL 1	Remember
9.	What is Recall (Sensitivity)?	BTL 1	Remember
10.	Define F1-score.	BTL 1	Remember
11.	What is the ROC curve?	BTL 1	Remember
12.	What is Area Under the Curve (AUC)?	BTL 1	Remember
13.	Differentiate model parameters and hyperparameters.	BTL 2	Understand
14.	What is manual hyperparameter tuning?	BTL 1	Remember
15.	What is automatic hyperparameter tuning?	BTL 1	Remember
16.	Define Grid Search.	BTL 1	Remember
17.	Differentiate Grid Search and Random Search.	BTL 2	Understand
18.	Why is hyperparameter tuning important in deep learning?	BTL 2	Understand
19.	What is overfitting?	BTL 1	Remember
20.	What is underfitting?	BTL 1	Remember
21.	How does a baseline model help in model evaluation?	BTL 2	Understand
22.	What are debugging strategies in deep learning?	BTL 1	Remember
23.	Why is model debugging important?	BTL 2	Understand
24.	List the common hyperparameters used in deep learning models.	BTL 1	Remember
PART - B			
1.	Discuss the various performance metrics to evaluate a deep learning model with an example.	BTL 4	Analyze
2.	Why are hyperparameters? Discuss the steps to perform hyperparameter tuning.	BTL 4	Analyze
3.	Develop various graphs to describe model structure.	BTL 6	Create
4.	Explain various debugging strategies with their advantages and disadvantages.	BTL 5	Evaluate
5.	Compare and contrast evaluation metrics such as Accuracy, Precision, Recall, F1-score, and ROC-AUC. When would you prefer one over another?	BTL 5	Evaluate
6.	Outline the role of Grid Search in Deep Learning with a suitable example.	BTL 3	Apply
7.	Apply suitable performance metrics to evaluate the performance of a classification model using a confusion matrix.	BTL 3	Apply
8.	Analyze the significance of baseline models in measuring the performance of deep learning models.	BTL 4	Analyze
9.	Evaluate the effectiveness of baseline models in improving predictive performance.	BTL 5	Evaluate
10.	Design a baseline model for a classification problem and justify the selected evaluation metrics.	BTL 6	Create
11.	Demonstrate the implementation of manual hyperparameter tuning	BTL 3	Apply

	for optimizing a deep learning model.		
12.	Analyze the working principles of Grid Search and Random Search for hyperparameter optimization.	BTL 4	Analyze
13.	Evaluate the advantages and limitations of Manual and Automatic Hyperparameter Tuning techniques.	BTL 5	Evaluate
14.	Design an automatic hyperparameter tuning strategy for improving the performance of a deep learning model.	BTL 6	Create
15.	Apply suitable debugging strategies to identify and resolve training issues in a deep learning model.	BTL 3	Apply
16.	Analyze the common causes of overfitting and underfitting, and explain suitable debugging techniques to overcome them.	BTL 4	Analyze
17.	Develop a comprehensive debugging framework for diagnosing and improving the performance of a deep learning model.	BTL 6	Create
UNIT V - AUTOENCODERS AND GENERATIVE MODELS			
Autoencoders: Undercomplete autoencoders - Regularized autoencoders - Stochastic encoders and decoders - Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks.			
PART – A			
1.	Write a note on Variational Autoencoders (VAE).	BTL 1	Remember
2.	Define a Generative Adversarial Network (GAN).	BTL 1	Remember
3.	Define Linear Factor Model.	BTL 1	Remember
4.	Mention the applications of GAN in real-world scenarios.	BTL 2	Understand
5.	What is a Regularized Autoencoder?	BTL 1	Remember
6.	Define a Stochastic Encoder.	BTL 1	Remember
7.	What is an Autoencoder?	BTL 1	Remember
8.	Define an Undercomplete Autoencoder.	BTL 1	Remember
9.	What is the purpose of an Autoencoder?	BTL 2	Understand
10.	Differentiate Undercomplete and Regularized Autoencoders.	BTL 2	Understand
11.	What is a Decoder in an Autoencoder?	BTL 1	Remember
12.	Define a Stochastic Decoder.	BTL 1	Remember
13.	What is latent representation?	BTL 1	Remember
14.	Why is latent representation important in Autoencoders?	BTL 2	Understand
15.	What is reconstruction error?	BTL 1	Remember
16.	State the objective of training an Autoencoder.	BTL 2	Understand
17.	What is unsupervised learning in Autoencoders?	BTL 1	Remember
18.	How do Regularized Autoencoders prevent overfitting?	BTL 2	Understand
19.	What is the purpose of the latent space in a Variational Autoencoder?	BTL 2	Understand
20.	What are the two neural networks used in a GAN?	BTL 1	Remember
21.	Differentiate Generator and Discriminator in GAN.	BTL 2	Understand
22.	What is the role of the Generator in a GAN?	BTL 1	Remember
23.	What is the role of the Discriminator in a GAN?	BTL 1	Remember
24.	List the applications of Autoencoders.	BTL 1	Remember
PART - B			
1.	What is an Undercomplete Autoencoder? Explain how an Undercomplete Autoencoder works with a suitable example.	BTL 3	Apply
2.	Explain the distribution equation for an Energy-Based Model with a suitable example.	BTL 3	Apply
3.	What is a Generative Adversarial Network (GAN)? Explain the architecture of a GAN with a neat diagram.	BTL 3	Apply

4.	Describe the following: i) Representation Learning (8) ii) Greedy Layer-Wise Unsupervised Pretraining (8)	BTL 3	Apply
5.	Analyze the working principle of Regularized Autoencoders and explain their advantages over Undercomplete Autoencoders.	BTL 4	Analyze
6.	Compare Structured Probabilistic Models and Unstructured Modeling with suitable examples.	BTL 4	Analyze
7.	Analyze Sparse Autoencoders and Denoising Autoencoders with suitable illustrations.	BTL 4	Analyze
8.	Compare GANs and Variational Autoencoders (VAEs) in terms of architecture, training stability, and quality of generated samples.	BTL 4	Analyze
9.	Analyze the process of learning with Autoencoders and explain its significance in feature extraction.	BTL 4	Analyze
10.	Justify why Autoencoders are more suitable than Principal Component Analysis (PCA) for dimensionality reduction.	BTL 5	Evaluate
11.	Evaluate the effectiveness of Autoencoders for representation learning in deep neural networks.	BTL 5	Evaluate
12.	Assess the role of Variational Autoencoders in deep generative modeling with suitable examples.	BTL 5	Evaluate
13.	Evaluate the advantages and limitations of Generative Adversarial Networks in real-world applications.	BTL 5	Evaluate
14.	Develop an Energy-Based Model and explain its probability distribution with suitable illustrations.	BTL 6	Create
15.	Design a Variational Autoencoder for image generation and explain its working with a neat diagram.	BTL 6	Create
16.	Develop a Deep Generative Model using GAN for image synthesis and justify the design choices.	BTL 6	Create
17.	Construct a complete Autoencoder-based framework for feature learning and explain the architecture with suitable diagrams.	BTL 6	Create
