PAPER ID-310625

Roll No:

BTECH
(SEM VII) THEORY EXAMINATION 2024-25
DEEP LEARNING

TIME: 3 HRS   **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1.   Attempt *all* questions in brief.   **2 x 10 = 20**

Q no.	Question	CO	Level
a.	Discuss the differences between a perceptron and a support vector machine in terms of decision boundary formation.	1	K_1, K_2
b.	Discuss how the choice of a loss function affects model performance for a classification problem.	1	K_1, K_2
c.	Trace the historical development of deep learning that enabled deep networks to outperform traditional machine learning models.	2	K_1, K_2
d.	How does weight sharing in CNNs improve efficiency and performance?	2	K_1, K_2
e.	Explain the impact of weight initialization on the performance of deep networks.	3	K_2
f.	Compare performance of autoencoders with traditional dimensionality reduction techniques.	3	K_2
g.	Provide examples of optimization algorithms used for deep networks.	4	K_2, K_3
h.	How do techniques address the challenges of stochastic optimization in deep learning?	4	K_2, K_3
i.	Describe the architecture and training of WaveNet for audio generation.	5	K_3, K_6
j.	Discuss the role of Word2Vec in natural language processing.	5	K_3, K_6

SECTION B

2.   Attempt any *three* of the following: **10 x 3 = 30**

a.	Derive the gradient of the logistic regression loss function with respect to its parameters. How does regularization impact its optimization process?	1	K_1, K_2
b.	Define VC dimension and discuss its implications for understanding the generalization capabilities of deep networks.	2	K_1, K_2
c.	Explain the role of manifold learning in dimensionality reduction. How does it compare to linear methods?	3	K_2
d.	Explain the concept of generalization in neural networks. How do techniques like dropout and weight regularization improve generalization performance?	4	K_2, K_3
e.	Discuss the pipeline of scene understanding using deep learning models. How does this pipeline handle challenges like occlusion and varying lighting conditions?	5	K_3, K_6

SECTION C

3.   Attempt any *one* part of the following: **10 x 1 = 10**

a.	Prove that neural networks can act as universal function approximators. Discuss any constraints or assumptions involved in this theorem.	1	K_1, K_2

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b.	Discuss the relationship between the choice of activation function in a shallow neural network and its ability to model non-linear relationships.	1	K_1, K_2

4. **Attempt any *one* part of the following:**   **10 x 1 = 10**

a.	Analyze the trade-offs between increasing network depth and the risk of vanishing/exploding gradients. What role does skip connections in ResNet play in addressing these issues?	2	K_1, K_2
b.	How does semi-supervised learning differ from supervised and unsupervised learning? Discuss its application in training deep networks with limited labeled data.	2	K_1, K_2

5. **Attempt any *one* part of the following:**   **10 x 1 = 10**

a.	Explain the concept of metric learning in the context of dimensionality reduction. How does it differ from traditional techniques like PCA	3	K_2
b.	Analyze the architectural differences between AlexNet, VGG, Inception, and ResNet. How do these architectures address the vanishing gradient problem?	3	K_2

6. **Attempt any *one* part of the following:**   **10 x 1 = 10**

a.	Discuss the implications of non-convex optimization in designing deep learning models. How do saddle points influence the training process?	4	K_2, K_3
b.	Provide a detailed overview of computational neuroscience principles applied in designing artificial neural networks.	4	K_2, K_3

7. **Attempt any *one* part of the following:**   **10 x 1 = 10**

a.	Provide a detailed overview of deep learning-based techniques for audio detection. How does WaveNet outperform traditional methods?	5	K_3, K_6
b.	Describe the process of joint detection and captioning in image captioning systems. How does attention enhance this process?	5	K_3, K_6