SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)
SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

VIII SEMESTER

1904801 DEEP LEARNING

Regulation – 2019

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Prepared by

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SUBJECT :1904801 DEEP LEARNING
SEM/YEAR : VIII/IV

UNIT - I: INTRODUCTION TO MACHINE LEARNING BASICS			
Scalars – Vectors – Matrices – Tensors – Identity and Inverse Matrices – Linear Dependence and Span – Eigen Decomposition – Probability – Random Variables – Conditional Probability – Expectation – Variance – Covariance –Bayes' Rule – Supervised Learning Algorithm – Unsupervised Learning Algorithm –Stochastic Gradient Descent.			
PART – A			
Q.No	**Question**	**BT Level**	**Competence**
1	**What** is Deep Learning?	BTL-1	Remember
2	**Differentiate** scalar and vector.	BTL-2	Understand
3	**Compare** Deep Learning and rule based system.	BTL-4	Analyze
4	**What** is Auto encoder?	BTL-1	Remember
5	**List** out the special kind of matrices.	BTL-1	Remember
6	**What** is representation learning?	BTL-1	Remember
7	**Compare** Deep Learning with Machine learning.	BTL-5	Evaluate
8	**State** the Bayes rule.	BTL-1	Remember
9	**List** out some supervised learning algorithms.	BTL-1	Remember
10	Can principle component analysis viewed as unsupervised learning algorithm? **Examine**.	BTL-3	Apply
11	**Discuss** about supervised learning algorithms.	BTL-2	Understand
12	**Give** Venn diagram for Deep Learning.	BTL-2	Understand
13	**Specify** the formula for conditional probability.	BTL-6	Create
14	**Illustrate** support vector machine.	BTL-3	Apply
15	**Show** the formula for Variance.	BTL-3	Apply
16	**Differentiate** Independence and Conditional Independence.	BTL-2	Understand
17	**Analyze** Eigen Decomposition.	BTL-4	Analyze
18	**Analyze** random variable.	BTL-4	Analyze

19	Probability theory is a fundamental tool of many disciplines of science and engineering. **Justify**.	BTL-5	Evaluate
20	**Develop** a formula for unbiased sample covariance matrix associated with an m x n dimensional matrix X. Assume E[x] =0.	BTL-6	Create
21	**Analyze** about tensor.	BTL-4	Analyze
22	**Illustrate** identity matrix?	BTL-3	Apply
23	**Discuss** about matrix inverse.	BTL-2	Understand
24	**Assess** linear dependence of vectors.	BTL-5	Evaluate
	PART – B		
1	i. **What** is Deep Learning? (3) ii. Describe how different parts of an Artificial Intelligence system relate to each other within different AI disciplines in detail with diagram.(10)	BTL-1	Remember
2	**Describe** how deep learning is a kind of representation learning with the Venn diagram. (13)	BTL-1	Remember
3	**List** and explain the historical trends in Deep Learning.	BTL-1	Remember
4	i. **Discuss** about scalars.(7) ii. Give detail description of vectors. (6)	BTL-2	Understand
5	i. **Give** the Difference between deep learning and machine learning.(7) ii. **Give** the various concepts of probability. (6)	BTL-2	Understand
6	**i. Demonstrate** linear dependence and independence of vectors.(7) **ii. Explain** span of vectors. (6)	BTL-3	Analyze
7	**Analyze** and write short notes on the following. i. Vectors. (6) ii. Matrices.(7)	BTL-4	Analyze
8	**Explain** the following in detail. i. Eigen Decomposition. (7) ii. Tensors.(6)	BTL-4	Apply
9	**Assess** the following. **i.** Expectation .(5) **ii.** Variance.(4) **iii.** Covariance . (4)	BTL-5	Evaluate
10	Extrapolate conditional probability and **Develop** a summary of various common probability distribution. (13)	BTL-6	Create
11	**Describe** Stochastic Gradient Descent. (13)	BTL-1	Remember
12	i. Illustrate the importance of principal components analysis. (6) ii. Explain support vector machines in detail. (7)	BTL-3	Analyze
13	**Explain** supervised learning algorithm. (13)	BTL-4	Apply

14	**Discuss** unsupervised learning algorithm. (13)	BTL-2	Understand
15	**Discuss** Normal distribution. (13)	BTL-2	Understand
16	**Explain** Probability Mass function and Probability Density function. (13)	BTL-3	Analyze
17	**Explain** Principal Components Analysis. (13)	BTL-5	Evaluate
	PART – C		
1	**Develop** short notes on following with respect to deep learning with examples. i) Scalar and Vectors. (6) ii) Matrices. (7)	BTL-6	Create
2	**Assess** the following with respect to deep learning examples. i) Random Variables. (6) ii) Probability. (7)	BTL-5	Evaluate
3	**Develop** a supervised learning algorithm and explain in detail.(15)	BTL-6	Create
4	**Assess** unsupervised learning algorithm.(15)	BTL-5	Evaluate
5	**Assess** the historical developments in deep learning. (15)	BTL-5	Evaluate

UNIT - II: DEEP NETWORKS

Deep Feed Forward Network: Learning XOR – Gradient Based Learning- Hidden Units – Architecture Design – Back Propagation Algorithms. Regularization for Deep Learning: Parameter Norm Penalties – Regularization and unconstrained Problems – Dataset Augmentation – Noise Robustness – Semi supervised Learning – Challenges in Neural Network Optimization.

PART – A

Q. No	Questions	BT Level	Competence
1	**Point out** different set of layers in Feed forward networks.	BTL-4	Analyze
2	**Point out** the default activation function for modern neural networks.	BTL-4	Analyze
3	**Compare** linear models and neural networks.	BTL-5	Evaluate
4	**Develop** three generalizations of rectified linear units based on using a non-zero slope.	BTL-6	Create
5	**What** is Deep Feed Forward networks?	BTL-1	Remember
6	**List** reasonably common hidden unit types.	BTL-1	Remember
7	**Give** the drawback of rectified linear units.	BTL-2	Understand
8	**Describe** gradient descent.	BTL-2	Understand
9	**Give** example of a feed forward neural network.	BTL-2	Understand
10	**Define** chain rule of calculus.	BTL-1	Remember
11	**List** some classification problems where Data augmentation is used.	BTL-1	Remember
12	**Define** universal approximation theorem for feed forward network.	BTL-1	Remember

13	**What** critical points or stationary points in derivative illustration of a function?	BTL-1	Remember
14	**Describe** regularization for deep learning.	BTL-2	Understand
15	**Illustrate** semi supervised learning.	BTL-3	Apply
16	**Illustrate** the derivative function used in gradient descent algorithm.	BTL-3	Apply
17	**Explain** importance of dataset augmentation.	BTL-3	Apply
18	**Analyze** and write chain rule of calculus.	BTL-4	Analyze
19	Reason for calling Feed forward neural networks as networks–**Justify.**	BTL-5	Evaluate
20	**Develop** a computational graph for any function.	BTL-6	Create
21	**Give** reason for the term "feed forward" used in the feed forward networks.	BTL-2	Understand
22	**Explain** XOR operation.	BTL-3	Apply
23	**Analyze** cost function.	BTL-4	Analyze
24	**Justify** the application of Dataset Augmentation various tasks	BTL-5	Evaluate
	PART – B		
1	**Describe** Deep feed forward networks. (13)	BTL-1	Remember
2	**Explain** cost function in gradient based learning. (6) Explain learning conditional distributions with maximum likelihood. (7)	BTL-3	Apply
3	i. **Describe** about learning conditional statistics in gradient based learning.(7) ii. Explain linear units for Gaussian Output Distributions.(6)	BTL-1	Remember
4	**Explain** output units of feed forward networks. (13)	BTL-3	Apply
5	i. Explain sigmoid units for Bernoulli Output Distributions.(8) ii. **Justify** the importance of Rectified linear units in Hidden units. (5)	BTL-5	Evaluate
6	i. **Give** Soft max units for Multinoulli Output Distributions. (7) ii. Discuss about Hidden Units. (6)	BTL-2	Understand
7	i. **Describe** Rectified linear units and their generalizations. (7) ii. Describe Logistic Sigmoid and Hyperbolic Tangent. (6)	BTL-2	Understand
8	i. Write a short notes on Radial Basis function, Soft plus and Hard tanh(7) ii. Write a short notes on Architecture Design. (6)	BTL-4	Analyze
9	i. **Describe** Back Propagation algorithm. (7) ii. Explain regularization for deep learning. (6)	BTL-1	Remember
10	Briefly **describe** Universal Approximation Properties and Depth. (13)	BTL-1	Remember
11	**Analyze** and write short notes on Dataset Augmentation. (13)	BTL-4	Analyze
12	**Develop** a data set and demonstrate Noise Robustness. (13)	BTL-6	Create
13	**Discuss** in detail about chain rule of calculus. (13)	BTL-2	Understand

14	**Illustrate** Computational graphs. (13)	BTL-4	Analyze
15	**Give** the applications of Dataset Augmentation. (13)	BTL-2	Understand
16	**Explain** Multi-Task Learning. (13)	BTL-3	Analyze
17	**Assess** Computational graphs with necessary diagrams. (13)	BTL-5	Evaluate
	PART – C		
1	**Develop** a Deep Feed forward network and explain. (15)	BTL-6	Create
2	**Assess** the routines to implement forward propagation computation. (15)	BTL-5	Evaluate
3	**Assess** the difference between linear models and neural networks. (15)	BTL-5	Evaluate
4	**Develop** your own scenarios to demonstrate computational graph. (15)	BTL-6	Create
5	**Develop** Chain Rule of Calculus. (15)	BTL-6	Create

UNIT - III: CONVOLUTIONAL NETWORKS

The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs – Data types – Efficient Convolution Algorithm – Random or Unsupervised Features.

Q.No	Questions	BT Level	Competence
	PART – A		
1	An essential feature of any convolutional network implementation is the ability to implicitly zero-pad the input V. **Justify**	BTL-5	Evaluate
2	The output layer of convolutional network is usually relatively inexpensive to learning layer. **Justify**.	BTL-5	Evaluate
3	**What** is convolutional networks?	BTL-1	Remember
4	**Create** a chart that demonstrates convolution with a stride.	BTL-6	Create
5	**How** pooling handles inputs of varying size?	BTL-4	Analyze
6	**What** is meant by convolution?	BTL-1	Understand
7	**List** three important ideas that help to improve a machine learning system.	BTL-1	Remember
8	**What** is unshared convolution?	BTL-2	Understand
9	**Define** primary visual cortex.	BTL-1	Remember
10	**How** to reduce the cost of convolutional network training?	BTL-2	Understand
11	**Simulate** the idea behind reverse correlation.	BTL-6	Create
12	**Discuss** about parameter sharing in neural network.	BTL-2	Understand
13	**Give** three properties of V1 that a convolutional network layer is designed to capture.	BTL-2	Understand
14	**Explain** feature map.	BTL-4	Analyze
15	**Explain** how a convolutional layer have a property called equi-variance to translation?	BTL-3	Apply

16	**List** three stages of a convolutional network.	BTL-1	Remember
17	**List** out various formats of data that can be used with convolutional networks.	BTL-1	Remember
18	**Illustrate** pooling stage in convolutional network.	BTL-3	Apply
19	**Differentiate** complex layer terminology and simple layer terminology in convolutional network.	BTL-4	Analyze
20	**Show** three basic strategies for obtaining convolution kernels without supervised training.	BTL-3	Apply
21	**Give** example for convolution.	BTL-2	Understand
22	**Illustrate** reverse correlation.	BTL-3	Apply
23	**Explain** complex layer terminology.	BTL-4	Analyze
24	**Examine** equi-variance to translation.	BTL-5	Evaluate
	PART – B		
1	**Write** an example function for Convolution operation and explain in detail. (13)	BTL-1	Remember
2	**Explain** the following with suitable diagram. i. Sparse interactions. (6) ii. Parameter sharing. (7)	BTL-4	Analyze
3	**Describe** Pooling with suitable example. (13)	BTL-1	Remember
4	**Write** an expression for Unshared convolution with explanation and explain Tiled convolution.(13)	BTL-1	Remember
5	**Discuss** in detail the variants of the Basic Convolution Function. (13)	BTL-2	Understand
6	**Construct** an architecture that show complex layer terminology and Simple layer terminology in convolutional neural network.	BTL-5	Evaluate
7	**Discuss** local connections, convolution and full connections with diagram? (13)	BTL-2	Understand
8	**Develop** a table with examples of different formats of data that can be used with convolutional networks. (13)	BTL-6	Create
9	**Describe** in detail about the following. i. Parameter Sharing. (7) ii. Equi-variant representation. (6)	BTL-1	Remember
10	**Differentiate** locally connected layers, tiled convolution and standard convolution with suitable examples and diagram. (13)	BTL-4	Analyze
11	i. **Write** short notes Max Pooling. (6) ii. Explain Pooling with down sampling. (7)	BTL-2	Remember
12	**Explain** random or Unsupervised Features.(13)	BTL-4	Analyze
13	**Illustrate** unshared convolution with suitable examples. (13)	BTL-3	Apply
14	**i. Show** three properties of V1 that a convolutional network layer is designed to capture. (6) **ii. Prove** the working learned invariances with necessary example and diagram. (7)	BTL-3	Apply
15	**Discuss** parameter sharing. (13)	BTL-2	Understand

16	**Illustrate** Equi-variant representation. (13)	BTL-3	Analyze
17	**Evaluate** the working learned invariances with necessary example and diagram. (13)	BTL-5	Evaluate
	PART – C		
1	**Construct** a graphical demonstration for sparse connectivity and explain it in detail. (15)	BTL-5	Evaluate
2	**Create** a graphical demonstration for parameter sharing and explain it in detail. (15)	BTL-6	Create
3	**Evaluate** variants of the basic convolution function. (15)	BTL-5	Evaluate
4	**Construct** a convolutional network to demonstrate the effect of zero padding on network size. Explain Neuro scientific basis for Convolutional Networks. (15)	BTL-6	Create
5	**Create** a table with examples of different formats of data that can be used with convolutional networks. (15)	BTL-6	Create

UNIT - IV: SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS

Unfolding Computational Graphs – Recurrent Neural Networks – Bidirectional RNNs – Encoder Decoder Sequence to Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Challenge of Long- Term Dependencies – Echo State Networks – The Long-term memory and other Gated RNNs – Optimization for Long Term Dependencies – Explicit Memory.

PART – A

Q.No	Questions	BT Level	Competence
1	**What** is Recurrent Neural Networks**?**	BTL-1	Remember
2	**What** is Encoder?	BTL-1	Remember
3	**Give** the blocks of decomposition of computation of most Recurrent Neural Networks.	BTL-2	Understand
4	**What** is Bidirectional Recurrent Neural Networks?	BTL-1	Remember
5	**Give** the advantage of recursive nets over recurrent nets.	BTL-2	Understand
6	**What** is decoder?	BTL-1	Remember
7	**Describe** Recursive Neural Networks.	BTL-1	Remember
8	**Predict** the concept of gated RNNs.	BTL-2	Understand

9	**Compare** echo state network and liquid state machines.	BTL-4	Analyze
10	**Distinguish** content based addressing and location based addressing in memory networks.	BTL-2	Understand
11	**Classify** the different strategies for Multiple Time Scales.	BTL-3	Apply
12	**Develop**a block diagram for LSTM.	BTL-6	Create
13	**Illustrate** important design patterns for recurrent neural networks.	BTL-3	Apply
14	**Summarize** about echo state networks.	BTL-5	Evaluate
15	**Point out** the advantage of introducing depth in Deep recurrent Networks.	BTL-4	Analyze
16	**Compare** gradient descent with and without gradient clipping using diagram.	BTL-4	Analyze
17	**Justify** the major advantages of unfolding process in computational graphs.	BTL-5	Evaluate
18	**Illustrate** block diagram of LSTM recurrent network "cell".	BTL-3	Apply
19	**What** are leaky units?	BTL-1	Remember
20	**Develop** a schematic diagram of a network with an explicit memory.	BTL-6	Create
21	**Give** a block diagram for Long Short Term Memory.	BTL-2	Understand
22	**Illustrate** echo state networks.	BTL-3	Apply
23	**Explain** liquid state machines.	BTL-4	Analyze
24	**Assess** explicit memory.	BTL-5	Evaluate
	PART – B		
1	**i. Describe** Unfolding Computational Graphs. (6) **ii.** Explain Bidirectional RNNs. (7)	BTL-1	Remember
2	**Describe** the following. i. Teacher Forcing in Recurrent Neural Networks. (7) ii. Networks with Output Recurrence. (6)	BTL-1	Remember
3	i. **Describe** Echo State Networks. (7) ii. **Explain** challenge of Long-Term Dependencies.(6)	BTL-1	Remember
4	**Discuss** Recurrent Neural Networks in detail.(13)	BTL-2	Understand
5	**Describe** Deep Recurrent Networks in detail.(13)	BTL-2	Understand
6	**Illustrate** Encoder-Decoder sequence-to-sequence Architecture. (13)	BTL-3	Apply
7	**Explain** Leaky Units and Other Strategies for Multiple Time Scales. (13)	BTL-4	Analyze
8	**Point out** various features of Echo state networks. (13)	BTL-4	Analyze
9	**Explain** Optimization for Long-Term Dependencies**.** (13)	BTL-5	Evaluate
10	**Compute** the gradient in a Recurrent Neural Network. (13)	BTL-6	Create

11	i. **Illustrate** Clipping Gradients. (7) ii. **Illustrate** Regularizing to Encourage Information Flow.(6)	BTL-3	Apply
12	**Describe** the following. i. Long Short-Term Memory. (7) ii. Other Gated RNNs. (6)	BTL-1	Remember
13	**Explain** in detail about the following. i. Adding Skip Connections through Time. (6) ii. Leaky Units and a Spectrum of Different Time Scales .(7)	BTL-4	Analyze
14	**Describe** Explicit memory. (13)	BTL-2	Understand
15	**Discuss** Echo State Networks. (13)	BTL-2	Understand
16	**Illustrate** Bidirectional RNNs.(13)	BTL-3	Analyze
17	**Explain** challenge of Long-Term Dependencies. (13)	BTL-5	Evaluate
	PART – C		
1	**Develop** an example for Unfolding Computational Graphs and describe the major advantages of unfolding process. (15)	BTL-6	Create
2	**Explain** how to compute the gradient in a Recurrent Neural Network.(15)	BTL-5	Evaluate
3	**Explain** a modeling sequences Conditioned on Context with RNNs. (15)	BTL-5	Evaluate
4	**Prepare** an example of Encoder- Decoder or sequence-to-sequence RNN architecture.(15)	BTL-6	Create
5	**Explain** various Gated RNNs. (15)	BTL-5	Evaluate

UNIT - V: DEEP LEARNING APPLICATION

Linear Factor Models – Auto Encoders - Representation Learning – Structured Probabilistic Models for Deep Learning - Monte Carlo Methods.

PART – A

Q.No	Question	BT Level	Competence
1	**What** is Probabilistic PCA and Factor Analysis?	BTL-1	Remember
2	**Define** Linear Factor Model.	BTL-1	Remember
3	**Give** the various generalizations of ICA.	BTL-2	Understand
4	**What** is Independent Component Analysis?	BTL-1	Remember
5	**Give** major advantage of slow feature analysis.	BTL-2	Understand
6	**Name** the various tasks than can be done by probabilistic models.	BTL-1	Remember
7	**What** is Denoising Auto encoders?	BTL-1	Remember
8	**Predict** the primary disadvantage of the non-parametric encoder.	BTL-2	Understand
9	**Point** out the trade-off faced in representation learning problems.	BTL-4	Analyze

10	**Distinguish** between one-shot learning and zero-shot learning.	BTL-2	Understand
11	**Classify** the different Graphical models.	BTL-3	Apply
12	**Develop** distribution equation for energy based model.	BTL-6	Create
13	**Which** are undirected models?	BTL-3	Apply
14	**Summarize** Distributed representations.	BTL-5	Evaluate
15	**Point out** the reason for why Greedy layer-wise pre-training called Greedy.	BTL-4	Analyze
16	**Compare** directed models and undirected models.	BTL-4	Analyze
17	Slow Feature Analysis is an efficient application of slowness principle? **Justify**.	BTL-5	Evaluate
18	**How** many task does the learner must perform in transfer learning?	BTL-3	Apply
19	**List** the two different ideas combined by Unsupervised pre-training.	BTL-1	Remember
20	**Develop** an example for distribution equation that represent a Boltzman distribution.	BTL-6	Create
21	**Give** an example of learning algorithm based on non-distributed representations.	BTL-2	Understand
22	**Compare** distributed representation and a symbolic one.	BTL-4	Analyze
23	**Illustrate** the reasons for which Modeling a rich distribution is not feasible in unstructured modeling.	BTL-3	Apply
24	**Evaluate** Undirected models.	BTL-5	Evaluate
	PART – B		
1	**Describe** Sparse Coding. (13)	BTL-1	Remember
2	**Describe** the following i. Probabilistic PCA and. (6) ii. Factor Analysis. (7)	BTL-1	Remember
3	**Describe the following.** **i,** Independent Component Analysis,**.**(5) **ii,** Slow Feature Analysis**.** (8)	BTL-1	Remember
4	**Discuss** Manifold interpretation of PCA. (13)	BTL-2	Understand
5	**Discuss** Auto encoders**.** (13)	BTL-2	Understand
6	**Write** in detail about Under complete Auto encoders. (13)	BTL-3	Apply
7	**Explain** Regularized Auto encoders. (13)	BTL-4	Analyze
8	**Compare** Structured Probabilistic Model and Unstructured Modeling (13)	BTL-4	Analyze
9	**Summarize** usage of various Graphs to describe Model Structure.(13)	BTL-5	Evaluate
10	**Develop** an example distribution equation for energy-based model and explain in detail**.** (13)	BTL-6	Create
11	**i. Write** short notes Sparse Autoencoders.(7) **ii. Illustrate** Denoising Autoencoders. (6)	BTL-4	Analyze
12	**Describe** the following. i. Representation learning.(6) ii. Greedy Layer-Wise Unsupervised Pretraining.(7)	BTL-1	Remember

13	**Discuss** in detail about transfer learning and Domain Adaptation. (13)	BTL-3	Apply
14	**Describe** Distributed Representation.(13)	BTL-2	Understand
15	**Discuss** about Slow Feature Analysis. (13)	BTL-2	Understand
16	**Write** about representation learning. (13)	BTL-3	Analyze
17	**Explain** Markov random fields. (13)	BTL-5	Evaluate
	PART – C		
1	**Develop** a short notes on Separation and D-Separation.(15)	BTL-6	Create
2	**Explain** Monte Carlo methods.(15)	BTL-5	Evaluate
3	**Explain** Auto encoders.(15)	BTL-5	Evaluate
4	**Develop** a various graphs to describe Model Structure. (15)	BTL-6	Create
5	**Assess** Independent Component Analysis. (15)	BTL-5	Evaluate