22DS3E4: DEEP LEARNING

Course Name	Deep Learning		L	T	P	C	CIA	SEE	TM
Course Code	22DS3E4		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Descriptive and Purpose: This course is intended to facilitate students' comprehension of several key aspects of deep learning. It covers foundational principles of deep learning, explores memory-augmented neural networks, delves into deep reinforcement learning, provides hands-on experience with neural networks in TensorFlow, and examines practical applications of deep learning in various fields.

Course Objectives: The course help the students to understand Basics of Deep Learning, Memory Augmented Neural Networks, Deep Reinforcement Learning, Neural Networks in Tensor Flow, Applications of Deep Learning.

Specific objectives include:
1. To gain familiarity in Basics of Deep Learning.
2. To understand the concepts of Memory Augmented Neural Networks.
3. To acquire knowledge Deep Reinforcement Learning.
4. To implement Neural Networks in Tensor Flow
5. To understand the Applications of Deep Learning.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Students will possess a comprehensive understanding of Convolutional Neural Networks (CNNs), including their architecture, feature extraction, max pooling, image preprocessing, batch normalization, and training algorithms, equipping them with the knowledge and skills to effectively apply CNNs to various computer vision tasks and artistic style replication
CO2: Students will have a deep understanding of Memory Augmented Neural Networks, including Neural Turing Machines and Differentiable Neural Computers, along with their memory addressing mechanisms, interference-free writing, temporal linking, and practical implementation in Tensor Flow, enabling them to apply these advanced memory-augmented models for tasks requiring memory and comprehension.
CO3: Students will have mastered Deep Reinforcement Learning, including its application in mastering Atari games, understanding the fundamentals of Reinforcement Learning, Markov Decision Processes (MDP), exploration-exploitation trade-offs, policy and value learning, and practical implementation of algorithms like Q-Learning and Deep Q Networks (DQN) for solving complex decision-making problems.
CO4: students will be proficient in implementing neural networks in Tensor Flow, including creating and manipulating Tensor Flow variables, performing operations, working with placeholder tensors, managing sessions, handling variable scopes, specifying and training models for various tasks, and effectively utilizing Tensor Flow for deep learning projects.
CO5: This course will equip students with the knowledge and skills to apply large-scale deep learning techniques to a wide range of applications, including computer vision, speech recognition, natural language processing, and various other domains, enabling them to solve complex real-world problems using deep learning models.

UNIT-I (12 Hours)

Basics of Deep Leaning- Deep learning architectures: Convolutional Neural Networks : Neurons in Human Vision – The Shortcomings of Feature Selection – Vanilla Deep Neural Networks Don't Scale – Filters and Feature Maps – Full Description of the Convolutional Layer – Max Pooling - Full Architectural Description of Convolution Networks – Closing the Loop on MNIST with Convolutional Networks – Image Preprocessing Pipelines Enable More Robust Models – Accelerating Training with Batch Normalization –Building a Convolutional Network for CIFAR 10 – Visualizing Learning in Convolutional Networks – Leveraging

Convolutional Filters to Replicate Artistic Styles – Learning Convolutional Filters for Other Problem Domains – Training algorithms.

UNIT-II (12 Hours)

Memory Augmented Neural Networks: Neural Turing Machines – Attention Based Memory Access – NTM Memory Addressing Mechanisms – Differentiable Neural Computers – Interference Free Writing in DNCs-DNC Memory Reuse – Temporal Linking of DNC Writes – Understanding the DNC Read Head – The DNC Controller Network – Visualizing the DNC in Action-Implementing the DNC in Tensor Flow – Teaching a DNC to Read and Comprehend.

UNIT-III (12 Hours)

Deep Reinforcement Learning: Deep Reinforcement Learning Masters Atari Games – What Is Reinforcement Learning? – Markov Decision Processes (MDP) – Explore Versus Exploit – Policy versus Value Learning – Pole Cart with Policy Gradients- Q Learning and Deep Q Networks – Improving and Moving Beyond DQN.

UNIT-IV (12 Hours)

Implementing Neural Networks in Tensor Flow: What Is Tensor Flow? – How Does Tensor Flow Compare to Alternatives? – Installing Tensor Flow – Creating and Manipulating Tensor Flow Variables – Tensor Flow Operations-Placeholder Tensors-Sessions in Tensor Flow – Navigating Variable Scopes and Sharing Variables – Managing Models over the CPU and GPU – Specifying the Logistic Regression Model in Tensor Flow – Logging and Training the Logistic Regression Model.

UNIT-V (12 Hours)

Applications: Large Scale Deep Learning – Computer Vision – Speech Reorganization – Natural Language Processing – Other Applications.

Prescribed Text Books			
	Author	Title	Publisher
1	Nikhil Buduma, Nicholas Locascio	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms.	O'Reilly Media, 2017
2	Ian Goodfellow, YoshuaBengio, Aaron Courville	Deep Learning (Adaptive Computation and Machine Learning series).	MIT Press, 2017

Reference Text Books			
	Author	Title	Publisher
1	Douwe Osinga	Deep learning Cook Book, Practical Recipes to Get Started Quickly	O'Reilly

e-Resources:
1) https://keras.io/datasets/
2) http://deeplearning.net/tutorial/deeplearning.pdf
3) https://arxiv.org/pdf/1404.7828v4.pdf
4) https://github.com/lisa-lab/DeepLearningTutorials

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.Sc.(Computational Data Science), Third Semester

Course Name: Deep Learning

Course Code: 22DS3E4

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70**

SECTION-A

Answer ALL questions **(5×4=20Marks)**

1. (a) Explain Max Pooling.(CO1, L2)

(or)

(b) Explain Accelerating Training with Batch Normalization. (CO1,L2)

2. (a) What is Attention Based Memory? Explain.(CO2,L1)

(or)

(b) Explain Visualizing the DNC in Action.(CO2,L1)

3.(a) What are the differences between Explore and Exploit? (CO3,L1)

(or)

(b) List out the Algorithm steps in implementation of Reinforce. (CO3,L1)

4.(a) Explain Creating and Manipulating Tensorflow Variables. (CO4,L2)

(or)

(b) Explain Operations in Tensorflow. (CO4,L2)

5.(a) Explain Neural Machine Translation. (CO5,L2)

(or)

(b) Explain Speech Recognition and its applications? (CO5,L2)

SECTION-B

Answer Five Questions Choosing One Question from each unit.

All Questions Carry Equal Marks. **(5×10=50Marks)**

6. (a) Explain about Filters and Feature Maps..(CO1,L2)

(or)

(b) Explain Building a Convolutional Network for CIFAR 10.(CO1,L2)

7. (a) Divide various NTM Memory Addressing Mechanisms. (CO2,L4)

(or)

(b) Explain about Differentiable Neural Computers. (CO2,L4)

8. (a) What is Markov Decision Processes ? Explain. (CO3,L1)

(or)

(b)What is Deep Reinforcement Learning? Explain. (CO3,L1)

9.(a) Explain Placeholder Tensors and Sessions in Tensor Flow. (CO4,L2)

(or)

(b) Explain Specifying the Logistic Regression Model in Tensorflow. (CO4,L2)

10. (a) Explain Pre Processing and Data Set Augmentation in Computer Vision.(CO5,L5)

(or)

(b) Explain use of Shortlist and Hierarchical Softmax in NLP. (CO5,L5)