CENTRAL UNIVERSITY OF PUNJAB
BATHINDA

Post Graduate Certificate Course in Deep Neural Networks

Session – 2024 onwards

Department of Computer Science & Technology

Proposed Course Curriculum
Certificate Course in Deep Neural Networks

Course Description: Deep neural networks are an emerging area and is effecting the research in mostly all disciplines. Thus there is a strong need to train our students from various departments in the area of neural networks and deep learning. The course is designed for Second year PG students and PhD research Scholars. The course will be based on case studies from various disciplines with hands on training.

The course duration will be of 6 months. The broad topics to be covered are given below.

Programme Objectives

Deep neural networks are used in most fields from Education, Law to Medical Science, Defense and other critical areas. The objective of this certificate course is to introduce the students from various disciplines to the area of Deep Neural Networks. The certificate course will help the students from various disciplines to:

1. Understand the concept of neural networks and its evolution to deep neural networks
2. Discuss major technology trends driving Deep Learning
3. Be able to build, train and apply deep neural networks to their area specific problems
4. Recognize the key parameters in a neural network's architecture that effect the results

Desirable: Basic programming skill

Eligibility: Any UG Program in Science or Humanities

Duration: 06 months

Number of Seats: 30

The certificate course comprises of two papers with project work:

Course code	**Course Title**	**Course Type**	**Credits Hours**			
			L	**T**	**P**	**Cr**
CNN 101	**Artificial Neural Networks**	**Core**	**4**	**1**	**2**	**6**
CNN 102	**Deep Neural Networks**	**Core**	**4**	**1**	**2**	**6**
CNN 103	Capstone Project	**Skill Based**	**0**	**0**	**16**	**8**

Total Credits	**8**	**2**	**20**	**20**

Course Code:CNN 101

L	T	P	Cr
4	0	4	6

Course Title: Artificial Neural Networks

Course Objectives

- Understand the basic concepts of neural networks, including neurons, activation functions, and architectures.
- Identify and describe various neural network architectures.
- Explain the process of training neural networks, including the backpropagation algorithm and gradient descent.
- Applying neural networks to simple real world problems

Learning Outcomes

After completion of the course the students will be able to

- Describe Artificial Intelligence and Machine Learning
- Explain the architecture and characteristics of Artificial Neural Networks
- Discuss the different types of neural network training algorithms
- Build simple neural network models using open source tools

Unit I: Introduction to Artificial Intelligence and Machine learning and their role in emerging areas. 10 Hrs

Unit II: Fundamentals of Artificial Neural Networks (ANN): Definition, Introduction to the ANN Architecture, Characteristics of neural networks, Example uses of ANN. 12 **Hrs**

Unit III: Neural Networks Training Algorithms: Supervised and Unsupervised Training Algorithms, Learning using Hebbian, competitive and Boltzmann method, Types of Activation Functions. **18 Hrs**

Unit IV: Building a neural network from scratch using either MatLab, Python. Introduction to open source libraries for machine learning like Tensor flow. 20 **Hrs**

Text book

1. Herbert Jones, Neural Networks: An Essential Beginners Guide to Artificial Neural Networks and their Role in Machine Learning and Artificial Intelligence

Suggested Reading

1. Neil Wilkins, Artificial Intelligence: An Essential Beginner's Guide to AI, Machine Learning, Robotics, The Internet of Things, Neural Networks, Deep Learning, Reinforcement Learning and Our Future, Bravex Publications (20 July 2019)
2. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, (3rd Edition)
3. Chandra S.S.V, Artificial Intelligence and Machine Learning, Prentice Hall India Learning Private Limited; 1st edition (1 January 2014)
4. Denis Rothman, Artificial Intelligence By Example, Packt Publishing; 1st edition (31 May 2018)

Course Code:CNN102

Course Title: Deep Neural Networks

L	T	P	Cr
4	0	4	6

Course Objectives

- Understand the fundamental concepts and components of deep neural networks (DNNs).
- Describe various types of DNN model
- Learn the process of training DNNs using different algorithms.
- Understand the concept of transfer learning and its significance in deep learning.
- Learn to identify critical hyperparameters in DNNs, such as learning rates, batch sizes, and layer configurations.

Learning Outcomes

After completion of the course the students will be able to

- Discuss the Deep Neural Network Models and their types
- Apply various Deep Neural Network Training algorithms
- Describe Transfer Learning and its types
- Design Deep Neural Network model as minor project and Identify and fine tune the Deep Neural Network parameters

Unit I: Deep Neural Networks, Types of Deep Neural Network Models (RNN, CNN, LSTM, Deep Belief Network, semantic Hashing). Uses, merits and demerits of various models. Training deep neural network: Training process of deep neural networks, Challenges in training the deep learning models and frontier areas of research. 20 Hrs

Unit II: Overview of Transfer Learning: Inductive, unsupervised and Transductive 15 **Hrs**

Unit III: Building deep neural network based project 15 Hrs

Unit IV: Tuning Deep Learning Models, Trends in Deep Learning, Deep Neural Networks Case Studies **10 Hrs**

Text Book

1. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer; 1st ed. 2018 edition (13 September 2018)

Suggested Reading

1. Seth Weidman, Deep Learning from Scratch: Building with Python from First Principles, O`Reilley.
2. David Julian, Deep Learning with PyTorch Quick Start Guide: Learn to train and deploy neural network models in Python, Packt Publishing Limited (24 December 2018)
3. Yuxi (Hayden) Liu, Hands-On Deep Learning Architectures with Python: Create deep neural networks to solve computational problems using TensorFlow and Keras, Packt Publishing Limited (30 April 2019).