

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Technology
Name of Programme:	BTech in Electronics and Instrumentation Engineering
Semester:	VII
Course Code:	4EI501ME25
Course Title:	Deep Learning for Vision Systems
Course Type:	Department Elective-III
Year of Introduction:	2024-25

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. illustrate basic architecture of convolution neural network (BL2)
2. evaluate existing practical vision systems (BL5)
3. optimize convolutional neural network model (BL5)
4. design deep learning based real life vision applications (BL6)

Unit	Contents	Teaching hours (Total 45)
Unit- I	Introduction to Computer Vision Image acquisition, image pre-processing, feature extraction, computer vision pipeline, applications of computer vision.	04
Unit- II	Deep Learning Single layer perceptron, multi-layer perceptron (MLP), activation functions, errors functions, backpropagation, feedforward process, optimization algorithm.	09
Unit- III	Convolutional Neural Networks Image classifications using MLP, basic components of a convolutional neural network (CNN), CNN architecture, image classification using CNN, overfitting and underfitting, popular CNN architectures.	08
Unit- IV	Design of Deep Learning Structure Baseline model design, define performance metrics, data preparation, model training, model evaluation, performance estimation, network improvements, hyperparameter tuning, optimization and learning, regularization, batch normalization.	11
Unit- V	Image Classification and Detection Advanced CNN architectures, object detection, transfer learning, object classification.	08

Industrial and commercial applications of deep learning in vision systems, case studies and latest research in the area of deep learning.

Self Study:

The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. Mohamed elgendy, *Deep learning for vision systems*, Manning publications.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep learning*, The MIT press publications.
3. Francois chollet, *Deep learning with python*, Manning publications.
4. Josh patterson, Adam gibson, *Deep learning: A practitioner's approach*, Shroff/O'Reilly publications.
5. Nikhil buduma, Nicholas locascio, *Fundamentals of deep learning: Designing next-generation machine intelligence algorithms*, Shroff/O'Reilly publications.

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1.	Understand the basic image acquisition and pre-processing process	02
2	Understand and implement the basic pipeline of a vision application	02
3	Implement the activation functions and error functions	02
4	Implement the back-propagation and feed-forward process	02
5	Apprehend the data preparation for an application	02
6	Implement a basic CNN architecture - I	02
7	Implement a basic CNN architecture - II	02
8	Apprehend the model evaluation and analysis	02
9	Apprehend the model improvement techniques	02
10	Develop a simple CNN application	02
11	Develop an object detection application	02
12	Develop an object classification application	02