Department Elective with Laboratory:

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech in Electronics and Instrumentation Engineering
Course Code:	2EIDE61
Course Title:	Deep learning for vision systems
Course Type:	([] Core/[] Value Added Course/[√] **Departmental Elective**/ [] Institute Elective/[]University Elective/[]Any other)
Year of introduction:	2023-2024

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLO):

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

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

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
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	05
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	05

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	09
Unit-V	**Image classifications** Object detection, transfer learning, object classification, advanced CNN architectures	07

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: Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

Suggested List of Experiments:

1. Introduction to the simulation software
2. Image pre-processing and feature extraction
3. Apprehend the activation functions and error functions
4. Apply the feedforward and backpropagation learning
5. Image data preparation
6. Model training
7. Perform model optimization and evaluation
8. Model improvements and hyperparameter tuning
9. Apply regularization and batch normalization
10. Design of an object detection application
11. Design of an object classification application
12. Understand advanced CNN architecture

Suggested Readings/ References:

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 Case List: Fabric defect detection, empty bottle inspection, sorting/grading applications, surface defect detection applications, print quality inspection etc.

L= Lecture, T=Tutorial, P= Practical, C= Credit