COURSE HANDOUT

ARTIFICIAL INTELLIGENCE WITH COMPUTER VISION (COM-601)

BE-6TH SEMESTER

ACADEMIC YEAR (2024-25)

Dr. Richa Vij

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Department of Computer Science and Engineering

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-601	Artificial Intelligence with Computer Vision	PCC	4	3	1	0	50	100	150

COURSE OUTCOMES

	At the end of the course, the student will be able to:
CO1	Design and implement intelligent solutions to classification, regression and clustering problems.
CO2	Design and implement distinguishing features in pattern and object recognition tasks.
CO3	Understand how images are represented numerically and to Implement image processing techniques like Colour and geometric transforms.
CO4	Design to programmatically track a single point over time and understand motion models that define Object Movement over time.
CO5	Implement a method for tracking a set of unique features over time to match features from one image Frame to another.

Unit-I

Introduction to Artificial Intelligence: Basic of AI, history of AI, various techniques of Artificial Intelligence (Machine learning, NLP, Automation & Robotics and Computer vision, Types of AI, Applications of Artificial Intelligence, two ways of Artificial Intelligence work i.e., symbolic and Data Based.

(8 Hours)

Unit-II

Foundation of Machine learning: Terminology used in ML, ML Process (Building the Model), Supervised ML, Unsupervised ML and Reinforcement ML and its Algorithms, types of problems solved using ML (Regression, Classification, Clustering), Exploratory Data Analysis on Real world Problem i.e., possibility of Rain including the variable dependency.

(8 Hours)

Unit-III

Image Processing, Computer Vision and Computer Graphics: Computer Vision - Low-level, Mid-level, High- level, Overview of Diverse Computer Vision Applications, Light-Models, Image Acquisition, and Backgrounds: Adaptive Background Subtraction; Camera Geometry, Calibration, and Stereo Interest Operators and Feature Extraction.

(8 Hours)

Unit- IV

Tracking: Feature Tracking (Selecting features, Nose Tracking); Direct Method (Image-Based Tracking): Head Tracking, Face feature tracking; Model-based Tracking: (Hand tracking, Body tracking, Fingertip Tracking), Kalman Filtering, Particle Filtering and Mean shift tracking.

(8 Hours)

Unit-V

Recognition: Space-Time Methods: Discriminant Analysis, Bayesian Network Classifiers; Temporal Methods; Model-Based Methods (Markov-Dynamic Networks); Hidden Markov Models.

(8 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson	4th (2020)
2.	Computer Vision - A Modern Approach	D. Forsyth and J. Ponce	McGraw-Hill	2nd (2018)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Artificial Intelligence: Strategies and Techniques for complex problems solving	George Luger	Addison Wesley	6th (2008)
2	Introductory Techniques for 3D Computer Vision	E. Trucco and A. Verri	Prentice Hal	2nd (2009)

COURSE PLAN		
Unit-I Introduction to Artificial Intelligence		
S.No	**Topics**	**Recommended Books**
1	Introduction to Artificial Intelligence	Book 1, Ch.1
2	Basic of AI	Book 1, Ch.1
3	History of AI	Book 1, Ch.1
4	How AI is related to Computer Vision	Book 2, Ch.2
5	Various Techniques of Artificial intelligence	Book 2, Ch.2
6	Types of AI	Book 2, Ch.2
7	Applications of Artificial Intelligence	Book 2, Ch.2
8	Two ways of Artificial intelligence work i.e., symbolic and Data Based.	Book 2, Ch.2
Unit-II Foundation of Machine learning:		
9	Terminology used in ML	Book 1, Ch.2
10	ML Process (Building the Model)	Book 1, Ch.1
11	Supervised ML, Unsupervised ML and Reinforcement ML	Book 2, Ch.2
12	Algorithms	Book 2, Ch.2
13	types of problems solved using ML (Regression)	Book 2, Ch.2
14	types of problems solved using ML (Classification)	Book 2, Ch.2
15	types of problems solved using ML (Clustering)	Book 2, Ch.2
16	Exploratory Data Analysis on Real world Problem i.e., possibility of Rain including the variable dependency.	Book 2, Ch.2
Unit-III Image Processing, Computer Vision and Computer Graphics		
17	Computer Vision - Low-level	Book 2, Ch.2
18	Computer Vision - Mid-level	Book 2, Ch.2
19	Computer Vision - High-level	Book 2, Ch.2
20	Overview of Diverse Computer Vision Applications	Book 2, Ch.2
21	Light-Models, Image Acquisition, and Backgrounds	Book 2, Ch.2
22	Adaptive Background Subtraction	Book 2, Ch.2
23	Camera Geometry, Calibration,	Book 2, Ch.2
24	Stereo Interest Operators and Feature Extraction	Book 2, Ch.2

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	Unit-IV Tracking:	
25	Feature Tracking (Selecting features, Nose Tracking)	Book 2, Ch.3
26	Direct Method (Image-Based Tracking)	Book 1, Ch.4
27	Head Tracking	Book 1, Ch.4
28	Face feature tracking	Book 2, Ch.3
29	Model-based Tracking: (Hand tracking, Body tracking, Fingertip Tracking)	Book 1, Ch.3
30	Kalman Filtering,	Book 2, Ch.3
31	Particle Filtering.	Book 1, Ch.3
32	Mean shift tracking	
	Unit-V Recognition	
33	Space-Time Methods	Book 2, Ch.8
34	Discriminant Analysis	Book 1, Ch.8
35	Bayesian Network Classifiers	Book 2, Ch.8
36	Temporal Methods	Book 1, Ch.8
37	Model-Based Methods (Markov-Dynamic Networks)	Book 2, Ch.8
38	Hidden Markov Models	Book2, Ch. 8
39	Integration of Discriminant Analysis and Bayesian Networks	Book 2, Ch.2
40	Dynamic Spatial Networks	Book 2, Ch.2

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Introduction to Computer Vision and Image Processing https://www.coursera.org/programs/b-e-faculty-learning-path-julcd/learn/introduction-computer-vision-watson-opencv?source=search
2.	**COURSERA:** Introduction to Artificial Intelligence (AI) https://www.coursera.org/programs/b-e-faculty-learning-path-julcd/learn/introduction-to-ai?source=search

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

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FACULTY INFORMATION

- **Office Hours**
  Monday (12:05 PM - 12:55 PM)
  Friday (12:05 PM - 12:55 PM)

- **Contact Information**
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