Course Code	UDS21402J	Course Name	INTRODUCTION TO COMPUTER VISION	Course Category	C	Professional Core Course	L	T	P	C
							4	0	2	5

Pre-requisite Courses	Nil		Co-requisite Courses	Nil		Progressive Courses	Nil
Course Offering Department		Computer Applications		Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning			Program Learning Outcomes (PLO)															
CLR-1 :	Inculcate the participants with the fundamentals of computer vision, their working principles and their functions in a business scenario.	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	To teach the participants the functions of a Computer vision techniques involved in training the Computer vision models on different problems like image classification, image detection, Object recognition, object detection etc, with a deep dive into the role the computer vision techniques play in building a scalable enterprise machine learning solutions.																		
CLR-3 :	To teach the participants to build intelligent and automated real-world Computer vision applications and use cases spanning healthcare, retail, energy verticals by intelligently analyzing different datasets collected from diverse data sources.																		
CLR-4 :	To teach the participants choosing the right set of frameworks involved in building critical Computer Vision solutions which are efficient, reliable and working at scale.																		
CLR-5 :	To introduce the participants to the modelling pedigree of Text classification, Image classification, Image detection, Object recognition, and Object detection techniques.																		
CLR-6 :	To bring the learners to an alignment, applies their learning to a real-world business problem, and then performs research, design, development, and delivers an end-to-end Computer vision for a given industry problem. The students will be working either in a group or individually.																		

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLO-1 :	Have a strong control over the fundamental concepts of Computer vision including the ability to clearly define Computer vision from both academic and industry perspective.	2	85	80	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-2 :	Gain hands-on solid skills, knowledge and expertise of real-world situations the applicability of tools and techniques in extracting valuable insights from the data of different formats on time.	3	85	80	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-3 :	Have solid hands-on skills, knowledge and expertise in Data gathering, Data collection, Model training, and model evaluation with domain-specific components.	3	85	80	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-4 :	Have a good Hands-on skills, knowledge and expertise on applying all the computer vision techniques to real -world industry problems.	3	85	80	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H
CLO-5 :	Have solid hands-on skills, knowledge and expertise in applying the right computer vision techniques for the problem statement at hand.	3	85	80	H	H	H	H	H	H	H	H	H	H	M	H	H	H	H

CLO-6 :	Design and develop computer vision processing solution artifacts and ultimately demonstrate an "end-to-end" computer vision solution for a given problem statement either in a group or individually.	3	85	80		H	H	H	H	H	H	H	H	H	M	H	H	H	H

Note: All our curriculum, study materials, assignments, quizzes, lab works, and learning resources are personalized and dynamically generated using machine learning models based on the learner's learning ability. Users can review our learning curriculum only through our intelligent learning management platform (iLMSP), and our learning resources and lab infrastructures are available only in the digital form on our cloud infrastructures.

Duration (hour)		18	18	18	18	18
S-1	SLO-1	**Unit 1: Computer Vision Defined - Academic and Industry Perspective**	Computer Vision in Energy	**Unit 6: Computer Vision Implementation Framework**	Image Processing Models Canny Edge Detectors	Choosing the software components
	SLO-2	Computer Vision Overview	Computer Vision in Oil & Gas	What is a Computer Vision framework?	Hough Transformers	Choosing the OS
S-2	SLO-1	Computer Vision defined from academic perspective	Computer Vision in Automobile	Features of a good Computer Vision framework	SURF	Adding Packages
	SLO-2	Computer Vision defined from Industry perspective	**Unit 4: Computer Vision Workflow**	Popular Computer Vision frameworks ✓ OpenCV ✓ TensorFlow ✓ Matlab ✓ CUDA ✓ YOLO	Image Classification Models	**Unit 12: Computer Vision Hands On Lab Work - Build, Test and Deploy ML Models (Consumer 1)**
S-3	SLO-1	Challenges of Computer Vision	Computer Vision Workflow Steps	**Unit 7: Computer Vision Techniques an Overview**	ImageNet	Challenges
	SLO-2	Tasks in Computer Vision	Business Problem Identification	Image Processing	CIFAR	High level decisions
S-4	SLO-1	Optical character recognition (OCR)	Success Criteria Definition	Image Processing Techniques	MNIST	Choosing the hardware components (GPU, TPU)
	SLO-2	Medical Imaging	Right Computer Vision Techniques	Image Restoration, Linear Filtering , Independent Component Analysis , Pixelation	Object Detection Models	Building a CV Software system
S-5 & S-6	SLO-1	Lab 1 :	Lab 4 :	Lab 7:	Lab 10 :	Lab 13:
	SLO-2					
S-7	SLO-1	Surveillance	Collect Training Data	Template Matching, Image Generation Technique, Filtering Techniques in Image Processing	Fast R-CNN	Benefits
	SLO-2	Fingerprint recognition and biometrics	Label Train and Test Datasets	Linear Filter, Non Linear Filter, Box Filter, Gaussian Filter	Faster R-CNN	Challenges

S	SLO					
S-8	SLO-1	**Unit 2: Demytifying Artificial Intelligence and Computer Vision**	Train the computer vision model	Median Filter	**Unit 10: Computer Vision Data Requirements**	High level decisions
	SLO-2	Introduction to Computer Vision	Evaluate the computer vision model	Feature etection and matching	How much data is needed	Customer Image Segmentation
S-9	SLO-1	What is Computer Vision?	Test the model	Harris Corner Detector, SIFT (scale invariant feature transform), SURF (speeded-up robust features), FAST (features from accelerated segment test)	Is your data good enough?	Problem statement
	SLO-2	Object Recognition	Deploy the model	✓ BRIEF (Binary Robust Independent Elementary Features), Harris Corner Detector ✓ SIFT (scale invariant feature transform) ✓ SURF (speeded-up robust features) ✓ FAST (features from accelerated segment test)	Data Structure	Problem type
S-10	SLO-1	Medical Image Analysis	Iterate the steps process	**Unit 8: What Problem Computer Vision Solves**	Data Format	Data engineering
	SLO-2	Content-Based Image Retrieval	**Unit 5: Computer Vision Architecture**	Text Classification	Data Type	Data pipeline
S-11 & S-12	SLO-1	Lab 2 :	Lab 5 :	Lab 8:	Lab 11:	Lab 14:
	SLO-2					
S-13	SLO-1	Video Data Processing	Components of Computer vision solution	Image Detection	Source System	Model selection
	SLO-2	Virtual Reality and Augmented Reality	Data Ingestion	Image Segmentation	Target system	Model engineering
S-14	SLO-1	Image Processing	Data Pre-processing	Image Classification	Training Data	Model outcome
	SLO-2	Image Processing Techniques Image Restoration, Linear Filtering,Independent Component Analysis, Pixelation,	Multiprocessing	Object Detection	Validation Data	Model analysis

		Template Matching, Image Generation Technique (GAN)				
S-15	SLO-1	Filtering Techniques in Image Processing Linear Filter, Non-Linear Filter	Transfer Learning/Model Processing	Object Recognition	Test Data	Model optimization
	SLO-2	**Unit 3: Computer Vision in Real World Applications**	Data Transformation	Object Classification	**Unit 11: Computer Vision Development Hardware and Software Requirements**	Model pipeline
S-16	SLO-1	Computer Vision in Healthcare	Parallel Processing	**Unit 9: Computer Vision Models**	Building a Computer Vision Hardware system	Data visualization
	SLO-2	Computer Vision in Retail	User Interface and Advanced Analytics	Computer Vision Models overview	Benefits	User interface
S-17 & S-18	SLO-1	Lab 3:	Lab 6:	Lab 9:	Lab 12:	Lab 15:
	SLO-2					

Learning Resources	1. R. Jain, R. Kasturi, and B. G. Schunck, Machine Vision , McGraw-Hill, Inc. 1995. 2. Digital Image Processing and Analysis: Application with MATLAB and CVIPtools, 3rd Edition, SE Umbaugh, Taylor&Francis/CRC Press, 2018	3. Computer Vision: Algorithms and Applications by Richard Szeliski. Available for free online. 4. Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce. Available for free online. 5. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman. Available for free online (Warning: Direct PDF link). 6. Multiple View Geometry in Computer Vision (Second Edition) by Richard Hartley and Andrew Zisserman. Available for free online through the UM Library (Login required).

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	15%	20%	15%	20%	15%	20%	15%	20%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	15%	10%	15%	10%	15%	10%	15%	10%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.Jothi, Periyasamy , Chief AI Architect DeepSphere.AI, CA, USA	Dr.S.Gopinathan, Associate Professor, University of Madras, Chennai	Dr.Sivakumar, SRMIST