



SECOND SEMESTER 2024-2025

Course Handout Part II

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : BITS F459
Course Title : Computer Vision
Instructor-in-charge : Kamlesh Tiwari (kamlesh.tiwari@pilani.bits-pilani.ac.in)
Co-Instructor : Hardik Jain (hardik.jain@pilani.bits-pilani.ac.in)

1. Course Description

Computer Vision (CV) is a field of computer science that allows computers to sense the environment using visual and non-visual sensors. This sensory information is then used to infer meaningful information from the environment using various computing techniques. The course introduces students to the basics of computer vision and then adopts a task oriented learning, including detection, segmentation, annotation, inpainting, image and video generation. Various applications introduced in the lectures would be practically demonstrated in the laboratory allowing a hand-on experience of the learned concepts. By the end of the course, the students should have gained a fair understanding of a computer vision system, thereby allowing them to use the learnings from this course in solving real-world problems.

2. Text Book:

TB. Richard Szeliski. Computer Vision: Algorithms and Applications, 2nd ed.

Reference Books:

- R1. Valliappa Lakshmanan. Practical machine Learning for Computer Vision : End-to-end machine learning for images.
R2. Vaibhav Verdhan. Computer Vision using Deep Learning.

3. LECTURE PLAN (40 lectures)

Lecture	Topic Details	Chapter Reference	Objective
1-8	Image Processing: Brief Introduction to Computer vision; Image formation, filtering and processing; Evaluation Parameters and Optimization, Perceptron, Neural Network,	Ch.1-4 - TB	Introduction to CV with basics of image formation, processing. Neural network and their working.



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	Activation Function, Regularization, Loss Function, Convolutional Neural Networks (CNN)		Significance of convolutions for images
9-19	Object and Classification: Image and Video Recognition and Classification, Feature detection and matching, Segmentation, Object Detection, Person Re-Identification, Optical Flow, Medical Image Analysis	Ch. 6 - TB, Ch. 4 - R1, Class Notes	Basic CV tasks using hand crafted and DL features on images and videos
20-27	Specialized Application: Depth Estimation, Anomaly Detection, Inpainting, Face Recognition and Emotion Recognition, Pose/Gait Estimation - Human Action Recognition	Ch. 6 - R2, Class Notes	Applications dealing with depth from single image, image styling and human based tasks
28-31	Multimodal Learning: Multimodal Learning and Vision-Language Integration, Video Summarization and Highlight Detection, Visual Question Answering, Scene Understanding	Ch. 7 - R2, Class Notes	Multimodal learning involving text, images and videos.
32-35	Computational Photography: Super Resolution, Denoising, Blur Removal, Matting, Image quality estimation, Reconstruction and Modeling	Ch.10 - TB, Class Notes	Digital computation in images for various functionalities
36-40	Generative Modeling and Regulations: Image and Video Generation, Robustness and Adversarial Learning in Vision, Ethical and Privacy Considerations in Computer Vision	Ch. 12 -R1, Class Notes	Generative tasks on images and videos, ethics in CV applications

4. Evaluation Scheme:

Component	Weightage	Information
Mid-Semester Test: 05 March 2025 AN1	25%	Closed Book (Expected duration 90 Min)
Class Project: Would be done individually. A problem statement would be provided. Involves data collection, data cleaning, model training, result generation and preparation of report.	23%	Will be evaluated based on the quality of data collection (8%); implementation, ablation and experiment design (10%); report and result (5%).
Lab Participation: Marks from best six and a lab test.	17%	Based on submission during the lab session (12%); and a final lab test (5%).
Comprehensive Exam: 09 May 2025 FN	35%	Partially Open Book (Expected duration 180 Min)



5. Honor Code

All components are individual until specifically mentioned. Plagiarism in any form shall be tolerated (we would be using appropriate software tools). Students shall be awarded ZERO marks and cases may be reported to the appropriate committee of the Institute for appropriate action. Every component is individual until specifically specified.

6. Notices

All notices would be put on course website: www.ktiwari.in/cv and NALANDA. Submissions would be through NALANDA.

7. Make-up Policy

To be granted only in case of serious illness or emergency, on case to case basis for the Comprehensive Exam only.

8. Chamber Consultation Hours

Tuesday 10AM @ 6120J. Please seek an appointment.

Instructor-in-charge
BITS F459