BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

WORK INTEGRATED LEARNING PROGRAMMES

Digital

Part A: Content Design

Course Title	Video Analytics
Course No(s)	AIML* ZG531
Credit Units	4
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Version	1.0
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Course Objectives

No	Course Objective
CO1	Students should gain a working knowledge of video analytics.
CO2	Students should be familiar with various building block algorithms in video analytics, including Image ad Video processing and Deep Learning with emphasis on the algorithm building blocks.
CO3	Students should create at least one end-user application.

Text Book(s)

T1	Bovik, Alan C. The essential guide to video processing. Academic Press, 2009.

Reference Book(s) & other resources

R1	Tekalp, A. Murat. Digital video processing. Prentice Hall Press, 2015.
R2	Bovik, Alan C. Handbook of image and video processing. Academic press, 2010.

Content Structure

1 Video Analytics(4 hrs)
- 1.1 Introduction to Video Analytics (Class notes)
- 1.2 Applications of Video Analytics (Class notes)
- 1.3 Digital Video (T1 Ch 1, T1 Ch 1.2)
- 1.4 Spatio temporal sampling structures (T1 Ch 2)

2 Motion Detection and Estimation (6 hrs) (T1 Ch3)
- 2.1 MRF and MAP
- 2.2 Motion detection
- 2.3 Motion estimation
- 2.4 Optical Flow Motion estimation
- 2.5 MAP estimation for Dense motion
- 2.6 Application

3 Video Enhancement and Restoration (4 hrs) (T1 Ch 4)
- 3.1 Spatio temporal noise filtering
- 3.2 Coding Artifact reduction
- 3.3 Blotch reduction and removal
- 3.4 Vinegar Syndrome removal
- 3.5 Kinescope moiré removal
- 3.6 Flicker correction
- 3.7 Scratch removal
- 3.8 Application

4 Video Segmentation (6 hrs) (T1 Ch 6)
- 4.1 Shot boundary detection
- 4.2 Spatio temporal Change Detection
- 4.3 Motion Segmentation
- 4.4 Semantic video object segmentation
- 4.5 Application

5 Motion Tracking in Video (6 hrs) (T1 Ch 7)
- 5.1 Region-Based Object Tracking
- 5.2 Feature-Based Object Tracking
- 5.3 Template-Based Object Tracking
- 5.4 Kalman Filters and Extended Kalman Filters
- 5.5 Application

6 Video Indexing, Summarization, Browsing, and Retrieval (4 hrs) (T1 Ch 15)
- 6.1 Image and Video Features
- 6.2 Video Analysis
- 6.3 Video Representation
- 6.4 Video Browsing
- 6.5 Video Retrieval
- 6.6 Application

7 Discussion and advanced topics and applications (2 hrs)
   7.1 Applications including License plate detection on moving vehicles, monitor traffic jams, Activity recognition, crowd management, gesture recognition
   7.2 Deep learning techniques for video analysis

Optional Modules to be taken in Experiential Learning / Webinars / Tutorials / Assignments

1 Video Surveillance (T1 Ch 19)
2 Face Recognition from Video (T1 Ch 20)
3 Audiovisual Speech Processing(T1 Ch 21)

Detailed Plan for Lab work

Lab No.	Lab Objective	Module Reference
1	Reading video Displaying frames from video	1
2	Video pre-processing	2
3	Motion Detection and Estimation	3
4	Video Enhancement and Restoration	4
5	Video Segmentation	5
6	Motion Tracking in Video Kalman filtering for object tracking	6
7	Video Indexing Video Summarization	7
8	License plate detection on moving vehicles Monitor traffic jams Activity recognition Crowd management Gesture recognition	8

Evaluation Scheme:
Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1(a)	Quizzes	Online		10%	
EC-1(b)	Assignments	Take Home		20%	
EC-2	Mid-Semester Test	Closed Book		30%	
EC-3	Comprehensive Exam	Open Book		40%	

Note:
Syllabus for Mid-Semester Test (Closed Book): Topics in Session Nos. 1 to 8
Syllabus for Comprehensive Exam (Open Book): All topics (Session Nos. 1 to 16)

Important links and information:

Elearn portal: https://elearn.bits-pilani.ac.in or Canvas
Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.
Contact sessions: Students should attend the online lectures as per the schedule provided on the Elearn portal.

Evaluation Guidelines:

1. EC-1 consists of two Quizzes. Students will attempt them through the course pages on the Elearn portal. Announcements will be made on the portal, in a timely manner.
2. EC-2 consists of either one or two Assignments. Students will attempt them through the course pages on the Elearn portal. Announcements will be made on the portal, in a timely manner.
3. For Closed Book tests: No books or reference material of any kind will be permitted.
4. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
5. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course hand-out, attend the online lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the hand-out.