Computer Vision

Course Introduction

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Course Context and Overview:

COURSE OBJECTIVES

- The course will introduce computer vision, including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and pattern recognition.
- The course will equip the students with programming experience from implementing computer vision and object recognition applications.
- The course will develop basic methods for applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition.
- The course will develop the intuitions and mathematics of the methods in class and then learn about the difference between theory and practice in homework.

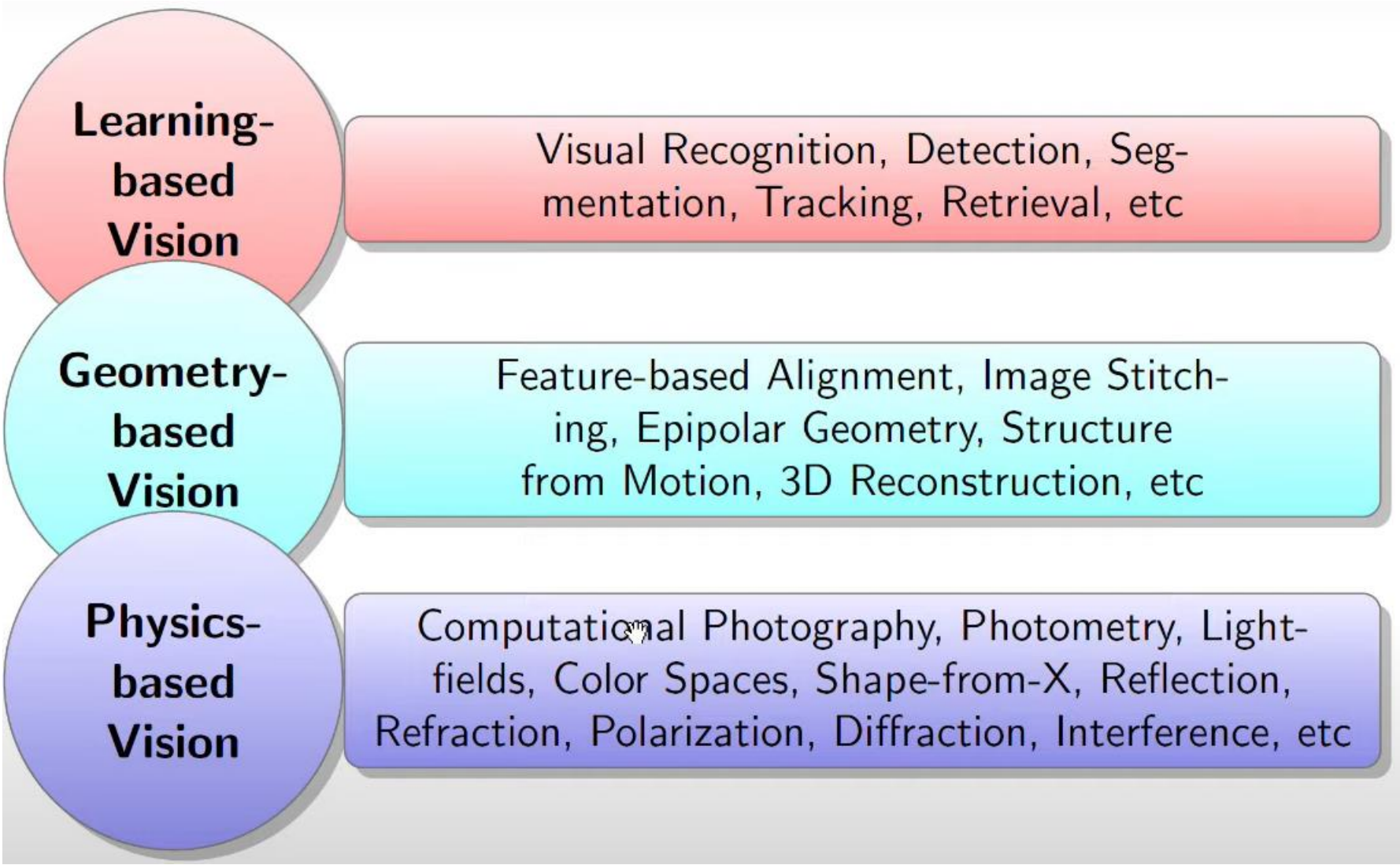
Course Context and Overview:

COURSE OUTCOMES

- After completing this course, the student must demonstrate the knowledge and ability to:

CO1	**Recognize and describe both the theoretical and practical aspects of image formation and computing with images.**
CO2	Understand the basics of 2D and 3D Computer Vision and Connect issues from Computer Vision to Human Vision.
CO3	Become familiar with the significant technical approaches in computer vision, including registration, alignment, and image matching.
CO4	Get exposure to advanced concepts leading to object categorization and segmentation in images.
CO5	Build computer vision applications.

Computer Vision Topics



Course Topics:

UNIT – I Fundamentals of Image Processing and Computer Vision

- What is an Image and Computer Vision,
- Image formation, Camera Projection,
- Sampling and Aliasing,
- Image Filtering,
- Frequency domain analysis of Image, Pyramids and Wavelet

UNIT – II Feature detection and matching

- Edge detection,
- Feature points and corners,
- Local Image features, SIFT, Hough transform,
- Feature Descriptors, Feature Matching

Course Topics:

UNIT - III Camera Geometry and Multiple View

- Camera Geometry, Camera calibration,
- Stereo vision,
- Epipolar geometry,
- Image Alignment, RANSAC,
- Optical Flow

UNIT - IV Recognition and Motion Estimation

- Image Classification,
- Object detection,
- Semantic segmentation

Textbook references

- **Text Book:**
  - Richard Szeliski, Computer Vision: Algorithms and Applications, 2nd ed., The University of Washington, 2022 (http://szeliski.org/Book/)
  - D. Forsyth and J. Ponce, Computer Vision - A modern approach, 2nd ed., Pearson Education India, 2015. (http://luthuli.cs.uiuc.edu/~daf/CV2E-site/cv2eindex.html)

- **NPTEL course:**
  - Deep Learning for Computer Vision By Prof. Vineeth N Balasubramanian, IIT Hyderabad
  - https://onlinecourses.nptel.ac.in/noc21_cs93/preview

Evaluation Methods:

Item	Weightage
Quiz/Assignment	20
Midterm	30
Endterm	50

MS-Team Code

919jet6

- **Let's Start**