Computer Vision and Image Processing - Fundamentals and Applications

By Prof. M. K. Bhuyan | IIT Guwahati

Learners enrolled: 7150

The intent of this course is to familiarize the students to explain the fundamental concepts/issues of Computer Vision and Image Processing, and major approaches that address them. This course provides an introduction to computer vision including image acquisition and image formation models, radiometric models of image formation, image formation in the camera, image processing concepts, concept of feature extraction and selection for pattern classification/recognition, and advanced concepts like motion estimation and tracking, image classification, scene understanding, object classification and tracking, image fusion, and image registration, etc.

This course will cover the fundamentals of Computer Vision. It is suited for mainly students who are interested in doing research in the area of Computer Vision. After completing the course, the students may expect to have the knowledge needed to read and understand more advanced topics and current research literature, and the ability to start working in industry or in academic research in the field of Computer Vision and Image Processing. They can also apply all these concepts for solving the real-world problems.

INTENDED AUDIENCE : UG, PG and Ph.D students.
PREREQUISITES : Basic co-ordinate geometry, matrix algebra, linear algebra and random process.
INDUSTRIES SUPPORT : The software industries that develop computer visions apps would be benefitted from this course.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	12 weeks
Category :	◦ Electrical, Electronics and Communications Engineering ◦ Computer Science and Engineering
Credit Points :	3
Level :	Undergraduate/Postgraduate
Start Date :	23 Jan 2023
End Date :	14 Apr 2023
Enrollment Ends :	06 Feb 2023
Exam Registration Ends :	17 Mar 2023
Exam Date :	29 Apr 2023 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

Course layout

Week 1: Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.

Week 2: Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models.

Week 3: Fundamental Concepts of Image Formation: Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.

Week 4: Image Processing Concepts: Image Transforms.

Week 5: Image Processing Concepts: Image Transforms, Image Enhancement.

Week 6: Image Processing Concepts: Image Filtering, Colour Image Processing, Image Segmentation

Week 7: Image Descriptors and Features: Texture Descriptors, Colour Features, Edges/Boundaries.

Week 8: Image Descriptors and Features: Object Boundary and Shape Representations.

Week 9: Image Descriptors and Features: Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded

up Robust Features, Saliency

Week 10: Fundamentals of Machine Learning: Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.

Week 11: Applications of Computer Vision: Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders.

Week 12: Applications of Computer Vision: Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.

Books and references

1. Forsyth & Ponce, “Computer Vision-A Modern Approach”, Pearson Education.
2. M.K. Bhuyan , “ Computer Vision and Image Processing: Fundamentals and Applications”, CRC Press, USA, ISBN 9780815370840 - CAT# K338147.
3. Richard Szeliski, “Computer Vision- Algorithms & Applications”, Springer.

Instructor bio

Prof. M. K. Bhuyan

IIT Guwahati

Prof. Manas Kamal Bhuyan received a Ph.D. degree in electronics and communication engineering from the India Institute of Technology (IIT) Guwahati, India. He was with the School of Information Technology and Electrical Engineering, University of Queensland, St. Lucia, QLD, Australia, where he was involved in postdoctoral research. Subsequently, he was a Researcher with the SAFE Sensor Research Group, NICTA, Brisbane, QLD, Australia. He was an Assistant Professor with the Department of Electrical Engineering, IIT Roorkee, India and Jorhat Engineering College, Assam, India. In 2014, he was a Visiting Professor with Indiana University and Purdue University, Indiana, USA. Dr. Bhuyan was a recipient of the National Award for Best Applied Research/Technological Innovation, which was presented by the Honorable President of India, the Prestigious Fullbright-Nehru Academic and Professional Excellence Fellowship, and the BOYSCAST Fellowship. He is an IEEE senior member. He is currently a Professor with the Department of Electronics and Electrical Engineering, IIT Guwahati, and Associate Dean of Infrastructure, Planning and Management, IIT Guwahati. His current research interests include image/video processing, computer vision, machine learning and human computer interactions (HCI), virtual reality and augmented reality. He has almost 25 years of industry, teaching, and research experience. He is the author of the book text book "Computer Vision and Image Processing: Fundamentals and Applications".
For more details www.iitg.ac.in/mkb (http://www.iitg.ac.in/mkb)

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.
The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
Date and Time of Exams: **29 April 2023** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
Registration url: Announcements will be made when the registration form is open for registrations.
The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.
Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = best 8 assignments out of the total 12 assignments given in the course.
Exam score = 75% of the pro exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE >=10/25 AND EXAM SCORE >= 30/75. If one of the 2 criteria is not met, you will not get the certificate even if the Final score >= 40/100.

Certificate will have your name, photograph and the score in the final exam with the breakup.It will have the logos of NPTEL and IIT Guwahati .It will be e-verifiable at nptel.ac.in/noc (http://nptel.ac.in/noc).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team

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for successfully completing the course

Computer Vision and Image Processing - Fundamentals and Applications

with a consolidated score of **52** %

Online Assignments	21.88/25	Proctored Exam	30/75

Total number of candidates certified in this course: **394**

Jan-Apr 2023

(12 week course)

Prof. T. V. Bharat
Head, Centre for Educational Technology
NPTEL Coordinator, IIT Guwahati

Indian Institute of Technology Guwahati

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Computer Vision and Image Processing - Fundamentals and Applications

with a consolidated score of **53** %

Online Assignments	22.81/25	Proctored Exam	30/75

Total number of candidates certified in this course: **394**

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