

Computer Vision and Object Recognition Syllabus (for M.Sc. Students)

Assist. Prof. Dr. Khawla Hussein Ali

1- Introduction. Background, requirements and issues, human vision and Open CV-Python software. (1 week)

2. **Image formation:** geometry and photometry Geometry, photometry (brightness and color), quantization, camera calibration (1 week)

3. **Operations on Images** (1 week)

3.1 Point operations

- Image negative
- linear transformation
- contrast stretching and gray level slicing

3.2 Neighboring Operations (1 week)

- general operations
- Interpolations of images (Bilinear and Cubic)

4- **Image Enhancement** (2 weeks)

- image filters (Gaussian, Laplacian)
- image Histogram
- Histogram Equalization

5. **Image Segmentation and Feature Extraction.** Various methods of image segmentation, edge detection (Canny, Prewitt, Sobel), object proposals, line detection (Hough Transform). (2 weeks)

6. **Image Restoration and types of noise in frequency (Fourier Transform) and spatial domains** (2 weeks)

7. **Object Recognition:** Traditional Methods (1 weeks) HoG features, Bayes classifiers, SVM classifiers (2 weeks)

8. **Introduction to Neural Networks** (1 week) Artificial neural networks, loss functions, backpropagation and SGD, Batch Normalization (2 weeks)

9. **Advanced Object Recognition methods:** Deep Learning Methods. Image classification, object detection and semantic segmentation, Various neural network architectures, visualization techniques. (1 week)

Text Book: “Computer Vision: Algorithms and Applications”, 2nd ed.

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<https://szeliski.org/Book>

Additional Sources

- Noah Snavely's [CS5670 - Introduction to Computer Vision](#) class at Cornell Tech (Spring 2022)
- Bill Freeman, Antonio Torralba, and Phillip Isola's [6.819/6.869: Advances in Computer Vision](#) class at MIT (Spring 2021)