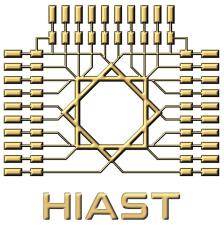
Syrian Arab Republic

Higher Institute for Applied Sciences and Technology



Course Specification Document

Title	Image Analysis and Understanding

Credits	5 ECTS

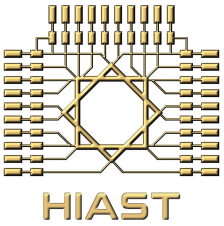
Aims	This course aims to teach students the fundamental concepts in the field of computer vision and image processing. This includes understanding how images are formed, the geometric operations for cameras and their calibration, object detection in images, tracking objects across consecutive images, motion detection, artificial intelligence techniques, and deep learning. The course concludes with comprehending scene understanding in images and videos, with the goal of applying these concepts in software development.

Intended learning outcomes

- On successful completion of this course, the student will be able to:
- Understand how images are formed and represented computationally.
- Identify methods and algorithms for calibrating cameras and deducing their internal and external parameters.
- Know the algorithms for object detection in images and tracking them.
- Grasp the fundamental concepts in artificial intelligence and deep learning relevant to this field.
- Apply mathematical techniques in digital signal processing and implement them on images.
- Develop computer vision applications using deep learning.

Syllabus

- **Acquisition and representation of images on the computer in various forms (color, grayscale, binary):** Introduction to computer vision, applications of computer vision in industry.
- **Basic operations on images:** Smoothing filters, edge detection filters.
- **Finding key points and corners for shaping local features and matching them with the features in another image:** The principle of key points, Harris corner detector, Scale-Invariant Feature Transform (SIFT) keypoint detector.
- **Recognition using supervised learning:** Support Vector Machine (SVM) for person detection, Adaboost for face detection, sliding windows for object detection.
- **Neural networks and Convolutional Neural Networks (CNN):** Introduction to convolutional neural networks, overview of important types of networks.
- **Image classification and generation:** Using CNN for image retrieval, introduction to Generative Adversarial Networks (GAN) principle, application of GAN for image generation.



- **Face detection and recognition:** Face detection using MTCNN, using Siamese network for face recognition.
- **Activity recognition:** Pose estimation algorithms, using LSTM for activity recognition.
- **Object detection:** Object detection using Faster R-CNN, object detection using YOLO.