Course Title	Computer Vision				
Course Code	ACSC438				
Course Type	Elective				
Level	BSc (Level 1)				
Year / Semester	4th (Fall/Spring)				
Teacher's Name	Dr Giorgos Demetriou				
ECTS	6	Lectures / week	2	Laboratories/week	2
Course Purpose	The course considers the key concepts, algorithms of computer vision, computer vision applications and the technology associated with computer vision, and image processing. The course teaches the theory and application of techniques commonly used to analyze and interpret images. The course describes challenging real-world applications where vision is being successfully used, both for specialized applications such as medical imaging, and for fun, consumer-level tasks such as image editing and stitching, which machine learning and deep learning libraries can be used and applied, such as popular frameworks, platforms, and APIs like OpenCV, Keras and TensorFlow .				
Learning Outcomes	Upon successful completion of the course students will be able to: 1. Describe in detail the key concepts, algorithms, and application of computer vision. 2. Define image manipulations such as transformations, blurring, thresholding, edge detection and cropping. 3. Apply both in theory and practice segmentation of images by understanding contours, circle, and line detection. 4. Examine feature set detection, object detection, and apply different image matching techniques. 5. Describe and compare technologies, platforms, frameworks, and APIs for computer vision using Deep Learning. 6. Apply and use Deep Learning libraries for real-world applications and hands-on projects in computer vision.				
Prerequisites	ACSC368, ACS382	Co-requisites	None		
Course Content	• **Overview**: Key concepts of Computer Vision, a brief history, and image formation. • **Image Formation and Processing**: Image manipulations, such as transformations, blurring, thresholding, edge detection and cropping. • **Image Segmentation**: Understanding contours, circle, and line detection, approximate contours, contour filtering and ordering as well as approximations. • **Feature Detection**: Feature detection techniques, scale invariant feature transform (SIFT), speed up robust feature (SURF), robust independent				

	elementary features (BRIEF), oriented FAST, rotated BRIEF (ORB), for object detection. Object Detection for faces, people & cars. • **Facial Recognition**: Extract facial landmarks for face analysis, applying filters and face swaps. • **OCR**: Simple Machine Learning, handwritten digit classification and recognition • **Motion Analysis and Object Tracking**: Filtering, background subtraction, meanshift, CAMshift, and optical flow object tracking
Teaching Methodology	The course will combine theoretical aspects of computer vision with extended practical work on the concepts and application of computer vision. Delivery will be based on 2 period lecturing and 2 laboratory period. Laboratory work will mainly consist of introducing students to the practical and students are expected to complete the practical outside contact hours. Students are expected to find references from the library and on the Internet to complete their practical work.
Bibliography	Textbooks: • Richard Szeliski, ***Computer Vision: Algorithms and Applications***, 1st Edition, Springer, 2011, ISBN: 978-1-84882-934-3. References: • Jan Erik Solem , ***Programming Computer Vision with Python: Tools and algorithms for analyzing images***, O'Reilly, 2012, ISBN 1449316549 • David A. Forsyth, Jean Ponce, ***Computer Vision: A Modern Approach*** (2nd Edition), Pearson, 2011, ISBN: 013608592X
Assessment	Students are assessed on the theoretical aspects of the course through a midterm, and the final exam, while extensive lab exercises cover the applied and hand-on aspects of the course. Coursework will comprise of one midterm, a set of lab exercises, and three-hour closed book exam. The weights for each assessment component are: • Labs and Assignments 40% • Midterm 20% • Final Exam 40%
Language	English