Subject Description Form

Subject Code	EIE4100
Subject Title	Computer Vision and Pattern Recognition
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	For 42477: EIE2106 Signal and System Analysis and EIE3103 Digital Signals and Systems
Objectives	1. To introduce students the fundamentals of image formation; 2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; 3. To develop an appreciation for various issues in the design of computer vision and object recognition systems; and 4. To provide the student with programming experience from implementing computer vision and object recognition applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Comprehend the fundamentals of image formation. 2. Comprehend the major ideas, methods, and techniques of image processing and computer vision. 3. Appreciate typical pattern recognition techniques for object recognition. 4. Implement basic image processing and computer vision techniques. 5. Develop simple object recognition systems. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively. 7. Think critically. 8. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** • Image Formation and Image Models Radiometry; Sources, Shadows and Shading; Colour; Cameras. • Early Vision with One Image Linear Filters; Edge Detection; Texture; Digital Libraries. • Early Vision with Multiple Images The Geometry of Multiple Views; Stereopsis. • Mid-Level Vision Segmentation and Fitting; Tracking with Linear Dynamic Models. • High-Level Vision Correspondence and Pose; Registration in Medical Imaging Systems. • Finding Templates Using Classifiers Classifiers; Building Classifiers from Class Histograms; Feature Selection. • Category-Level Recognition Current Approaches to Object Recognition; Decision Trees; Nearest Neighbour Rule (NNR); Support Vector Machine; Artificial Neural Networks; Deep Learning.

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<tr><td>Teaching/Learning Methodology</td><td>Lectures:
1. fundamental principles and key concepts of the subject are delivered to students;
2. guidance on further readings, applications and implementation is given.

Tutorials:
1. supplementary to lectures and are conducted with a smaller class size;
2. students will be able to clarify concepts and to have a deeper understanding of the lecture material;
3. problems and application examples are given and discussed

Laboratory sessions:
1. students will make use of the software tools to construct simple computer vision applications.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Subject Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="8">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>1. Continuous Assessment (total: 45%)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Tests</td><td>25%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Assignments</td><td>10%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>• Lab exercises and lab reports</td><td>10%</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>55%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="8"></td></tr>
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignments; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
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Reading List and References	**Recommended Textbook:** 1. D.A. Forsyth and J. Ponce, *Computer Vision: a Modern Approach,* Pearson, 2012. **Reference Books:** 1. M. Negnevitsky, *Artificial Intelligence: A Guide to Intelligent Systems*, 3rd Edition, Pearson/Addison Wesley, 2011. 2. C.M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006. 3. L.G. Shapiro and G. Stockman, *Computer Vision*, Prentice-Hall, 2001. 4. R. Schalkoff, *Pattern Recognition – Statistical, Structural & Neural Approaches*, John Wiley, 1992. 5. C.H. Chen and P.S.P. Wang (Editors), *Handbook of Pattern Recognition and Computer Vision*, World Scientific, 2005.
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Prepared by	Prof. Kenneth Lam and Dr Zheru Chi