## Subject Description Form

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>COMP5523</th>
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</thead>
<tbody>
<tr>
<td>Subject Title</td>
<td>Computer Vision and Image Processing</td>
</tr>
<tr>
<td>Credit Value</td>
<td>3</td>
</tr>
<tr>
<td>Level</td>
<td>5</td>
</tr>
<tr>
<td>Pre-requisite/Co-requisite/Exclusion</td>
<td>Nil</td>
</tr>
</tbody>
</table>

### Objectives
- To let the students learn the fundamental principles on the aspects of interdisciplinary research including acquiring, processing, analyzing, understanding and utilizing high-dimensional visual data from the real world;
- To equip the students with the knowledge of how to develop artificial intelligent systems which automate tasks that the human visual system can do;
- To guide the students to understand the relevant state of art technologies and gain experience throughout a variety of case studies.

### Intended Learning Outcomes
Upon completion of the subject, students will be able to:
- a. understand various methods for digital image processing and analysis and relate or apply them to different applications;
- b. understand various algorithms for vision related tasks and apply them to solve practical problems by considering various requirements and issues (e.g., legal/social/ethics issues);
- c. carry out in-depth analysis of the digital image data with different image data models, pattern recognition algorithms and learning theory;
- d. gain experience of team work by engaging in a group project on vision related topics and learn effectively through various learning activities;
- e. communicate effectively with competent presentation skills through reading and writing reports and documents.

### Subject Synopsis/Indicative Syllabus
1. **Introduction**
   - a. The background
   - b. An overview of the related fields;
   - c. The development of vision systems
2. **Image acquisition and formation models**
   - a. Imaging systems
   - b. Geometry of image formation
   - c. Camera models and calibration
   - d. Orthographic and perspective projections
3. **The fundamentals of image processing**
   - a. Image enhancement
   - b. Image representation
   - c. Image transformations
   - d. Image feature extraction
   - e. Image segmentation
4. **High-level image processing**
   - a. Image recognition
   - b. Image registration
   - c. Image restoration
5. **Computer vision related tasks**
a. Low-level vision
   -- image matching, optical flow and motion analysis
b. Middle-level vision: 3D analysis from 2D images
   -- The geometry of multiple views
   -- Reconstruction: Shape from X (stereo, shading, defocus, motion, structured light)
   -- Video tracking, motion detection, scene analysis
c. High-level vision:
   -- Image understanding, object recognition, pose estimation.

6. Computer vision algorithms and applications
a. The advanced computer vision algorithms
   -- Machine learning
   -- Artificial neural network and deep learning
b. The selected computer vision applications
   -- Content-based image retrieval
   -- Gesture recognition
   -- Intelligent character recognition
   -- Medical imaging
   -- Mobile robots
   -- Visual sensor network

7. Professionalism and legal/social/ethics issues related to computer vision
   (e.g., personal data (privacy) ordinance)

### Teaching/Learning Methodology

Lectures provide students with the content of main concepts and methods of the course, together with comprehensive examples, and class questions/answers/discussions for easy understanding.

Tutorials and lab sessions offer the opportunity for students to review and consolidate the lecture and reference materials through exercises and software tools.

Project assignments will give students the opportunity to solve practical visual information analysis problems.

Written assignments help students to develop a solid foundation of visual information processing and analysis throughout the project work of case studies.

### Assessment Methods in Alignment with Intended Learning Outcomes

<table>
<thead>
<tr>
<th>Specific assessment methods/tasks</th>
<th>% weighting</th>
<th>Intended subject learning outcomes to be assessed (Please tick as appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a</td>
</tr>
<tr>
<td>1. Written assignments and quiz</td>
<td>20</td>
<td>✓</td>
</tr>
<tr>
<td>2. Project Assignment</td>
<td>35</td>
<td>✓</td>
</tr>
<tr>
<td>3. Examination</td>
<td>45</td>
<td>✓</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Written assignments, tests/quizzes, and examination are used to test and deepen
students’ understanding of the subject materials while project assignment is used to provide a hands-on experience of how the subject materials are applied.

<table>
<thead>
<tr>
<th>Student Study Effort Expected</th>
<th>Class contact:</th>
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<tbody>
<tr>
<td>▪ Lectures</td>
<td>26Hrs.</td>
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<tr>
<td>▪ Tutorials/Labs</td>
<td>13Hrs.</td>
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Other student study effort:

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<tbody>
<tr>
<td>▪ Reading</td>
<td>26Hrs.</td>
</tr>
<tr>
<td>▪ Written and Project Assignments, Quizzes/Tests, Examination</td>
<td>39Hrs.</td>
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</table>

Total student study effort 104Hrs.

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<th>Reading List and References</th>
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