Fall 2015 Graduate Elective: Computer Vision and Image Analysis (EENG 5640-001 and EENG-4010-001)

Instructor: Parthasarathy (Partha) Guturu  
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Phone: 940-891-6877  
Email: guturu@unt.edu  
Teaching Assistant: Shuo Sun  
Class Hours: M/W 2:30 PM - 3:50 PM.  
Classroom: UNT Discovery Park B-227.  
Office Hours: T 2:00 PM-3:30 PM. Students unable to see me during this time may request an appointment.

Prerequisite: Senior standing (for undergraduates)

Course Description

This advanced elective course is designed to introduce to the senior undergraduate students mathematical principles of computer vision. Binary image processing with techniques of mathematical morphology, grey level image processing with various filters, color fundamentals and texture representation and recognition will be discussed. Advanced topics such as content based image retrieval, shape form X-techniques, 2D/3D object recognition and matching will also be discussed. A programming project on one of the topics will be included in this course.

Course Delivery Plan

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Topic</th>
<th>Time Allocated</th>
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<tbody>
<tr>
<td>1</td>
<td>Image Formation, Representation, basics of image processing, pattern recognition, and Computer Vision</td>
<td>1 Week</td>
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<tr>
<td>2</td>
<td>Binary Image Analysis and Mathematical Morphology</td>
<td>1 Week</td>
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<td>3</td>
<td>Grey Level Image Processing- Filtering, Enhancement and Edge Detection</td>
<td>1 Week</td>
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<td>4</td>
<td>Image Segmentation and Representation</td>
<td>1 Week</td>
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<td>5</td>
<td>Color and Shading</td>
<td>1 Week</td>
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<td>6</td>
<td>Texture</td>
<td>1 Week</td>
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<tr>
<td>7</td>
<td>Content-based Image Retrieval</td>
<td>1 Week</td>
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<td>8</td>
<td>2D Matching</td>
<td>1 Week</td>
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<td>9</td>
<td>Shape from X ( = shading/texture/motion/stereo/boundary)</td>
<td>3 Weeks</td>
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<tr>
<td>10</td>
<td>3D Object Recognition</td>
<td>1 Week</td>
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</table>
Reading Requirements

Students are required to come prepared to every class with the material discussed in the previous class.

Reference Book:

PowerPoint Slides

Attendance Policy: In view of the continuous evaluation strategy adopted by the instructor, perfect attendance is recommended for those aspiring to get good grades.

Grading Policy: The undergraduate students will have a totally different set of examinations with emphasis on problem solving rather than theory and algorithms, vis-a-vis the graduate students. The break-up for overall grading is as follows. Assignments/Quizzes/Class Tests: 50, Project: 30, and Final Examination: 20. Grades A, B, C, D, and F will be assigned, respectively, depending upon whether the total tally will be greater than/equal to 90, 80-89, 70-79, 60-69, or less than 60.

Academic Dishonesty: Honesty is the best policy. Cheating will not be tolerated. Anyone found guilty of cheating on a test or assignment will be awarded an F grade for the course. Discussions of problems and assignment with your classmates is welcome and encouraged, however, sharing of solutions is not. If you need help, you should ask the instructor. Cheating includes, but is not limited to, all forms of plagiarism and misrepresentation. For your rights and responsibilities please refer to http://www.unt.edu/csrr

Statement regarding Disabled Students: The Faculty of Electrical Engineering including this instructor cooperates with the Office of Disability Accommodation (ODA) to make reasonable accommodations for students with certified disabilities (cf. Americans with Disabilities Act and Section 504, Rehabilitation Act). If you have not registered with ODA, we encourage you to do so immediately and present a written accommodation request along with an appropriate documentation from the Dean of Students Office http://www.unt.edu/oda/, on or before the 2nd week of class.

Final Exam Date and Time: TBD.

Course Learning Outcomes

Course Learning Outcomes (CLOs) for Advanced Topics in Electrical Engineering- Computer Vision (EENG-4010) are as follows:

[CLO-1] Basics of image processing, pattern recognition, and computer vision
[CLO-2] Binary Image Analysis and Mathematical Morphology
[CLO-3] Grey Level Image Processing- histogram methods, filters, edge detection
[CLO-4] Image segmentation, shape representation and recognition
[CLO-5] Color fundamentals
[CLO-6] Texture representation and recognition
[CLO-7] Content-based image retrieval
[CLO-8] 2D-Matching with affine transforms
[CLO-9] Shape from X-techniques (binocular/photometric stereo, motion, etc.)
[CLO-10] 3D-representations and object recognition with applications

**Student Outcomes (SOs) of Our BSEE Program**

Upon completion of our BSEE program, the students will be able to:

**[SO-1]** Apply knowledge of mathematics, engineering and science.

**[SO-2]** Design and conduct experiments to verify and validate the design projects developed by them, and analyze and interpret data.

**[SO-3]** Develop project-based learning skills through design and implementation of a system, component, or process that meets the needs within realistic constraints.

**[SO-4]** Function on multidisciplinary teams.

**[SO-5]** Identify, formulate, and solve engineering problems.

**[SO-6]** Have an understanding of professional and ethical responsibility.

**[SO-7]** Communicate effectively.

**[SO-8]** Achieve broad education necessary to understand the impact of electrical engineering solutions in a global and societal context.

**[SO-9]** Understand learning processes, concepts of learning to learn, and engage in lifelong learning.

**[SO-10]** Achieve knowledge of contemporary issues.

**[SO-11]** Use techniques, skills, and computer-based tools for conducting experiments and carrying out designs.

**ABET Outcomes**

3a- an ability to apply knowledge of mathematics, science, and engineering

3b- an ability to design and conduct experiments, as well as to analyze and interpret data

3c- an ability to design a system, component, or process to meet desired needs

3d- an ability to function on multi-disciplinary teams

3e- an ability to identify, formulate, and solve engineering problems

3f- an understanding of professional and ethical responsibility

3g- an ability to communicate effectively

3h- the broad education necessary to understand the impact of engineering solutions in a global and societal context

3i- a recognition of the need for, and an ability to engage in lifelong learning

3j- a knowledge of contemporary issues
### Relationship of the course to Student Outcomes (SOs)

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<thead>
<tr>
<th>CLO</th>
<th>SO-1/3(a)</th>
<th>SO-2/3(b)</th>
<th>SO-3/3i</th>
<th>SO-4/3(d)</th>
<th>SO-5/3(e)</th>
<th>SO-6/3(f)</th>
<th>SO-7/3(g)</th>
<th>SO-8/3(h)</th>
<th>SO-9/3(i)</th>
<th>SO-10/3(j)</th>
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