Course: EE 528 - Digital Image Processing (4 Units)
Term: Spring 2002, Section 1
Time: TR 6:10-8:00 pm
Location: 14-247
Prerequisite: EE 414, EE 525, Graduate Standing, or Instructor Approval
(However, I feel that EE419 is excellent preparation, and that EE 414 and EE 525 are less critical).

Description: Course covers both the processing and interpretation of images by computer. Project oriented. Real images and practical limitations of techniques are discussed. Many applications will be described.

Instructor: Dr. Fred DePiero, Associate Professor
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fdepiero@calpoly.edu

Office Location: 20-203
Hours: M12, T12, W12, R12, F3, or by appointment
Phone: 756-2917


Goals: To provide students with a background in both Image Processing and Machine Vision. Exposure to include scientific, industrial and commercial applications.

Computer Usage: Extensive!
Students may use the CalPoly Signal and Image Processing Tool ('SIPTool') written by DePiero, which will be distributed in class and can be downloaded from the web. This environment provides a graphical user interface that serves as a front end to algorithms written by students. Example code and documentation are provided. Rudimentary knowledge of C is required. Microsoft Visual C++ is used for programming with the SIPTool, and is the only supported development environment. Visual C++ is available to CalPoly students at low cost. Students may use another development package, if they choose, but project requirements and timelines remain fixed… It will be most convenient if students have access to their own PC for projects.

The WWW and email will be used regularly in the course.
Topics are categorized as ‘IP’ for image Processing and ‘MV’ for Machine Vision

Introduction
(1) Image Processing vs. Machine Vision
(2) Image Acquisition Process, Lenses, Depth of Field, Localizing Objects

IP - Point Processing
(3) Histogram Equalization

IP - Neighborhood Processing
(4) 2-D Convolution and Correlation
(5) Spatial Domain Filtering
(6) Median Filtering

IP - Transform Processing
(7) 2-D Fourier Transforms and FFT
(8) Frequency Domain Filtering
(9) Edge Extraction and Hough Transform

IP - Image Compression
(10) Huffman Coding
(11) JPEG and MPEG
(12) QMF Pyramids

MV – Finding 2D Shapes and Regions
(13) Segmentation
(14) Morphological Operations
(15) Region Growing

MV – Describing and Identifying Shapes
(16) Texture Description
(17) Shape Descriptors
(18) Bayesian Pattern Classifiers

MV – 3-D Sensing
(19) Camera Calibration
(20) Ranging by Stereo, Structured Light, and Laser Radar

Grades: will be determined by the following weighting:

<table>
<thead>
<tr>
<th>Projects and Homework</th>
<th>70%</th>
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<tbody>
<tr>
<td>Final</td>
<td>30%</td>
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<td></td>
<td>100%</td>
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A variety of projects will be offered with varying weights. Options on project requirements will be given to provide flexibility for students and to permit some customization, to suit students’ interests. Projects will be judged in a competitive manner (approximately 10%). Grades for the projects will be based on relative effort, creative extensions, quality of results, and professional reporting, in addition to the baseline requirements. A 15% deduction will be applied to late projects.

Policies:
(1) Students are encouraged to participate in class discussions.
(2) Students are responsible for all lecture and project materials and all handouts.
(3) Students are responsible for material in any missed classes.