

## ECE 893-2 Machine Vision Spring 2005

**Instructor:** Stan Birchfield, 207A Riggs Hall, 656-5912, stb at clemson

**Office Hours:** 10:00-11:00 MWF, or by appointment

**Grading assistant:** TBD

**Class meets:** 9:05-9:55 MWF, 305 Riggs Hall

**Website:** <http://www.ces.clemson.edu/~stb/ece847b>

**Text (recommended):**

- Sonka, Hlavac, Boyle, *Image Processing, Analysis, and Machine Vision*, 1999
- Forsyth and Ponce, *Computer Vision: A Modern Approach*, Prentice-Hall, 2003
- Gonzalez and Woods, *Digital Image Processing*, 2<sup>nd</sup> ed., Prentice-Hall, 2002

**Prerequisites:** ECE847 Image Processing; also probability and statistics, linear algebra, signals and systems, programming skills, creativity and enthusiasm

**Overview:** This course builds upon ECE847 by exposing students to fundamental concepts, issues, and algorithms in digital image processing and computer vision. Topics include segmentation, texture, detection, 3D reconstruction, calibration, shape, and energy minimization. The goal is to equip students with the skills and tools needed to manipulate images, along with an appreciation for the difficulty of the problems. Students will implement several standard algorithms, evaluate the strengths and weakness of various approaches, and explore a topic of their own choosing in a course project.

**Objectives:** By the end of the course, students should be able to do the following:

- *Fundamental concepts.* Define the problems of compression, restoration, segmentation, detection, recognition, reconstruction, and tracking. Explain the relationship between image processing, machine vision, computer vision, and computer graphics. Explain the concepts of regions, edges, filters, transforms, photometry, and geometry.
- *Computation.* Write code to implement standard algorithms (such as region analysis, edge detection, template matching, segmentation, stereo correspondence, perspective projection, epipolar geometry calculation, color discrimination, compression, 3D reconstruction).
- *Course project.* Determine a topic to investigate and research it by finding and reading relevant research papers. Develop an approach to solving the problem, implement and test the solution, and critically evaluate the results. Effectively communicate the steps and conclusions of the investigation in an oral presentation and a written report.

**Grading:** assignments (60%), quizzes (10%), project (30%); up to 10 points extra credit for contributions to the C++ vision library

**Topical outline:**

- texture
- segmentation
- detection
- 3D reconstruction
- camera calibration
- range images
- object recognition
- shape and active contours
- energy minimization

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[http://www.cs.clemson.edu/html/academics/academic\\_integrity\\_2002.html](http://www.cs.clemson.edu/html/academics/academic_integrity_2002.html)