CAP 5416 : Introduction to Computer Vision

Schedule: MW, 7, 7 & 8th Period
Location: MCCB G108

Pre-requisites: *Linear algebra, multivariate calculus, proficiency in MATLAB or C/C++ and familiarity with image I/O.*

Texts and Other Material:

- *Recommended Text*: *Robot Vision*, by B. K. P. Horn, McGraw-Hill.
- *Computer Vision - A modern approach*, by D. Forsyth and J. Ponce, Prentice Hall and

  The former is some what dated. I will therefore be using material from both the books and will give out references to papers or copy them for you if time permits. Buy the book by Horn as assignments at the back of the chapters in the book will be given from time to time. The book is available on the web through Barnes & Noble.

References

1. *Introductory Techniques for 3D Computer Vision*, by E. Trucco and A. Verri, Publisher: Prentice Hall.
2. *Fourier Transforms and its Applications*, Bracewell, McGraw Hill Co.
3. *Vision*, by David Marr; Publisher: W. H. Freeman and Co.
4. *Other Material:* Papers from the following *IEEE TPAMI, CVIU (Academic Press, formerly: CVGIP), the AI Journal*, and *IJCV*.

Instructor: Baba Vemuri, CSE 324
Office hours: M- 8th & W- 9th period respec. or by appointment (to be set up via email).
TA: TBA
Grading:

1. Homeworks and Programs: 30% (10% for Hwks and 20% for Programs); NO late hwks. and programs.
2. Two Midterms: 25% each; There is NO makeup policy unless there are medical reasons and the student will be required to show a letter from an MD as proof.
3. Programing Project: 20%

Notes *on items 1-3 above*

1. Homeworks/programs will be assigned regularly (once every 10-15 days). All programs must be written either in C/C++ or in MATLAB. Your program output will invariably involve processed image display. Hence, it is useful for you to know or learn some graphics programming either via MATLAB or OPENGL or any other packages available on the departmental workstations/PCs. None of this will be covered in the class and students are expected to pick this up on their own through various online sources.
2. First Midterm will be given approximately at the middle of the semester and the second will be in the last week of classes.

3. Projects may be done individually or in teams of at most two. The project will involve two aspects namely, (a) a two page initial description, which will not be graded but **must** be submitted within the first 8 weeks of class for approval; a list of projects, depending on enrollment, may be handed out in class but considerable freedom will be given to the students in choosing their own projects, and (b) a final report (no more than 5 pages of text not including the images and references) that will be due on the last class day. Project demonstrations may be arranged at a mutually convenient time on an individual/team basis.

Other Policies:

- **Academic Honesty:** See http://www.dso.ufl.edu/judicial/honestybrochure.htm for Academic Honesty Guidelines. All academic dishonesty cases will be handled through the University of Florida Honor Court procedures as documented by the office of Student Services, P202 Peabody Hall. You may contact them at 392-1261 for a "Student Judicial Process: Guide for Students" pamphlet.
- You are allowed to discuss hwk and programing problems with your colleagues in class but keep in mind that you MUST hand in your own solutions which must be distinct from those you consulted with.
- **Cell Phones:** Your cell phones MUST be switched off before you come to the class.
- **Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

Syllabus

Image Formation: Monocular imaging system; Orthographic & Perspective Projections; Camera model and Camera calibration; Binocular imaging systems; 3D image sensing (range sensing with laser ranging, grid coding etc.)

Low-level Vision: Basic image processing (continuous and discrete images), Edges and edge finding, stereo vision, Regularization, Shape from X, Optic flow and it's computation, Motion analysis (computation of motion parameters and structure).

Shape Segmentation & Representation: Simple segmentation techniques in 2D and 3D: Deformable curves and surfaces a.k.a. "snakes" and associated numerical methods. Snakes for tracking and Kalman snakes. Normalized Cuts and Graph Cuts. 2D (implicit and explicit functions, boundaries: Fourier/Wavelet descriptors; regions: Texture description using co-occurrence matrices, Medial axis, quadtrees etc.) and 3D shape representation (surface based:implicit and explicit functions, Gauss map and its differential; and volume based: Octrees, deformable solids etc.) techniques, Multi-resolution representations (Laplacian pyramid and wavelet basis).

High-level Vision: Simple object recognition methods in 2D and 3D: Various criteria for image-image or shape-shape matching. Principal Component Analysis (PCA) and building priors for recognition.