Polytechnic University Of Puerto Rico
Department Of Electrical Engineering
Master's Degree in Electrical Engineering

Course Syllabus

Course Title : Computer Vision

Courser Code: EE 7716

Credits : Three (3) credits

Duration : One academic quarter

Schedule : Forty-five credit-hours per course.

Prerequisites : EE 7712 Image processing

Course Description

The aim of this course is to introduce the principles, models and applications of computer vision. The course will cover: image structure and encoding; edge and feature detection; interpretation of surfaces; texture, color, stereo, and motion; wavelet methods in vision; parameterizations for solids and shapes; visual inference; and strategies for automatic face recognition. The course requires an extensive use of MATLAB and other mainstream software packages for computer implementation. The course requires a research report and paper reviews.

Justification

This is a basic and advanced course for the study and understanding of image formation, acquisition and processing.

Objectives

With this course students should understand visual processing from both "bottom-up" (data oriented) and "top-down" (goals oriented) perspectives and be able to decompose visual tasks into sequences of image analysis operations, representations, specific algorithms, and inference principles. They should also be able to understand the roles of image transformations and their invariance in pattern recognition and classification.

Textbook

Computer Vision (2001)
By Shapiro, L., and Stockman, G
Prentice Hall.

Topics covered

1. Image sensing, pixel arrays, CCD cameras, frame grabbers.
2. Sampling theory. Finite differences and directional derivatives.
3. Filtering;
4. Convolution; correlation. 2D Fourier domain theorems.
5. Edge detection operators; the information revealed by edges.
6. The Laplacian operator and its zero-crossings.
7. Logan's Theorem.
8. Scale-space, multi-resolution representations, causality.
9. Wavelets. Texture, color, stereo, and motion descriptors.
10. Disambiguation. Lambertian and specular surfaces.
11. Reflectance maps. Bayesian inference in vision; knowledge-driven interpretations.
12. Inferring shape from shading: surface geometry. Boundary descriptors;
13. Fundamental Theorem of Curves; codons.
14. Object-centered coordinates. Solid parameterization.
15. Super quadrics. Inverse problems; energy minimization, relaxation, regularization.
16. Model-based vision. Appearance-based versus volumetric models.
17. Applications and case studies.
18. Face recognition.

Evaluation Criteria

Final grade will be determined based on the following scale:

100-90 A
89-80 B
79-70 C
69-60 D
59- 0 F

Course History

Jun 6, 2002 prepared by Roman E. López Ph. D.
June 20, 2002; revised by Alexander López

Bibliography

Image Processing, Analysis, And Machine Vision (1999)
By Milan Sonka, Vaclav Hlavac, Roger Boyle.
2nd Ed
Cole Publishing Company
ISBN: 053495393X

Introductory Techniques for 3D Computer Vision (1998)
By Trucco and Verri
Prentice Hall
ISBN: 0-13-261108-2

Machine Vision (1995)
By R.C. Jain, R. Kasturi and B.G. Schunck
McGraw-Hill
ISBN: 0070320187

Robot Vision (1986)
by Berthold KP Horn
MIT Press
ISBN: 0-262-08159-8

Computer Vision (1982)
By Dana H. Ballard, Christopher M. Brown.
Prentice Hall PTR
ISBN: 0131653164