CAP 6618 Machine Learning for Computer Vision

Credits: 3 credits

Text book, title, author, and year:

Prince [2012], **Computer Vision: Models, Learning, and Inference**, Cambridge University Press, ISBN: 978-1107011793, Theodoridis and Koutroumbas [2009], **Pattern Recognition**, 4th ed., Academic Press, ISBN: 978-1-59749-272-0, Theodoridis, Pikrakis, Koutroumbas, and Cavouras [2010], **Introduction to Pattern Recognition: A MATLAB Approach**, Academic Press, ISBN: 978-0-12-374486-9

Reference materials:

Marques [2011], **Practical Image and Video Processing Using MATLAB**, Wiley/IEEE Press, ISBN: 978-0470048153, Szeliski [2011], **Computer Vision: Algorithms and Applications**, Springer, ISBN: 978-1-84882-934-3

Specific course information:

Catalog description:
Introduction to machine learning techniques and their application in computer vision problems. Discussion of image processing principles, techniques, and algorithms. Discussion of selected machine learning concepts, techniques, and algorithms. Use of MATLAB® for lab assignments and projects.

Prerequisites:

College-level mathematics and solid programming skills. Graduate-level elective course for computer science, computer engineering, and electrical engineering.

Specific goals for the course:

To introduce selected contemporary machine learning techniques and their application in computer vision problems, with an implementation-oriented focus, using MATLAB®.
More specifically, by the end of the course students will be able to:
• Explain the main challenges behind selected contemporary image processing and computer vision problems.
• Demonstrate theoretical and practical understanding of the principles and applications of contemporary machine learning techniques.
• Implement machine learning algorithms and apply them to image- and video-related problems.

Brief list of topics to be covered:

1. Fundamentals of image processing and computer vision
2. Image processing using MATLAB
3. Feature extraction, description, and matching
4. Fundamentals of machine learning
5. Probability
6. Learning and inference in vision
7. Modeling complex data densities
8. Regression models
9. Classification techniques
10. Feature selection and dimensionality reduction
11. Clustering

12. System evaluation
13. Case studies and applications

The course uses Blackboard for notes, assignments, announcements, and all course information (restricted to enrolled students).