

DELAWARE STATE UNIVERSITY

MTSC 887-IMAGE PROCESSING

SPRING 2014

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*Classes: ETV 134, Tuesday, Thursday 16:30-17:45*  
*Start date: Jan.13, 2014 End date: May. 1, 2014*

*Instructor: Dr. Sokratis Makrogiannis*  
*Department of Mathematical Sciences*  
*Delaware State University*  
*ETV building, Room 221*

*Office: ETV 221*

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*Office Hours: Mon, Wed 13:00-14:30, Fri 11:00-11:50 and by appointment.*

*COURSE DESCRIPTION:*

The student should become familiar with Digital Image Fundamentals, Image Enhancement, Image Restoration, Wavelets and Multiresolution Processing, Image Compression, Morphological Image Processing, Image Segmentation, Representation and Description, and Object Recognition.

*TEXT:*

*Required:*

Digital Image Processing, by Gonzalez and Woods, 3<sup>rd</sup> Ed., Prentice Hall pub.

*Recommended:*

Image Processing, Analysis and Machine Vision, by Sonka, Hlavac and Boyle, Chapman and Hall pub.

Learning OpenCV: Computer Vision with the OpenCV Library by Bradski, and Kaehler, O'Reilly pub.

Pattern Classification, by Duda, Hart, and Stork, 2nd Ed., Wiley Interscience pub.

Computer Vision, By Shapiro, and Stockman, Prentice Hall pub.

*PREREQUISITES:*

Complex Analysis 25-871, or consent from instructor.

*COURSE OBJECTIVES:*

Upon completion of the course, students will be familiar with:

1. Image Enhancement
2. Image Restoration
3. Wavelets and Multiresolution Processing
4. Image Compression

5. Morphological Image Processing
6. Image Segmentation, Representation and Description and Object Recognition.

*HOMWORK AND GRADES OVERVIEW:*

1. There will be homework assignments assigned on a regular basis that will not be collected for grading. Homework solutions will be made available for each assignment.
2. There will be 5-6 programming assignments which will be done on an individual basis. For each assignment, you are to turn in a brief report which should include a description of the problem, a description of your approach, and your evaluation of the results. Details on the deliverables will be given for each assignment respectively.
3. There will be a closed-book and closed-notes midterm examination.
4. There will be a closed-book and closed-notes comprehensive final examination. A portion of the final examination may also be a take-home examination.
5. Your overall grade for the semester will be based upon the assignments and exams as defined below.

<b>Type of Assessment</b>	<b>Weight of Assessment</b>
Assignments and Projects	35%
Midterm Exam	30%
Final Exam	30%
Participation/Attendance	5%

<b>Percentage</b>	<b>Grades</b>
90 - 100 %	<b>A</b>
80 - 89 %	<b>B</b>
70 - 79%	<b>C</b>
60 - 69%	<b>D</b>

*READING ASSIGNMENTS:*

Reading assignments will be given for each lecture period. Students are expected to complete the reading assignments prior to each lecture. Additional material will also be developed in class lectures, so missing class is not advisable.

*ATTENDANCE POLICY:*

Students are expected to attend all classes. Students are expected to arrive on time and be prepared for the class. Attendance may be taken at the beginning of each class. Please notify in advance if you are going to miss a class. Absence does not justify missed homework due dates and missed quizzes. If you miss a class, you are responsible for all material covered or assigned in class.

*LATE WORK:*

Homework assignments are due on their due date at (or before) the start of class; late assignments lose 33% per day of delay. If you are unable to hand in an assignment by the deadline, you must discuss it with me before the deadline.

*MAKEUP EXAMS:*

If any student misses an exam because of an extreme emergency, the student needs to make up the exam **within a week** to receive credit. Exams cannot be made up unless there is an extreme and documented emergency.

*GROUP WORK:*

While students are encouraged to work together in order to reach the learning objectives, each student is evaluated independently in homework and quizzes, unless there are specific instructions for group work.

*(TENTATIVE) SCHEDULE:*

Week #	Week Beginning Date	Description	Work Due	Text Reference
1	1/13/2014	Course Overview <b>Introduction</b> What is Digital Image Processing Examples Fundamental Steps and Components in Image Processing Motivation and Review		DIP Ch. 1
2	1/20/2014	<b>Digital Imaging Fundamentals</b> Visual Perception Electromagnetic Spectrum Image Sensing and Acquisition Image Sampling and Quantization Spatial Relationships Between Pixels		DIP Ch. 2
3	1/27/2014	Mathematical Tools in Image Processing <b>Intensity Transforms and Spatial Filtering</b> Intensity Transforms Histograms	A1	DIP Ch. 3
4	2/3/2014	Spatial Filters Image Enhancement <b>Frequency Domain Filtering</b> Basics Fourier Transform		DIP Ch. 3 DIP Ch. 4
5	2/10/2014	Discrete Fourier Transform of One Variable Extension to Two Variables Properties of 2D DFT	A2	DIP Ch. 4

		Basics of Filtering in the Frequency Domain		
6	2/17/2014	Image Smoothing and Sharpening in the Frequency Domain Selective Filtering Implementation Topics <b>Mid-Term Exam</b>	A3	DIP Ch. 4
7	2/24/2014	<b>Image Restoration and Reconstruction</b> Model of Image Degradation/Restoration Basic Noise Probability Density Functions		DIP Ch. 5
8	3/3/2014	Noise Removal using Spatial and Frequency Domain Filtering Inverse Filtering	A4	DIP Ch. 5
9	3/10/2014	<i>Spring Break</i>		
10	3/17/2014	Wiener Filtering Case study: Image Reconstruction from Projections <b>Morphological Image Processing</b> Introduction Erosion, Dilation, Opening and Closing Hit-or-Miss	A5	DIP Ch. 5  DIP Ch. 9
11	3/24/2014	<b>Image Segmentation</b> Introduction Point, Line and Edge Detection		DIP Ch. 10
12	3/31/2014	Thresholding Region-based Segmentation	A6	
13	4/7/2014	<b>Color Image Processing</b> (pending on time availability and interest) Color Fundamentals Color Models Color Spaces		DIP Ch. 6
14	4/14/2014	<b>Wavelets and Multiresolution Processing</b> (pending on time availability and interest) Background Multiresolution Analysis Wavelet Transforms		DIP Ch. 7
15	4/21/2014	<b>Case studies:</b> Computer vision Medical Image Analysis	CP	
16	4/28/2014	Review and <b>Final Exam</b>		

**NOTE:**

If you have a disability which is documented with the Student Accessibility Services Office and wish to discuss academic accommodations with me, please contact me as soon as possible.