Syllabus for Image Analysis and Recognition with Learning

Fall 2018 Math569/CSCI569, *Sections 0SE, 4RE, 7RE***, Location: BA244**
Meets 8/27/2018 through 12/14/2018, Day and Time: M 7:20PM- 10:00PM

Instructor: Dr. Nikolay Metodiev Sirakov
Office Hours: T 5PM-6:30PM
W 1:30PM – 3PM
Th. 5PM-6:30PM
Additional by appointment

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For web enhancement materials, please visit: http://faculty.tamuc.edu/nsirakov/Teaching/

Text: Digital Image Processing, 3rd Edition, by Rafael C. Gonzalez, Richard E. Woods, Prentice Hull, 2008, 0-13-168728-x, 978-0-13-168728-8

A book which provides IA algorithms and Matlab code: Digital Image Processing Using Matlab, by Rafael C. Gonzalez, Richard E. Woods, S. L. Eddins, Prentice Hull, 2004,ISBN 0-13-008519-7

Students Learning Outcomes:
(1) Students will gain knowledge and skills and will be able to transform one color model to another;
(2) Students will learn and will be able to utilize the basic multi-resolution methods: Scaling Functions, Wavelet transforms;
(3) Students will learn and will be able to utilize the basic Mathematical Morphology operations for image analysis;
(4) Students will learn, understand and will be able to apply set of image segmentation methods including: Points, Lines, Edge detection, and Active Contour Models;
(5) Students will learn and will be able to utilize object recognition methods based on distance metrics, matching, and neural networks (NN). The will learn the theoretical basis and use of the NN;
(6) Students will conduct independent project development, which will help them develop skills for: survey, theoretical work, coding, performing experiments, writing and presenting reports.

Requirements: *instructor's permission*
Knowledge which may be of help: Integral and Differential Calculus of two variables;
For the project development the students may use any language including: C++, Java, C sharp, or Computer algebra programming systems as MatLab or Mathematica.

List of Topics

1. Defining the area of Image Analysis and Recognition;
2. Color Image Processing. Color Models. Transformation between models. Automatic coloring of gray level images and movies ;
3. Multi resolution images and processing. Multi resolution Expansion. Scaling and Wavelet functions. Discrete and continuous wavelet transformations.
4. Basics of Mathematical Morphology and its applications to image processing and analysis: erosion, dilation, opening, closing, hit and miss transformations;
5. Image segmentation fundamentals: Points, Lines, Edge detection, Threscholding and Region-based method, Active Contour Models;
6. Pattern Recognition: fundamentals; based on correlation; decision functions; rotational and scaling invariant methods.
7. Theoretical foundations of the NN, basic functions for changing weights and data motion;
8. CiraTefi methods -shape matching, Histograms of Oriented Gradients – for image description

Contemporary Active Contour models for objects & features extraction and introduction to Deep Learning for classification and recognition will be taught upon time permission.

Course Content & Calendar: *The 1st lecture will take place on August 27*
1st & 2nd weeks **– topics** 1. and 2.**;** *3rd to 5th weeks* – **topic** 3 and independent study projects

assignment; *6th & 7th weeks* – **topic** 4.; *8th to 10th week* – **topic** 5. Guidelines on the projects development and writing reports; *11th & 12th* weeks – **topics** 6. 7; *13th to 15th week* – **topic** 7, 8. Guidelines on how to prepare and deliver a presentation.

COURSE EVALUATION

Mid Term Exam	- 26%
HW	- 20%
Lab work, and in class problems	- 12 %
Project	- 22%
Final Exam (Project Presentation, and corrections)	- 20%

Grading Policy: ***A:*** 100%- 90%
B: 89% - 80%
C: 79% - 70%
D: 69% - 60%; ***F:*** Less than 59 %

The professor reserves the rights to reward students for continuous hard work.
Additional Activities: Experiments; Home Practice Problems**;** Extra Credit Problems (ECP)
Instructional Method: Teaching lectures with proofs and example applications, testing the students with HW, quizzes, Exams, ECP, Final Project.

Final Test **:** CSCI569	**Date:** Monday – December 10, 2018	**Time:** 6PM-9PM

COURSE POLICIES
In-class activity: *Problems to be solved during the class period.*
HW: *problems, which involve theoretical and practical skills above the average level. Some of the HW could be assigned as team works.*
Lab work: conduct experiments, during non-class time, with given Image Analysis tools and images
Mid term comprehensive exam: *Is to be given around mid semester. It will take 2/3 of a class period.*
Makeup: *Except in the case of a formal institutional excuse, no individual makeup test will be permitted***.**
Project (most likely group): *closed itself innovative problem, whose development includes: survey of the present state of the art; development of a theoretical model; numerical analysis of the implementation; algorithm design and coding; performing experiment and deriving conclusions.*

Students with Disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, contact: **Office of Student Disability Resources and Services; Texas A&M University-Commerce; Halladay Student Services Building; Room 132 A/D; Phone (903) 886-5150 or (903) 886-5835; Fax (903) 468-8148** StudentDisabilityServices@tamu-commerce.edu

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Commerce, Texas
August 04, 2018 **Dr. Nikolay Metodiev Sirakov**