

# EE435: Biometric Signal Processing

## Course Policy Statement

Spring 2009 – Section 1111

Associate Professor Robert W. Ives

**I. Introduction.** The course will give the students the analytical and computational tools to be able to perform image processing. Students shall develop algorithms to analyze biometric data and to solve real-world personnel identification problems using MATLAB. They will become familiar with state-of-the art commercial hardware that performs biometric identification, and become familiar with issues that surround the collection and use of biometric data (such as privacy).

In addition, by the end of the course the students will be able to meet the following overall course objectives:

1. Apply image processing techniques to digital imagery using MATLAB.
2. State the privacy, policy, and legal issues associated with the use of biometrics.
3. Describe techniques for fingerprint, iris and facial recognition.
4. Describe the processes of biometric enrollment, identification and verification.
5. Use commercial biometric systems for enrollment, identification and verification.
6. Using MATLAB, develop algorithms that will use fingerprint, iris and/or facial imagery for identification or verification.
7. Present the results of their research both orally and written.

The focus of this course is on image processing, and concentrates on the use of iris scans, facial recognition and fingerprint analysis for personnel identification.

## II. Course Background Info

### A. Textbooks

*Image Processing, Analysis and Machine Vision*, Svoboda et al.  
*Guide to Biometrics*, Bolle et al.

### B. Meeting Locations

MWF 1, Tu 12 (Ri057-Biometrics Lab). On occasion, some class periods may be devoted to project time. See the online syllabus for the schedule of topics and assignments.

## III. Center for Biometric Signal Processing Contact Information.

Assoc. Prof. Robert W. Ives Office: Maury 334 Phone: 3-6165 Email: ives@usna.edu	Professor Jim Matey Office: Maury 350 Phone: 3-6140 Email: matey@usna.edu	Asst. Prof. Randy Broussard Office : Maury 232 Phone: 3-6131 Email: broussar@usna.edu
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Course Website: <a href="http://www.usna.edu/EE/ee435/">http://www.usna.edu/EE/ee435/</a>		

**IV. Grades.** Your grade for each grading period will be made up of:

Graded Work/Item	6-Weeks	12-Weeks	16-Weeks	Final
Exam 1	40 %	50 %	55 %	55 %
Exam 2				
Exam 3				
Quizzes	10 %	7.5 %	7.5 %	7.5 %
Homework	10 %	7.5 %	7.5%	7.5 %
Projects	40 %	35 %	30 %	20 %
Final Project				10 %

As a reminder, *I reserve the right to adjust your final grade based upon your overall performance.* Your level of effort, including participation in class and completion of assigned work on time, counts!

**V. Quizzes.** There will be quizzes scheduled during the semester (I will let you know in advance). Quizzes are intended to test your general knowledge of the topics covered throughout the course. They are closed book quizzes.

**VI. Homework.** There will occasionally be homework assigned during the semester, and typically you will be given a week to complete it.

**VII. Exams.** Three exams will be given during the semester, which may possibly be take-home exams. They will typically include some type of problem(s) that you must solve using MATLAB or any other resource, but must be done individually and completed in the required time period. The exams are open book, open notes, open computer.

**VIII. Projects.** There will be projects that are assigned periodically which will be graded: the syllabus will be updated to reflect these when they get assigned. In some cases, these may be group projects, but may also be individual. These projects will primarily be done using MATLAB or C++, and are intended to take longer than a single lab period to complete. Some projects may be required to be written up using the format included on the last page of this document, and turned in by the due dates. Assignments that are turned in late will suffer a significantly reduced grade. Make sure that when submitting MATLAB or other code, you must document what you're doing and why (with comments)...readability counts. Lack of sufficient comments reduces the grade. An example of a well-written MATLAB function is provided on the last page of this handout.

Additionally, there is another project we may be involved in to some degree. If it all works out, you will assist the lab techs and I in the installation and testing of a new *IrisGuard* Iris Recognition System over the door to Ri057. This will allow an alternate means to access the biometrics lab.

**IX. Final Project.** There will be a final project in lieu of a final exam, this project will count for 10% of your final grade average, and will involve a presentation to the class on your results. More details will be forthcoming.

**X. Field Trips and Guest Speakers.** Periodically during the semester, there will be field trips to facilities involved in biometric work. In addition, there will be guest speakers on several occasions. Since it is not always easy to pin down exact dates for these until close to when they occur the syllabus will be updated as necessary to reflect these.

**XI. Excusals.** Let me know early if you will miss an exam or quiz. If you miss either, you may be required to make it up. If you know you're going to miss a class, turn in any projects due that day early, or have a classmate turn it in for you.

**XII. Extra Credit.** You have the opportunity to earn extra credit in this course. If you happen to come upon a very recent news article that involves the use of biometrics, you can earn extra credit by copying the article (scan or printout), writing a paragraph that summarizes the article, and then giving a few-minute talk to the class to summarize it. Arrange with me as to when to give the talk.

**XIII. Extra Instruction.** Email, drop by, or call to ask for help. My schedule is as follows:

	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>	<b>Friday</b>
<b>1</b>	<b>EE 435</b>	<b>EE 435</b>	<b>EE 435</b>	<b>Research</b>	<b>EE 435</b>
<b>2</b>		<b>Lab</b>			
<b>3</b>			<b>EE 302</b>		<b>EE 302</b>
<b>4</b>	<b>EE 302</b>		<b>EE 302</b>		<b>EE 302</b>
<b>Lunch</b>					
<b>5</b>					
<b>6</b>					

**XIV. Section Leader.** On the first day of class, we will appoint a section leader and assistant leader in the event the section leader is not present. They will perform the normal expected functions of a section leader.

**XV. Misc.** Check your email at least once a day. We will use email extensively to communicate with each other, including corrections to assignments or schedules.

Good Luck! R.W. Ives, '82

MATLAB/C++ Project Report Format
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Project #:

Project Title:

Midshipman Name(s):

### **I. Purpose**

What was the purpose of the project and what possible uses you think it could have in the Navy/Marine Corps, either in whole or as part of a system.

### **II. Algorithm**

Describe how you decided to approach the problem and why. If you tried several ways to do things before something finally worked, describe the problems encountered here.

### **III. Results**

Include the results you obtained, such as a derivation of a Fourier transform and its plot in MATLAB. If your results include any plots, remember the things a good plot should include: title, label on the x-axis, label on the y-axis, and a legend. If you include images or plots as part of the text (such as using MS Word), they should have a caption.

### **IV. Conclusions**

Put any conclusions you can draw about the results you obtained. For example; if a project had you compare two algorithms, state which is better and why.

### **V. Code**

Submit any MATLAB code you created (not code you were provided by me), including functions and programs. You should have a lot of comments in the code to describe how things worked. See the following page for an example of well-written MATLAB code.

### **VI. Acknowledgements and Feedback (Optional)**

If you received help in completing the project, give credit to who helped and how they helped you. If you have some suggestions about how to improve this lab, or other ideas, put them here. Good feedback is a form of class participation.

## A “Well-Written” MATLAB function

When you write a MATLAB function or program, there are a few items that should be included. The following is an example of a well-written function. It contains comments right after the “function” line that tell the user how to use the function. If a user typed “help sinc322” at the command line, these comments would appear. These comments should also list the author(s). In addition, some comments are placed after certain lines of code to help explain what that line does. Use this as a guide to writing your own code.

```
function z=sinc322(x)
% function z=sinc322(x)
%   This function returns the sinc function. Based on MATLAB's sinc.m.
%   For EE322 students.
%   Author: R.W. Ives, USNA
%   Date: 20 Sep 2004

z=ones(size(x)); % set all OUTputs = 1...this will make sinc(0)=1
n=find(x);      % find all INputs not equal to 0
z(n)=sin(pi*x(n))./(pi*x(n));
% this last will make sinc(x)=sin(pi*x)/(pi*x) for all values
%   of the input except x=0, which is already set to 1
```