University of Florida

Department of Electrical and Computer Engineering

EEL 6825, Section 026A

Pattern Recognition

Spring 2015

Course Description

This is a 3-credit course.

The objective of this course is to impart a working knowledge of several important and widely used pattern recognition topics to the students through a mixture of motivational applications and theory.

Course Prerequisites

- EEL 3135 (Discrete-Time Signals and Systems) or undergraduate-level signals and systems
- EEL 4516 (Noise in Devices and communication Systems) or undergraduate-level probability theory/stochastic processes
- Some exposure to MATLAB and C programming language
- Knowledge of basic matrix theory (linear algebra) would be helpful, but not necessary

Required Textbook


Recommended Readings

Course Information

Instructor:

Dr. Dapeng Wu  
Office: NEB 431  
Email: wu@ece.ufl.edu

TA:

Jiade Li  
Email: jiadeli@ufl.edu

Course website:  http://www.wu.ece.ufl.edu/courses/eel6825s15

Meeting Time

Monday, Wednesday, Friday, period 9 (4:05 pm - 4:55 pm)

Meeting Room

NEB 201

Office Hours

- Dr. Wu: Monday, Wednesday, period 8 (3 pm - 3:50 pm), and by appointment via email.

Structure of the Course

The course consists of lectures, 4 homework assignments, and 1 project.

This course is primarily a lecture course. I cover all important material in lectures. Since EEL 3135 and EEL 4516 are prerequisites, I assume some previous knowledge about DSP, probability theory and stochastic processes, and hence I will cover some material very quickly. Thus, depending on what and how much you recall from earlier study, varying amounts of reading in introductory books on DSP, probability theory and stochastic processes (other than the course textbook) may be necessary; these readings are up to the student. I will only give reading assignments from the course textbook.

Attending lecture is quite important as I may cover material not available in any book easily accessible to you. I use Powerpoint presentation during lecture. Lecture notes will be posted on the course website before the class. The lecture is to engage the students in independent thinking, critical thinking, and creative thinking, help the students organize the knowledge around essential concepts and fundamental principles, and develop conditionalized knowledge which tells them when, where and why a certain method is applicable to solving the problem they encounter.

I do not intend for the WWW material to be a substitute for attending lecture since engaging the students in active thinking, making logical connections between the old knowledge and the new knowledge, and providing insights are the objectives of my lecture. The lecture notes are posted on the web so that you can miss an occasional lecture and still catch up, and it makes taking notes easier. To reward those who attend regularly, there will be some lecture-based material in the exam which is not available via the web.
The class project is described [here](http://www.wu.ece.ufl.edu/courses/eel6825s15/).

### Course Outline

- Bayesian decision theory
- Parametric estimation and supervised learning
- Nonparametric methods
- Linear discriminant functions
- Unsupervised learning and clustering
- Nonmetric methods
- Feature extraction and feature selection
- Applications

### Course Objectives

Upon the completion of the course, the student should be able to

- use the fundamental techniques for pattern recognition
- understand the basics of statistical learning theory
- acquire the basic skill of designing machine learning algorithms and systems

### Handouts

Please find handouts [here](http://www.wu.ece.ufl.edu/courses/eel6825s15/).

### Course Policies

#### Attendance:
- Perfect class attendance is not required, but regular attendance is expected.
- It is the student's responsibility to independently obtain any missed material (including handouts) from lecture.

#### During lecture, cell phones should be turned off.

#### No late submissions of your homework solution and project proposal/report, are allowed.

#### Software use
- All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

#### Announcements:
- All students are responsible for announcements made in lecture, on the student access website, or via the class email list.
- It is expected that you will check your email several times per week for possible course announcements.

#### Students with disabilities:
- Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when
requesting accommodation. For more information on classroom accommodation, please click [here](#).

- **Intellectual Integrity**

All students admitted to the University of Florida have signed a statement of academic honesty committing them to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida, and to be honest in all work submitted and exams taken in this class and all others. Refer to the academic [honor code](#) for more information.

Students are encouraged to discuss class material in order to better understand concepts. All homework answers must be the author's own work. However, students are encouraged to discuss homework to promote better understanding. What this means in practice is that students are welcome to discuss problems and solution approaches, and in fact can communally work solutions at a board. However, the material handed in must be prepared starting with a clean sheet of paper (and the author's recollection of any solution session), but not refer to any written notes or existing code from other students during the writing of the solution. In other words, writing the homework report shall be an exercise in demonstrating the student understands the materials on his/her own, whether or not help was provided in attaining that understanding.

**Useful links:**

- UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
  - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
  - Career Resource Center, Reitz Union, 392-1601, career and job search services.

For university counseling services and mental health services, please visit [http://www.counsel.ufl.edu/](http://www.counsel.ufl.edu/).

- In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: [http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html](http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html)

Grading:

<table>
<thead>
<tr>
<th>Grades</th>
<th>Percentage</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
<td>see <a href="#">calendar</a></td>
</tr>
<tr>
<td>Project proposal</td>
<td>10%</td>
<td>4pm, March 13</td>
</tr>
<tr>
<td>Project report</td>
<td>60%</td>
<td>4pm, April 29</td>
</tr>
</tbody>
</table>

The project report consists of

1. (50%) A written report for your project
2. (25%) Computer programs that you develop for your project
3. (10%) Powerpoint file of your presentation
4. (15%) Your presentation/demo video on YouTube

Grading scale:

Top 25% students will receive A. Average score will be at least B+.

Homework:

- Due dates of assignments are specified in the course calendar.
- No late submissions are allowed.
- If you wish to dispute a homework grade, you must return the assignment along with a succinct written argument within one week after the graded materials have been returned to the class. Simple arithmetic errors in adding up grade totals are an exception, and can normally be handled verbally on-the-spot during office hours of the TA. For all other disputes, the entire homework may be (non-maliciously) re-graded, which may result in increase or decrease of points.

Class Project:

The class project will be done individually (that is, teaming with other students is not allowed). Each project requires a proposal and a final report. The final report is expected to be in the format of a conference paper plus computer programs, a Powerpoint file, and a video. On March 13, the project proposal (up to 2 pages) is due. On April 29, the final report (up to 10 pages) is due. For details about the project, please read here.

Suggested topics for projects are listed here.

Calendar

Course calendar can be found here.

Links Study Guides

Useful links

- MATLAB Tutorial
- MATLAB Central
- Matlab Primer, Matlab Manuals, Image Processing Toolbox
- Matlab implementation of image/video compression algorithms
- Introduction to Matarix Algebra (free book by Autar K Kaw, Professor, University of South Florida).
- HIPR2: a WWW-based Image Processing Teaching Materials with J
- Learning by simulations
- OpenCV
OpenGL
- Download the following free (open source) program to record video with screen capture: http://www.nchsoftware.com/capture/index.html?gclid=CNadwsW6-6wCFSVjTAodbjzT_sg

Software:
- **Virtual Dub**: VirtualDub is a video capture/processing utility for 32-bit Windows platforms (95/98/ME/NT4/2000/XP), licensed under the GNU General Public License (GPL).
- **XnView**: is an efficient multimedia viewer, browser and converter.
- **ImageJ**: Read and write GIF, JPEG, and ASCII. Read BMP, DICOM, and FITS. [Open Source, Public Domain]
- Open source for image processing tasks: http://octave.sourceforge.net/doc/image.html

JOURNALS

Elsevier
- Computer Vision and Image Understanding
- Journal of Visual Communication and Image Representation
- Data & Knowledge Engineering
- Image and Vision Computing
- Pattern Recognition
- Pattern Recognition Letters

IEEE
- IEEE Transactions on Circuits and Systems for Video Technology
- IEEE Transactions on Multimedia
- IEEE Transactions on Image Processing
- IEEE Transactions on Medical Imaging
- IEEE Transactions on PAMI

Computer Vision
- **Computer Vision Homepage** at CMU
- **Annotated Computer Vision Bibliography** from USC IRIS
- **CVonline: The Evolving, Distributed, Non-Proprietary, On-Line Compendium of Computer Vision**

3-D for Everyone
- Red-blue glasses or anaglyph for 3D viewing: http://www.best3dglasses.com/anaglyph.html
- Shutter glasses for 3D viewing: http://www.stereo3d.com/shutter.htm
- 3D photos at http://www.jessemazer.com/3Dphotos.html
- 3D video sequences can be downloaded at: http://research.microsoft.com/vision/InteractiveVisualMediaGroup/3DVideoDownload/

Public Domain Image Databases
CMU Database