Adaptive Signal Processing

ECE 635 Spring 2017

Syllabus

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Announcements:

Expected background:

- Students are expected to know enough about signals and systems, and Matlab, to be able to follow the lectures and do homeworks quite easily.
- Those who are considering this course, please look at the textbook to see if the material appears accessible to you.
- Prerequisite for this course is ECE 528 (or permission of the instructor).
- ECE 535 is not a required prerequisite, but if you have already completed it with a good grade, this course will be easier for you.
- You can also take ECE 635 concurrently with ECE 621.
- We will be using matrices, z-transforms, correlation functions and power spectral densities.
- We will use simple optimization algorithms.
- There will be several Matlab assignments.
- Students will be required to complete individual projects on one of the new methods of adaptive signal processing, preferably published in recent literature.
- If you have your own project that is related to your professional work, and it fits in this course, you may do some work on such a project for class credit.
- An interesting project in this class may get you started towards an ECE Scholarly Paper required for graduation with an MS EE degree.
- If you wish to discuss this further with me, please send me an email to amanitiu at gmu.edu

Office Hours will be by appointment, from 2:00 pm to 3:00 pm on Tuesday. To make sure I am available, please first send an e-mail or call.

Textbook

There exist good textbooks on this material. However, several among them are not suitable for this course, because they tend to be voluminous, too long, too detail-oriented and are better as reference textbooks but not as the primary, fundamental
textbook for a one-semester course. For these reasons I am adopting a classic in this subject. Students like this textbook.


However, to reflect the progress made in Adaptive Signal Processing in the last several years, I am going to add more recent material from the following more recent books:


**Homework Exercises and Project**

HW will be assigned periodically and will be **due by the date and time specified in Blackboard.** Homework will have to be submitted through Blackboard.

They should preferably be typed and uploaded as a file to Blackboard. Please do not submit by sending it to me by e-mail.
If you hand-write your homework, please scan it and submit as a clearly readable file. Mere photo shots of your HW with a smart phone will usually have inferior quality and may be not accepted. Use scanning. You can get an App DocScan for your smart phone.

In the second part of the course students will develop individual projects to be presented 2 weeks before the end of the semester.

Typically, a project will be a computational investigation of selected adaptive algorithms published in recent technical literature. You should start planning such a project early in the semester, by studying papers on adaptive signal processing and developing the project before the Spring Break. You should write a 1 page proposal and submit as an assignment on BlackBoard (My Mason)

**Two Tests**
Will be given (in class) during the semester. These are normally closed-book problem-solving tests, so you need to make sure you remember the basic algorithms and formulas before the test and know how to solve typical problems in this course. You will learn this by doing HW.

**Quizzes**
Will be given during lectures. Typically those will be short quizzes to test your retention of previous material (diagrams, equations), but will not require calculations. They will be announced the week before. Two quizzes will be given during the semester, each worth 5%.
Tentative Course Schedule - spring 2017

Week 2, Feb 1  Correlation Functions, Correlation Matrix. Error functions as a quadratic form.
Week 3, Feb 8  Minimization of error function
Week 4, Feb 15 Quiz 1 + Search of Minimum. Steepest Descent and Newton Algorithms
Week 5, Feb 22 The LMS algorithm. Learning curve.
Week 6, March 1 More on the LMS Algorithm. Examples.
Week 7, March 8 Test 1 + Performance of the LMS Algorithm. LMS/Newton.
Week 8, March 15 Spring Break, no class
Week 9, March 22 SER and RLS Algorithm, with and without forgetting factor.
Week 10, March 29 Other adaptive algorithms + Adaptive Modeling.
Week 11, April 5 Quiz 2 + Adaptive Channel Equalization.
Week 12, April 12 Adaptive Equalization, Adaptive Interference Cancellation
Week 13, April 19 Test 2 + more on Adaptive Interference Cancellation
Week 14, April 26 Adaptive Arrays, Project Review
Week 15, May 3 Special Topics, and Project Review (last class)

Final Exam date by GMU Calendar, Wednesday May 10, 4:30 - 7:15 pm

Final Grades
Will be determined by a weighted average of the homework, the two tests, quizzes, and the final exam in the following manner:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework and Project</td>
<td>15%</td>
</tr>
<tr>
<td>Test 1</td>
<td>20%</td>
</tr>
<tr>
<td>Test 2</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>35%</td>
</tr>
</tbody>
</table>

Grade scale (approximate, subject to small adjustments at the end of the course depending on difficulty of tests):

Generally, A+, A, A- requires scores in the range 90% - 100%, B+ and B requires scores in the range 80% -89.9%, while scores below 80% will result in B- or C. Scores below 66% will result in grade F. (There is no D on the graduate grading scale).

Academic Integrity expectations: Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work. Please read more at:

http://oai.gmu.edu/the-mason-honor-code-2/
Special accommodations through the Office of Disability Services:

http://ods.gmu.edu/

Faculty contact information

My preferred mode of communication with students is e-mail. Please write to

amanitiu@gmu.edu

Face to face discussions: preferably during my office hours, or by appointment.
Office: ENGR 5400  Telephone: 703-993-3565
Office hours: Tuesdays 2:00 pm – 3:00 pm by appointment. Please ask for an appointment before coming. That is because of my administrative duties I may sometimes be not available.

Other information

University Catalog: http://catalog.gmu.edu/
University Policies: http://universitypolicy.gmu.edu/