Michigan State University
DEPARTMENT OF ELECTRICAL ENGINEERING

ECE 966A: Discrete-Time Processing of Speech Signals

Fall Semester, 2001

http://www.egr.msu.edu/classes/ece966a

Prerequisites: • Background in stochastic processes (ECE 863), and in signal processing (ECE 466)
• Familiarity with some computing platform and the ability to use MATLAB and the WWW on that platform.)

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Office Hours: TBA

Text:

J.R. Deller, Jr., J.G. Proakis, and J.H.L. Hansen, *Discrete-Time Processing of Speech Signals*, New York: Prentice-Hall / Macmillan, 1993.

OR

J.R. Deller, Jr., J.H.L. Hansen, and J.G. Proakis, *Discrete-Time Process'g of Speech Signals* (2d ed.), New York: IEEE Press, 2000.

References: See appendices to Chapter 1 of text

About the Course

Course Purpose. This course is an advanced graduate-level offering in the concentration area of Signal Processing. The main objectives of this course are:

1. To provide a solid fundamental background for advanced research and development in the digital speech processing technologies;
2. To provide the student who is seriously interested in signal processing more exposure to, and experience with, signal processing concepts through an important and interesting application area.
3. To provide the graduate student with an appreciation for the nature of research.

Course Format. This course will be conducted as a high-level graduate seminar with a mixture of lectures, class discussions, problem discussions, and project / application discussions. Rather than following a rigorous lecture schedule, we will exercise the flexibility to more deeply explore areas of student interest in speech processing. Students will be expected to be prepared to participate and ask questions about the day's topic by virtue of having studied the material prior to the class. This participation will be considered in assigning a final grade. The maximum achievable grade is 3.5 for anyone who is passive and does not participate in the class discussions.

After completing the fundamental topics in the course (Chapters 1 – 6 in text), each student will "specialize" in some facet of one of the two main commercial areas of speech processing – coding and recognition – by focusing on topics in either Part III of the text (Coding, Enhancement, Quality Assessment) or Part IV (Recognition). Each

student will complete a small **term project** in his or her area of expertise. As components of this project, the each student will (1) be called upon to present one or more research papers on his or her topic (probably taken from one of the sources listed in the appendices to Ch. 1 in the text), and (2) become knowledgeable about one or more WWW-based resources for speech processing. Details will be discussed in class.

Course Outline and Schedule & Assignment Chart. Included with this syllabus is a schedule of topics, readings, and problem assignments for the course. It is recommended that you *try the problems and exercises as soon as possible after the relevant class*. This will strongly reinforce the new concepts.

Homework. Homework assigned for a given week is due in the instructor's mailbox by *5:00 PM Monday of the following week*. Some or all of the assigned problems will be graded. **Late homework will not be accepted.** Problems will be discussed in and outside of class to the extent that students have questions (*even prior to submission!*), and to the extent that certain problems might be particularly illustrative of important points.

Project and related tasks. Discussed under "Course Format." Discussed further in class.

Examination. There will be a *Midterm Exam* covering the fundamental ("pre-project") topics in the course. The date for this exam is shown on the course schedule. The final exam period will be used to present project results.

Grading. In determining a final grade, assignments will be weighted as follows:

Written & computer homework	30%
Midterm examination	20%
Term project report & related presentations	50%

The final course grade will be based on an evaluation of the percentage score and overall performance. The maximum achievable grade is 3.5 for anyone who is passive and does not prepare for, and participate in, the class discussions.

An INCOMPLETE (I) grade will be given only in unusual cases of illness or other personal emergency which causes the student to miss a significant amount of the course. The DEFERRED (DF) is reserved for special circumstances in which a student has undertaken special work which, in the instructor's opinion, would benefit from extra time beyond the semester period. The I and DF grades will NOT be given for any other reasons. University policy dictates that in order to be eligible for an I or DF grade, a student must be doing passing work at the time the grade is recorded. In the case of the I grade, the student must, in the instructor's opinion, be capable of completing the missed work with reasonable provisions.

ECE 966A - SCHEDULE & ASSIGNMENT CHART

(*DO YOU HAVE MOST RECENT UPDATE?*)

DATE	TOPIC(S)	READING (D,P&H)	PROB. ASSIGNMENT
Week of Aug. 27	Course Overview / SP Background	Ch. 1 (skim 1.4)	**HW #1:** 1.2,4,9,10,11,12,13,15,17**
Week of Sep. 3	SP Background / Speech Science	Ch. 2	**HW #2:** 1.6, **7**; **HW #3A:** 2.1,**17**
Week of Sep. 10	Speech Models	Ch. 3 (skip appendices)	**HW #3B:** 3.1,2,4,**5**
Week of Sep. 17	Short-Term SP	Ch. 4	**HW #4:** 4.1,2,3
Week of Sep. 24	Recognition Preview	Ch. 10	**HW #5:** 4.6,7,**8(G1)**,**10 (G2)** ††
Week of Oct. 1	Linear Prediction	Sec. 5.1, 5.2	**HW #6:** 5.1–9
Week of Oct. 8	Linear Prediction (cont'd)	Sec. 5.3 (pp. 297-314) Sec. 5.4, 5.5	**HW #7:** 5.10,13,14,15 **23**, 25
Week of Oct. 15	Cepstral Analysis	Sec. 6.1, 6.2	**HW #8:** 6.1,**2**,6
Week of Oct. 22	Review Chs. 1 – 6 / Discuss Projects		
Week of Oct. 29 Tues. Oct. 28 **Thurs., Oct. 30**	Continue Review; Discuss Projects **Midterm Exam**		
Week of Nov. 5	Recognition Seminars: DTW / HMM	Chs. 11&12; Rabiner & Juang	Projects
Week of Nov. 12	Recognition Seminars: HMM / Language Modeling	Chs. 12&13	Projects
Week of Nov. 19 Tues. Nov. 23 **Thurs., Nov. 25**	Seminar: Topic TBD **Thanksgiving Holiday: No Class**		Projects
Week of Nov. 26	Coding Seminars: Coding; Enhancement	Chs. 7,8,9	Projects
Week of Dec. 3	Seminars: Topics TBD		Projects
Week of Dec. 10	**Finals Week: Presentations of Project Results**		

‡‡Problems due Monday following week of assignment at 5:00 p.m. unless otherwise noted.

*Boldface problem numbers indicate those involving computer work.

**Submission of these problems is optional. They are for review purposes only.

††The class will be divided into Group 1 (G1) and Group 2 (G2).

INSTRUCTIONS FOR ACCESSING THE "JOJO" FILES

Several times in the course we will need to access files resident on the archive server at Michigan State University's College of Engineering. The first task, which we will do as an exercise in getting connected to the server, will be to download two text files: README.DPH, and ERRATA.TEX. The first file contains some general information about the database, while the latter is a compilation of errors in the textbook. README.DPH is a plain ASCII file, while ERRATA.TEX is an ASCII-coded LaTeX file.

Here's what to do:

1. From any computing platform on which you can establish an ftp connection, connect to the machine with address archive.egr.msu.edu. For example, from a UNIX or DOS system, type

   ```
   >ftp archive.egr.msu.edu
   ```

2. When you are asked for your login name, type `anonymous`.

3. For your password, use your email address.

4. Once logged in, change to the directory pub/jojo/DPHTEXT (case is important). For example,

   ```
   >cd pub/jojo/DPHTEXT
   ```

5. If the files to be transferred are binary-encoded, we will need to change to binary transmission mode. This is NOT the case in the present exercise, but it will be true when we download data files later. For example,

   ```
   >binary
   ```

6. Now get the desired files. For example,

   ```
   >get readme.dph
   ```

   ```
   >get errata.tex
   ```

   This will place the files in the current directory of your local machine.

7. Send the README.DPH file to any standard printer. Use LaTeX and an appropriate printer driver to print ERRATA.TEX (This process will be demonstrated in class).