Project Assignment

DUE DATES:

- Pre-Proposal (optional): Friday Oct. 24
- Proposal (mandatory, 15% of grade): Friday Oct. 31
- Progress report (mandatory, 10% of grade): Friday Nov. 21
- Project (75% of grade): Friday Dec. 12

Introduction

The purpose of this assignment is for you to pursue a DSP topic of your interest in more depth than can be covered in class. It is not intended to be a full-scale “final project”, but rather a kind of extended independent homework assignment on advanced or supplementary material. You will need to do some outside reading. You will have to write a short (nominally 5 to 10 pages) report based on this reading. The default plan is for projects to be done by teams of two people; if you want to work alone or be a team of three, let me know and we will discuss it. Also, if you have questions about what topic to choose, a reasonable scope for your project, or want to get my ideas, feel free to come to office hours, make an appointment to see me, or send email. However, expect me to start by asking you what your interests are, so it will help if you approach such an exchange having thought about this question.

In general there are two types of projects you can do:

1. Do some software/hardware implementation related to your reading (Matlab, C code, etc. or using the Blackfin board), in which case your report should include results with figures, code, timing of results, etc., in your report, or

2. Write a more analytical report, in which case you should consult at least one additional reference on your topic and discuss a comparison of the articles you have read.

A list of some possible topic categories is below, but you are free to pick your own topic, as long as I approve your proposal (as described below). Three ways to find information on your topic are described in the next three paragraphs. I may be able to suggest other references, but given the size of this class my ability to do this will be somewhat limited.

One approach is to read material, in our course text or another book, that we will not be covering in class. If you choose not to include an implementation component in your project, you need to find at least one other approach to the same problem so that you can do a meaningful comparison. I will post some suggested texts, and topics that they cover that are not in our book, on the course web site, but you should not feel limited to this list—look around in the library.

Another approach is to read one or more articles in IEEE Signal Processing Magazine as the basis for your project. If you choose not to include an implementation component in your project, you should also read another related Signal Processing Magazine article or some journal article.
(typically one referenced in the magazine article you read). I will post on the course web site a listing of some relevant articles published in the magazine in the last few years. In addition, a few years ago there were some issues which included overview papers written by the various Technical Committees of the IEEE Signal Processing Society summarizing a number of sub-areas of DSP.

A third approach is to look for information on-line. Of course, the dangers of on-line information is that its informative quality is generally up to the ability and integrity of its authors with no external review, so you will need to be careful, and I will want detailed information in your proposal so that I can form an independent judgement if necessary.

You are not expected to completely master a topic, which may well itself be large enough to be the subject of a graduate course, but rather to gain an understanding of some of the issues and problems involved and a feel for some of the techniques/solutions. On the other hand, I expect you to produce something which reveals the investment of real effort.

Since there is a wide variance in the background of students in this course, I expect that students will produce reports whose depth and sophistication correspond to their background. In particular, students registered for graduate credit are expected to work at a more sophisticated level than those registered for undergraduate credit.

Details of What You Need to Hand In

Note from the due dates listed that this assignment has four parts:

1. **Due Oct. 24:** An optional one page pre-proposal, containing your names, a brief description of your proposed topic (or topics, if you have several ideas and want input from me on choosing one), and as much as possible of the following: a brief but clear description of what work you intend to do (for example, read these two articles, or do Matlab simulations to implement this algorithm, or . . . ), and specific identification of your reference(s). The purpose of the pre-proposal is to give you an opportunity to get input from me during your planning process. I will do my best to respond to pre-proposals as quickly as possible.

2. **Due Oct. 31:** A one to two page proposal, which is worth 15% of the project grade. This proposal should complete the same information as listed above for the pre-proposal, with more specifics. It will be graded on completeness, not the quality of the DSP, as measured by the extent to which it meets the requirements specified in the description above of the pre-proposal. It is **not** optional and should be handed in by the due date. I will respond to each proposal with comments in as timely a fashion as I can; the more timely your proposal submission is the more timely my response is likely to be.

3. **Due Nov. 21** A one to three page progress report, worth 10% of the grade. This should let me know how much progress you have made completing the tasks described in your proposal, as well as describe any changes you have decided to make from the plan in your original proposal. Including any initial results is always helpful. Again, this will be graded more for completeness than for technical content.

4. The report itself: The report should contain

   (a) enough of an introduction to let me know why the topic is of interest or importance,

   (b) enough detail in the description of the subject to let me know you have achieved some degree of understanding of the topic,

   (c) if you do simulations or hardware/software implementations, precisely what you did and what your results show,
(d) if you are comparing two or more articles, precisely how the articles are similar and how
they differ, and
(e) a conclusion summarizing what you got out of the project (or, if you didn’t get much
out it, why not).

The body of the report, not including graphs, should generically be 5 to 10 pages long. Include
relevant complete citations. The standards for the report are those of good technical
writing; I expect a well-structured organization, clear, concise exposition, adequate detail
to understand what is presented without excessive minor details, professional presentation
(word-processed or typeset), and all graphs, etc., to be well-labeled and explained. Use a
spell-checker!! As is almost always the case, including some comments on what you present
and drawing some conclusions is an essential ingredient of a good project report.

The purpose of the pre-proposal and the proposal is to help me help you pick a topic whose
scope is sufficiently challenging but still reasonable within the confines of a single semester. You
can always modify your plan if you need to while working on the project, but first you need to have
a solid plan to modify. The purpose of the progress report is to allow me to comment on any need
for changes in your plan (as well as to help keep you from leaving the entire project for the last few
days, of course!). As such, the grades for the proposal and progress report are simply an incentive
to help convince you that it is important to complete these tasks thoughtfully and on time.

**Important Note:** For each of the four parts, please hand in a hardcopy of your submission and
send it to me by email. In your email, *please* make sure ECE U666 or ECE G110 is in the subject
line of the email.

**Some Suggestions for Project Topics**

Below is a listing of some general topic categories by area of DSP that might help you think
about a project topic. This division into topics is somewhat arbitrary. I will post on the course web
site a partial listing, organized by these categories, of articles in IEEE Signal Processing Magazine
over the last few years.

1. Sigma-delta modulation and/or other coding/quantization schemes,
2. System identification and deconvolution,
3. FFT implementations,
4. Non-stationary signals processing and wavelets,
5. Filter design methods,
6. VLSI/hardware implementations,
7. Speech and audio processing,
8. Biomedical signal processing and medical imaging,
9. Image and multimedia processing,
10. Statistical signal processing,
11. DSP and Communications,
12. Non-linear systems, neural nets and related topics
13. Array processing,
14. DSP and Control,
15. DSP Theory

And next comes a list of example topics organized more by application area:

1. Topics in wireless communications, such as the use of antenna arrays in base stations, or how equalization schemes using signal processing, or DSP chipsets for cell phone handsets,

2. Topics in medical imaging, such as how computed tomography or MRI or ultrasound imaging works or other techniques work and what some currently important areas are for further advancement any of these or similar modalities,

3. Speech recognition or synthesis,

4. Image or speech compression, or standards for such compression such as MPEG or JPEG,

5. Comparing DSP chips to FPGA’s for signal and image processing algorithm implementations,

6. Digital music: synthesis or analysis or compression/transmission,

7. How radar or sonar or other such technologies work, and DSP algorithms in current or future systems.

These are just a few examples that come to mind; if you are interested in other areas, or want to talk about other possible areas to explore, contact me.