

ECE 1778 – Creative Applications for Mobile Devices
January 2012
Assignment #A3, for Appers

Understanding Parts of the Canvas

One of the goals of this course is to give experience in reaching across disciplines in a meaningful way (on the way towards our goal of creating a novel application of a mobile device). In this assignment, you will be asked to engage in a learning process about the capabilities of the computers that are part of the mobile devices, with your programming partners, and then to continue your learning on your own.

I believe that there is much to be gained by reaching across disciplines, and learning some of the language and basic understanding in other disciplines. As an Apper, you should be teaching the programmers some of the key terms in your field - their meaning and the underlying concepts behind those terms. Here, I'm asking the programmers to teach you some of the key terms and understandings in the computer field.

1 Key Capabilities of Computation

The computation capability of a computer could be broken down into many different sub-fields, at least one of which you're sure to be using in your project. Below is a list of different capabilities along with a small amount of context in which it is used. You are to choose one of these areas – one that you **are not** already familiar with, but your programming partners are - and to engage in a two-step learning process about it, with some help from your programming partners.

1. **Searching and Databases.** Computers are very good at organizing data in many ways, including in a database, but also in complex data structures, that make it easy to find something that you're looking for very quickly. A ground-breaking example of this is something called a Hash Table. Get your programmer to explain what kinds of problems a Hash table is used to solve, and how it cleverly does it better than the more obvious methods. Alternatively, create a coherent view of what a database is, and how it is used, and issues that show up in making use of it.
2. **Digital Signal Processing.** Many of the things that our senses can perceive in the 'analog' world – sight, sound, touch – are converted into a series of digital numbers when represented inside a computer. The very broad field of digital signal processing has produce a myriad of techniques to enhance those sensory data, and to try to 'understand' at some higher level, just like we do. Three examples of Digital Signal Processing are:
 - Filtering – isolating out different frequencies in a signal (which could be any one of a sound, picture or touch sensor data)

- Speech Recognition – a major field itself, which converts the sound to known words.
- Computer Vision – also a major field, which converts pixels into objects as well as other tasks such as tracking.

Have your programmers to describe what an how one of these three tasks (filtering, speech recognition or computer vision) works – what is involved in the key steps of the task, and how well it currently works in the state of the art.

3. **Optimization.** Given a few choices, a human being is pretty good at selecting among those choices, which might be the best. Given millions, billions or trillions of possibilities, computers can do a great job of sorting through these and choose the best, whereas a human has little hope of success. There is a gigantic field of automatic ‘optimization’ for which many different methods have been invented in mathematics, computer science, and engineering. Optimization could perhaps be divided into two sub-categories:

- **Combinatorial** - in which there are many different combinations of possible things to look at – for example, selecting the best route between two points on a map, in the presence of traffic data. Example techniques in this area include ‘greedy’ methods, ‘hill-climbing’ methods, dynamic programming, and the ‘branch and bound’ method.
- **Continuous** - here the set of possible ‘choices’ is represented as a set of numbers which can take on any value. This might be used NEED EXAMPLE APP. Example techniques in this area include Linear Programming and Convex Optimization methods.

Have your programmers describe one application of these methods, and how they actually do the solution. Make sure to spend some time understanding the ‘complexity’ of the approach, and what that means.

4. **Internet Communication.** The modern world is now predicated on vast communication networks that connect our wired desktops and wireless mobile devices to everyone! Having some sense of the layers of communication, both physical and virtual, that connect us could well enhance some of the projects you will do. Have a programmer describe what happens from an entry on the Google web search page and where it goes, when you press enter. They will have to speculate some, but it would be good if you had a clearer sense of all that is involved in that action. This should include some level of technical detail that includes notions of client/server, the nature and connectivity of the network (get the programmer to show you how many ‘hops’ and the average latency in the network it takes to go from your computer to Google’s servers), and a little about what actually goes on at Google to satisfy your query.

2 Learn from Your Partner

Choose one of the areas listed above (again: one that you **are not** already familiar with, but your programming partners are) and have your programming partners teach it to you. Take notes. Then, go away from them and write up a 2-page (500 words plus pictures; it

is really important to use pictures in this) description of the concepts involved. While you make connect with them and ask questions, do not have them edit your document in any way. Include a section in which you detail the things that you don't fully understand, or would like to understand better.

Submit this document online on Friday February 9th by 6pm, before moving on to the next step.

3 Take A Few Steps on Your Own

Using the Internet, pursue a deeper understanding of the topic. Look up the things that you didn't understand or wanted to know more about. Write a new document, also 500 words in length that conveys this deeper understanding. **In addition, write a single paragraph on your view of this learning process – how it went, how much you learned from Part 2 vs. Part 3, and what would have made it better.**

Due date:

For Part 2: Friday February 10th, at 6pm, 0.5 marks off every hour late.

For Part 3: Monday February 13th, at 6pm, 0.5 marks off every hour late.

Full assignment marked out of 10.

Submit your documents on the Blackboard Course Portal. Be sure to submit it to the 'A3' Assignment, clearly delineating which parts.