Silicon Neural Networks

Special Topics EE 541

Spring Semester 2005 T,TH 12:30-1:50PM, Norton 214

Professor:
Albert Titus
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213 Bonner Hall
Office Hours: Tuesday and Thursday 11-12noon.

Course Description:

Artificial Neural Networks (ANN) is the name given to a broad class of processing algorithms that are loosely based on how the brain processes information. The term artificial is important because it distinguishes the silicon-based systems and from the biological systems (such as ourselves). Artificial Neural Networks also form the foundation for artificial intelligence (AI) systems. In this course, we will begin by discussing what ANNs are and what features define them, and then we will examine a number of the most common neural network algorithms and techniques such as the perceptron, backward error propagation ("Back-prop"), self-organizing networks, and self-organizing maps. After this introduction, we will move into silicon neural networks (SNNs), which are based on the software ANNs. We will discuss current and classical papers on these subjects in class, with discussions led by students. The goal is to extend how you think about solving problems using circuits on a chip.

Course Material:

There is no textbook for this course. It is completely based on Journal Papers.

Course Coverage:

Neurons, the Brain, and Neural Network Overview
Learning (Hebbian, Competitive, Boltzmann, Supervised)
Single Layer Perceptrons and Multi-layer Perceptrons (Back-prop)
Self-organizing Networks
Self-organizing Maps
Silicon (CMOS-based) structures
Analog Layout of these

Grading:

Oral Midterm Exam - 10%
Biweekly homework projects – 30%
Final Project – 45%
Class Participation – 15%

- The project topic will be announced later in the quarter.
- Biweekly assignments will be approximately biweekly.
- Programming language will not be limited to C or C++. Java, Perl, Visual Basic, and Matlab will be allowed.
- No help will be provided in terms of code writing or de-bugging. This class is not a coding class but an applications class. It is assumed that you know the language you are writing in.
- Class participation includes answering questions, raising questions, contributing to the discussion of ideas in class.
- Late work will be accepted with a penalty. Work that is more than one week late will not be accepted.
- You should read the material before class and keep up with the reading.

Course Expectations:

The course is a combination of theory and application. You will be expected to demonstrate an understanding of the theory underlying neural networks and be able to do a basic implementation of some of the algorithms. You will be expected to read material on your own and be able to discuss it in class; class time will not be spent solely on lecturing, but will require interaction and discussion. The course is not intended to cover all areas of artificial neural networks, but will provide an overview of major concepts, and after taking the course, you will have a good understanding of how to use ANNs and be able to evaluate ANN algorithms and implementations for their usefulness. It is expected that you are familiar with MAGIC for doing the analog layout.

Email:

My email address is ahtitus@eng.buffalo.edu. I check email regularly, so this is a good way to contact me. Check your email regularly.

UBLearns Page:

There is a class web page and it is an important part of the class. Go to your MyUB page, then ->UBLearns. It will include general information about the class, as well as information for each exam. ALL homework assignments can be found there, as well as solutions to homework. Check the web page regularly for any updates.

YOUR FIRST ASSIGNMENT IS TO SEND ME AN EMAIL WITH THE FOLLOWING INFO ON IT:

1. Your full name
2. Your nickname (For example, your full name is Kenneth and you prefer to be called Kenny)
3. Your email address
4. The class you are in (EE 541)
5. Any other information you want me to know.