MATHEMATICS &

COMPUTER SCIENCE I

Section Moderator: Dr. Joan Lind
Room: Inman Health Sciences Building 310
Time: 3:20 – 5:00 PM

3:20 – 3:40
"Developing a Model Certificate Authority for Collegiate Institutions"

Henry L. Carter
Faculty Advisor: Dr. Glenn Acree

Modern network security depends on asymmetric encryption algorithms to maintain the integrity and privacy of electronic communications over public networks. Development of these algorithms has led to the creation of digital certificates to identify the participants in an electronic transaction. Due to the open nature of most collegiate communications infrastructures, communication on these networks is often exposed to malicious attack. Digital certificates would resolve a number of these security issues. However, the public certificate authorities that issue digital certificates are too expensive and difficult to use for most students and faculty.

The goal of my research is to develop a model certificate authority that could be scaled and implemented within a college institution. The project will consist of two stages: the development of the certificate authority server standards and the development of procedural policy to govern the use of the certificate authority. I am projecting that the availability of such a model will encourage the establishment of certificate authorities on college campuses, increasing the security of internal communications by authenticating email, securing web servers, and encrypting stored data.

Discipline: Computer Science

3:40 – 4:00
"Sniffica: Wireless Network Detection and Coverage Map Generation for the iPhone"

Ross Buffington
Faculty Advisor: Dr. William Hooper

As technology and society become increasingly mobile, it is essential to develop new tools for analyzing our environment. For a mobile individual to stay connected to the Internet, they must know where to find wireless networks. In many situations, a geographical map of wireless network coverage would suffice.

Sniffica is a native application for the iPhone, developed in the Objective-C programming language. Its purpose is to collect wireless network beacons and GPS coordinates, and then use this data to calculate the locations and ranges of wireless access points. This information is then represented on a geographical map of the individual's surroundings.

A further application of *Sniffica* is its use in pinpointing areas of interference between competing wireless access points. By generating and analyzing a coverage map, a network administrator could detect and remove rogue access points as well as minimize wireless network interference, thereby improving their organization's network infrastructure.

Discipline: Computer Science

4:00 – 4:20
"Improved Motion Detection via Artificial Intelligence and new Photometric Techniques"

Heather D. Ellis, William T. Proffitt
Faculty Advisor: Dr. William H. Hooper

Currently, NASA uses computer-based systems and photographic search techniques to detect near-earth objects and determine impact probabilities. However, it is possible to apply these same techniques to conventional situations on earth to determine object movement in general. This research examines the impact that improvements in spectrophotometric techniques have on objection motion detection.

Inexpensive, high-quality cameras have become available to the public, rendering technologies that were previously inapplicable to the consumer sector more relevant. For example, sorting through video evidence of a crime currently requires extensive manpower; where as, artificially intelligent algorithms could solve this problem in mere minutes, due to the increased image information available from modern cameras. This result can be achieved by expanding the specific methods used by NASA for photographic analysis with goal of applying them to the more general problem of motion detection.

By breaking the image into several pixel groups and comparing changes in color information, scaled by a weighted error function, the relation between two images can be discovered; however, image quality can affect the algorithm's efficiency and ability to detect movement. By providing as much information as possible, modern cameras minimize the margin of error and allow even the simplest algorithms to succeed.

Discipline: Computer Science

4:20 – 4:40
"Real Time Facial Recognition"

Jordan Williams and Jared Burke
Faculty Advisor: Dr. William Hooper

Facial recognition is a rapidly advancing frontier in the field of artificial intelligence, and recent advancements in the speed of computer processors has made real time facial recognition a possibility.

We intend to build a program that runs on Mac OSX and makes use of the internal camera to perform facial recognition on the real time video stream. We are performing a Single Scale Retinex transform on the video stream in real time in order to control for differences in illumination, and we are performing the actual detection with a back propagation neural network implemented in the C language.

Discipline: Computer Science

4:40 – 5:00
“Context-Free Grammar Inference in Java with Sequitur”

Andrew B. Hill & Matthew C. Lefavor
Faculty Advisor: Dr. William H. Hooper

In a 1997 paper, Craig G. Nevill-Manning and Ian H. Witten describe Sequitur, a linear-time algorithm that infers the structure of a sequence of discrete symbols, including characters, musical notes, numbers, and more. Though the result lacks the generality of typical context-free approximations of natural languages, the algorithm may at least provide a firm basis upon which machines may in the future perform grammar induction from a written text. In addition, the algorithm’s constraints guarding against symbol redundancy make the algorithm work well as a data compression scheme.

We will explore techniques for improving the qualitative performance of the algorithm, particularly changing the definition of “symbol.” The Sequitur algorithm is often used for sequences of characters, but perhaps the algorithm could more easily recognize grammatically significant “phrases” by focusing on individual words. We will also explore the algorithm’s effectiveness in parsing “unnatural” languages, such as formal arithmetic, Java, strings of bits, and so forth.

Discipline: Computer Science