



MONTCLAIR STATE
UNIVERSITY



Department of Computer Science
RI 301
Montclair State University
Montclair, NJ, 07043
<http://cs.montclair.edu>

Undergraduate Student Projects – Dr. Stefan Robila

If you are interested in an independent study, in exploring new computer and information technologies, acquiring new skills, or learning what research is, you may want to consider doing an undergraduate research project. Here is what staff the Undergraduate Research Center in Sciences at University of California Los Angeles wrote on undergraduate research ([UCLA](http://www.ucla.edu)):

“Conducting research as an undergraduate is an excellent way to gain experiences and skills that will benefit you both academically and professionally. In addition to exploring your areas of interest in-depth, undergraduate research develops skills in collaborative learning and critical thinking.”

I am currently looking for enthusiastic students to embark on investigative work associated to several projects. Skills needed for these projects vary greatly and I encourage you to approach me to discuss them. Work on these projects also vary greatly and can include software development, system design and administration, as well as reading and writing. Opportunities to present your work in local and national meetings exist.

No pay is provided, however, research projects are done in collaboration with a faculty mentor and taken as for credit course for 3-6 credits. Registration for such projects is done as an independent study based on a signed written agreement. Participation in the projects allows you 24hr access to the Computational Sensing Laboratory (267B) that includes computing systems, printers, and an extensive library.

If you are interested in any of the project directions described on the next pages, or would like to propose your own project, please contact me.

Stefan Robila, Ph.D.

RI 312

(973) 655-4230 / robilas@mail.montclair.edu

Undergraduate Projects

U1. Spectral Imaging

We are working on a variety of problems centered on spectral imaging. First, we investigate a unifying framework for the use of higher order statistics in multispectral/hyperspectral image processing. The main goal is to find efficient algorithms for land cover classification, feature extraction and target detection. Second, we are also investigating new applications of spectral imagery. One direction followed here is the use of hyperspectral images for face recognition. Participating in the project you will learn about spectral imaging, work with a hyperspectral camera, develop applications and test solutions. Alternative projects include computing configuration and set up for mobile data collection.

U2. Distributed Computing

A 512 compute-cores AMD Opteron system with Linux OS is available for use. Various problems including matrix and vector processing, computer security techniques and system benchmarking have been approached and new directions are available. While engaged in these project you will receive access to the cluster as well as other Linux machines. You will learn paradigms of parallel and distributed computing, implement and test new algorithms. Opportunities to learn, maintain and benchmark the cluster also exist.

U3. GPU Computing

"GPU computing is the use of a GPU (graphics processing unit) together with a CPU to accelerate general-purpose scientific and engineering applications. Pioneered five years ago by NVIDIA, GPU computing has quickly become an industry standard, enjoyed by millions of users worldwide and adopted by virtually all computing vendors." ([NVIDIA](#)) A Microway Xeon Tesla WhisperStation that includes a 2,496 core NVIDIA GPU is available for use. The first steps of the project include set up, configuration and benchmarking, future steps include development and testing of applications on the GPU environment. While participating in this project you will learn about parallel processing, GPU programming and performance analysis.

U4. Small Form Computing (Raspberry PI and Intel NUC)

Small form computing are designed to minimize the system's size while offering at least similar to a computing system. In recent years, several initiatives have resulted in quite stable platforms such as [Raspberry PI](#) (a card side device) or [Intel NUC](#). Both platforms are available for use. If you decided to join this project you first investigate how to set the systems up and then proceed with implementation and testing of novel applications.

U5. Robots and Sensors

A complete [Arduino](#) set is available for building and for experimentation. The robot allows you to investigate basic navigation and localization problems as well as imagine your own. In addition over a dozen [Scribbler+Fluke](#) robots are ready to use off the box. The robots use Bluetooth for communication, have cameras, as well as other sensors (infrared, light, etc.) Several successful projects were demonstrated by students recently enrolled in a class at MSU. Your robotic project can start from scratch or build upon the course work of others. In addition several Microsoft Kinect sensors are available for experimentation and application development.

U6. Computer and Information Security

The projects under this title cover a variety of directions and often can be a continuation of the work done in the security course you might have enrolled. They range from design and experimentation of brute force attacks to investigation of communication protocols to social aspects of hacking.