Available Projects for Undergraduate Research

Project ID: 22S1

Faculty Mentor: Hank Childs

Undergraduate's Position Title: Undergraduate Researcher

Project Description:
Projects are defined by the student after taking computer graphics (CIS 441) or scientific visualization (CIS 410). Previous student projects have included exploring ways to incorporate the latest computer graphics techniques (like photorealistic rendering) in a scientific visualization setting, as well as developing scientific visualization algorithms that will run efficiently in a parallel environment. Other projects have considered human factors, in particular how to optimize the visualization process for human viewers.

Minimum Qualification Requirements:
Completion of computer graphics (CIS 441) or scientific visualization (CIS 410).

Sponsorship:
Unpaid/Volunteer position; Research/Thesis credits.

Application Deadline:
Until position filled

Project ID: 22S2

Faculty Mentor: Jee Choi

Undergraduate's Position Title: Undergraduate Research Assistant

Project Description:
This project involves optimizing the tensor train decomposition algorithm, which is commonly used in machine learning and data analysis, on modern parallel systems (e.g., multi-core CPU or GPUs). This work will involve a) studying the related literature, b) designing efficient algorithms and implementing them on a multi-core CPU or GPU, and c) publishing the results in a peer-reviewed conference. The project is expected to take 3-4 terms. If excellent progress is made on the project and the student shows promise in research, a paid position over the summer will be considered.

Minimum Qualification Requirements:
Excellent a) C/C++ coding skills (e.g., A in CIS 330), b) algorithm knowledge (e.g., A in CIS 315), and c) have taken linear algebra course(s).

Sponsorship:
Research/Thesis credits

Application Deadline:
Until position filled

Project ID: 22S3

Faculty Mentor: Ram Durairajan

Undergraduate's Position Title: Undergraduate Research Assistant

Project Description:
Successful application of machine learning (ML) for networking problems depends on the availability of high-quality labeled data from real-world networks. Equally critical is the ability to share these datasets, respecting the data owners' privacy concerns. Unfortunately, short of sharing the data via today's commonly-applied data-to-code paradigm, researchers lack a systematic framework for working with or benefiting from data collected and curated by third parties. Consequently, Internet Data Science as practiced today is ill-suited for applications such as (i) high-quality data labeling, (ii) rigorous evaluation of research artifacts such as learning models, and (iii) independent validation/reproducibility of reported research findings. To tackle these problems, we have built a new framework called EMERGE (https://ix.cs.uoregon.edu/~ram/papers/NetAI-2020.pdf) to enable the pursuit of Internet Data Science as a full-fledged collaborative effort.

We are seeking a self-motivated and hardworking undergraduate student to build several components of EMERGE. Specifically, we will first harness FABRIC (https://fabric-testbed.net/) to facilitate privacy-preserving collaboration from one enclave (i.e., UO) resulting in a secure enclave-to-FABRIC workflow. More concretely, the envisioned enclave-to-FABRIC workflow will be built atop gRPC which is an open-source high-performance RPC framework. All communication in this workflow will be secured using TLS. To support this workflow, the EMERGE framework running at the enclave will represent the gRPC Stub (or client) on one end. On the other end will be a gRPC server---henceforth called as EMERGE agent---that will run on FABRIC. The main role of the EMERGE agent will be to help with coordination and facilitate collaboration among the enclaves. To this end, the agent has to be able to interact with the following three components, each of which will be designed and developed as part of this project:

Feature repository: Collects and stores data features. The data sets can be collected at different timescales, different locations, or different granularities.

Collaboration module: Provides basic capabilities for the enclaves to collaboratively identify specific features, hyperspace parameters, or data collection strategies that can boost the quality of different labels and ML models from individual enclaves. In our design, we will use the collaborative editing module from neptune.ai (https://neptune.ai/) to tap into the combined domain knowledge across enclaves and not be limited to the existing domain knowledge in any of the individual universities. The results of these interactions and collaborative efforts will be shared via APIs (to be designed).

Comparison module: Using the collaboration module and the APIs, the EMERGE agent can facilitate exchange of labeling functions, event detection configurations, data features, and model hyperparameters between the enclaves as well as independently compare trained models with each other using metrics such as F1 scores, accuracy, recall, training time, etc.

The project is expected to take a year. Successful completion of a B.S. thesis is mandatory!

Minimum Qualification Requirements:

Python, gRPC, some machine learning knowledge, strong software development project experience, experience building APIs.

CIS 322 (preferably with Prof. Durairajan) is a must!

GPA minimum = 3.9/4.0 is a must!

Sponsorship:

Research/Thesis credits; Paid position.

Application Deadline:

Until position filled

Project ID: 22S4

Faculty Mentor: Jun Li

Undergraduate's Position Title: Programmer

Project Description:
This project studies Internet routing sovereignty. It is well-known that the Internet traffic between two computers from the same country may be routed through an Internet service provider at a different country and/or under a different sovereignty, posing potential network connectivity or security concerns. Little is known, however, how common this phenomenon is and what impact it may have. This project analyzes the Internet routing data and tries to provide an answer for any country of interest (e.g., USA, or any European nation).

Minimum Qualification Requirements:
Students should have better taken CIS 432 and understands computer networking, including the border gateway protocol (BGP). Can program in at least one popular programming language (e.g., Python, C, Java, C++, etc.) fluently. Good at plotting graphs with some basic data analysis skills. Or, strongly motivated to learn the above required knowledge and skills. Can work at least 10 hours a week. $13-15/hr.

Sponsorship:
Research/Thesis credits; Paid position.

Application Deadline:
Until position filled

Project ID: 22S5

Faculty Mentor: Jun Li

Undergraduate's Position Title: Undergraduate researcher

Project Description:
This network security project studies spoofing, man-in-the-middle, DoS or DDoS attacks on the Internet and their defense. The goal is to identify and focus on specific critical attacks and design, develop and test defense solutions.

Minimum Qualification Requirements:
The candidate student should have better taken CIS 432 and understand computer networking, especially TCP/IP. CIS 433 or equivalent is also a must. Motivated to solve tough network security problems. Can work at least 10 hours a week. $13-15/hr.

Sponsorship:
Research/Thesis credits; Paid position.

Application Deadline:
Until position filled

Project ID: 22S6

Faculty Mentor: Jun Li

Undergraduate's Position Title: Programmer

Project Description:
This project explores the potential opportunities with various blockchain-based services and applications, including, but not limited to, DAO, NFT, DeFi, GameFi.

Minimum Qualification Requirements:
The ideal candidate should have a solid knowledge of blockchain and solid programming skills in one of the blockchain programming platforms. Can work at least 10 hours a week. $13-15/hr.

Sponsorship:
Research/Thesis credits; Paid position.

Application Deadline:
Until position filled