

# Research projects for undergraduate students with UH CS Faculty - Spring 2024

## Guoning Chen

I am working on various problems in data analysis and visualization, geometric modeling and geometry processing.

My research webpage is below

<https://www2.cs.uh.edu/~chengu/research.html>

I usually work with undergraduate students on projects that are small components of a bigger project. For example, one recent undergraduate student project helped us extend a functionality of a web-based visualization system. Another example project aims to improve an optimization process for polygonal meshes. We also had a project that asked the student to help us set up a simulation framework.

We have a weekly group meeting every Friday. And yes, we welcome undergraduate students to join our meeting.

## Albert Cheng

Real-time machine learning; data-based real-time risk assessment; fault-tolerant and secure real-time, embedded, cyber-physical systems and IoT; real-time virtualization and cloud computing.

Building an Experimental Scaled City with Autonomous Model Cars to Evaluate Real-Time Learning and Decision System for Traffic Routing (Lego sets and fast autonomous model cars!);

Real-Time COVID-19 Infection Risk Assessment and Mitigation based on Public-Domain Data (a cool App!);

Real-Time Machine Learning: Leveraging the Selfless Driving Model to Reduce Vehicular Network Congestion;

Detecting Integrity Attacks in Cyber-Physical Systems, Fault-Tolerant Regularity-Based Real-Time Virtual Resources;

Incorporating Deadline-Based Scheduling in Extreme-Scale Parallel Computing (HPC).

## Zhigang Deng

The research in Prof. Deng's computer graphics and interactive media lab is centered on three inter-connected areas: (1) virtual humans (modeling, animation, interaction/perception), (2) computer graphics/animation (mesh processing, crowd simulation, insect/traffic simulation), (3) graphics + X (extend graphic/animation techniques for interdisciplinary applications).

Some research ideas: (a) create and extract motion from large-scale data (such as video data) and then perform some machine learning models on it, (b) develop animation tools/platforms (such as crowd simulation) for open-source academic research.

## Omprakash Gnawali

<https://www2.cs.uh.edu/~gnawali/>

Internet systems and performance

- Cloud

- Network protocols

Understanding Society using Internet

- Government shutdown

- COVID 19

- Privately run 5G network spanning four cities in the US

Time series (network or sensor) data analysis using AI

- Body/vehicle (IMU)

- Environment sensors

Wireless network and embedded/IoT systems

Location tracking

- Ultra Wide-band technology

Low power reliable network systems for data collection at city-scale

Open source hardware and software

## Stephen Huang

Within Cybersecurity, my research concentrates on Intruder Detection. We would like to identify intruders routing their traffic to avoid being detected (also called anonymity networks). Currently, we are working on two areas, network intrusion detection (such as VPN or TOR traffic detection) and host Intrusion Detection (such as Malware Detection).

I am also interested in applying AI technology for cybersecurity. One example is training AI systems to analyze computer system logs for security issues.

Algorithms and Data Structures, including optimized data structures, optimization, and machine learning algorithms.

Undergraduate students are encouraged to apply for the Research Experience for Undergraduates (<http://project.cs.uh.edu/reu/>). This is a paid 10-week summer research program for qualified undergraduate students. The funding is provided by the National Science Foundation (NSF). Dr. Huang's website: <https://www2.cs.uh.edu/shuang/>.

## **Ioannis Kakadiaris**

AI and Social Good

<https://www.linkedin.com/in/ioannisakakadiaris/>

AI-HEAT: Students can do research on models that have "I do not know" as answer

AI-SNIPS: Students can do research on connecting images via keywords and large language models

AI-FEED: Students can implement research modules in collaboration with the team.

CRASA: Students can explore the issues of accountability of AI algorithms.

iReadUSA: Students can do research on how to incorporate information from Twitter alternatives

## **Sen Lin**

1. My research interests lie in general machine learning algorithm design and theory development, with applications in multiple domains, e.g., wireless communications and security. Here is the link to my research page: <https://slin70.github.io/>
2. A few potential research projects in my group can be as follows:
  1. Leveraging continual learning techniques to achieve machine unlearning
  2. Theoretical investigations of machine unlearning based on linear models
  3. Investigating neural collapse in continual learning and leveraging neural collapse to develop better continual learning algorithms
  4. Investigating the impact of data ordering on the performance of single-task/multi-task learning

## Arjun Mukherjee

1. Applied Machine learning, deep learning , Bayesian learning and inference for broad based Artificial intelligence problems in natural language processing (detecting fake news, deceptive online content, fake user profiles on LinkedIn, Twitter, Facebook) and computational social science (detecting stance, sentiment on social, political discussions in online social media) and software engineering (detect malware, etc.)

Recent Papers:

[https://scholar.google.com/citations?hl=en&user=wUNpA\\_sAAAAJ&view\\_op=list\\_works&sortby=pubdate](https://scholar.google.com/citations?hl=en&user=wUNpA_sAAAAJ&view_op=list_works&sortby=pubdate)

2. Help with large scale data collection (basic python/c#/Java web content based parsing) and able to use APIs to crunch text data and run existing models on data), generate plots and summarize insights from data. Sufficient experience with python is a plus.

3, 4. Interested undergraduate with sufficient background can attend one of our weekly lab meetings and have deeper on task one on ones with my PhD students. If sufficient interest to work closely is expressed (we request a minimum of 6 months of dedicated effort because we are a publication focused group and it takes a min of 6 months of work for it to be submitted to a venue), they can be given a task to match their interests on the larger umbrella of projects we handle and do a small rotation to see if they would like to continue their research.

In the past our group has had a few domestic and international undergrad student (and received placements at research groups like John Hopkins PhD program, Uber, Northwestern Business school, etc.)

## Carlos Ordonez

<https://www2.cs.uh.edu/~ordonez/index.html>

Research area: big data, making python more scalable OR any systems-level DB related topics

How to contact: Teams message (instead of email).

## **Gopal Pandurangan**

Algorithms, Distributed Computing, Networks, Machine Learning, Big Data, Data Science.

Explore interesting algorithms with real-world applications, especially algorithms for networks, big data, and machine learning

Do research on real-world networks, especially peer-to-peer networks.

## **Shishir Shah**

Research at Quantitative Imaging Laboratory is focused on basic and applied research in computer vision, image understanding, and machine learning. The mission of this research group has been to develop novel methods and systems for image and scene analysis that are capable of making human-like decisions. Our passion has been in the pursuit of scientific excellence and innovative engineering, enabling pragmatic solutions to problems of societal impact. . Current research initiatives of the laboratory are in wide-area video surveillance for behavioral analysis and biometrics, quality-aware deep learning models for image and video analysis, and human behavior modeling for biomedical and medical applications.

### Research ideas

1. Fundamental understanding of 2D+ signals and methods for processing
2. Understanding the role of key physical attributes (visual information, shape, geometry) in solving visual understanding problems
3. Development of methods for solving challenges in object matching

## **Jaspal Subhlok**

1. Educational technologies with a current focus on making lecture video an interactive learning companion.  
<https://www2.cs.uh.edu/~jaspal/>
2. Example undergraduate projects. i) Evaluating how effective are tools developed in our project to find topic boundaries and summaries on diverse types of educational videos, possibly videos used in K-12 education ii) Employing available public domain software to automatically identify keywords in lecture videos from OCR and speech transcripts, iii) Surveying new products developed by educational video companies to discover state of the art in enhancing/integrating video usage for education.

## Rakesh Verma

1. Applications of Data Science/ML to cybersecurity challenges, Natural Language Processing, and Adversarial Machine Learning. My research page is here: <http://www2.cs.uh.edu/~rmverma/book.html>
2. Undergrads can work on both human and machine learning aspects of deceptive attacks such as phishing. They can also work on NLP topics such as authorship attribution for which we have a unique dataset.