Princeton REACH Program 2019 Available Positions

Chemical & Biological Engineering

- **Faculty Host:** Professor Athanassios Panagiotopoulos
- **Website:** http://www.princeton.edu/cbe/people/faculty/panagiotopoulos/group/research/
- **Eligibility Requirements**
    - **Majors:** Chemical Engineering, Mechanical Engineering
    - **Level of study:** Graduate student
    - **Research Area:** The group performs molecular-based computer simulations on polymers, colloidal particles, and surfactants in order to study pattern formation and self-assembly. There is also an active program on Monte Carlo studies of phase behavior and thermodynamic properties of aqueous systems and electrolyte solutions.
    - **Positions available:** 1

- **Faculty Host:** Professor Sujit Datta
- **Website:** http://dattalab.princeton.edu
- **Eligibility Requirements**
    - **Majors:** Chemical Engineering, Biological Engineering, Mechanical Engineering, Physics, Chemistry
    - **Level of study:** Graduate student
    - **Research Area:** Soft materials under flow in porous media -- Many applications involve the flow of soft materials, like polymers, hydrogels, and even bacteria, through a porous rock. Examples include oil recovery and water remediation. However, studying these flow processes is challenging due to the opacity of typical porous media. Our lab has developed expertise to make mode porous rocks that are transparents. In this project, we seek to use this capability to directly visualize how soft materials flow through a porous medium, change the structure of the pore space, and thereby alter subsequent flow.
    - **Positions available:** 1

- **Faculty Host:** Professor Sujit Datta
- **Website:** http://dattalab.princeton.edu
- **Eligibility Requirements**
    - **Majors:** Chemical Engineering, Biological Engineering, Mechanical Engineering, Physics, Applied Math, Computer Science
    - **Level of study:** Graduate student
    - **Research area:** Dynamic network modeling of the multi-scale mechanics of breathing -- Respiratory disorders like Cystic Fibrosis and Asthma are characterized by the changes in the mechanical properties of lung tissues and secretions, which in turn lead to difficulties in breathing. However, a quantitative connection between altered lung mechanics and the spatiotemporal features of

lung opening remains lacking. We have developed a computational network model of the lungs as a branched network that incorporates key biomechanical factors like geometry, tissues stiffness, and mucus surface tension and viscosity. Using this model, we have been able to show how the dynamics of inhalation depend strongly on both breathing rate and lung biomechanics. In this project, the goal will be to extend this model to be able to study multiple breathing cycles (of inhalation and exhalation). Ultimately, by connecting multi-scaled processes, this study will enhance our fundamental understanding of respiration. Familiarity with the Python programming language will be useful in this project.

- **Positions available:** 1

Computer Science

- **Faculty Host:** Professor Jia Deng
- **Website:** http://pvl.cs.princeton.edu/
- **Eligibility Requirements**
  - **Majors:** Computer Science
  - **Level of study:** Graduate student. Strong programming ability and mathematical background, completed courses in Computer Vision, Artificial Intelligence, or Machine Learning
  - **Research areas:** Our research is focused computer vision, machine learning, and automated formal reasoning. Our goal is to enable computers to see, thing, and learn like humans. Specifically, students can expect to work in one of the following areas.
    - (1) Action Understanding: We want enable to computer to be able to tell us "what happened?" in a video. To solve this task, a computer must be able to do more than just look at the individual images. It must also be able to reason about the interactions, intents, causality, and dynamics of the video.
    - (2) 3D Perception. We are looking at ways to recover 3D representations from 2D images and videos. Some tasks include estimating depth, surface normals, and camera motion.
    - (3) Automated Formal Reasoning: Given a mathematical theorem, can we ask a computer to prove it? This is a challenging problem which combines representation learning with formal logic.
    - (4) Deep Learning and Representation Learning: We are working on new representations and architectures for vision and cognition. We are interested in equipping computers with common sense, the ability to acquire and represent basic facts about the world and the ability to learn and reason using such knowledge by developing strong priors while requiring limited supervision.
  - **Positions available:** 1

Electrical Engineering

- **Faculty Host:** Professor H. Vincent Poor
- **Website:** www.princeton.edu/poor
- **Eligibility Requirements**
    - **Majors:** Electrical Engineering
    - **Level of study:** Graduate student
    - **Research area:** We work on information theory and signal processing, and their applications in wireless networks, energy systems, and related applications.
    - **Positions available:** 1