

Faculty Member Contact Information

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Contact Info	
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Department	Electrical and Computer Engineering

1 Funded, 3-4 Unfunded URCA Assistant(s)

Are you willing to work with students from outside of your discipline? If yes, which other disciplines?

- Yes

How many hours per week will your student(s) be required to work in this position?
(Minimum is 6 hours per week; typical is 9)

- 6-9

Will it be possible for your student(s) to earn course credit?

- Yes, in ECE 491 for 3 credit hours.

Location of research/creative activities:

- Biomedical Imaging Research Lab - EB 2026A

Brief description of the nature of the research/creative activity?

- The main effort we pursue in the lab is to develop automated algorithms to quantify and characterize cardiac fat in medical image data and we involve URCA students in numerous facets of these projects, and they often make significant contributions.
- The first aspect of the project involves the development and validation of segmentation algorithms for the identification of cardiac fat in magnetic resonance images (MRI). The layer of fat around the heart is related to the risk of cardiovascular events (i.e. heart attack). Studies of this process require the identification of cardiac fat in three-dimensional MRI, which can be cumbersome and time consuming, particularly in longitudinal studies requiring imaging at multiple time points. The development of three-dimensional segmentation algorithms can facilitate the investigation of this important health phenomenon. Using this 3D segmentation data, we are also working on developing

and building 3D modeling tools to assess the volume and distribution of the cardiac fat and to relate it to the location of the coronary arteries.

- With this project, we are also developing methods for identifying this layer of cardiac fat using ultrasound imaging. This project includes the development of image analysis algorithms and spectral analysis of the ultrasound radiofrequency signals. We are also beginning work in the lab on fusing the modalities. We have a project in which we are using image registration algorithms to locate the ultrasound image planes in the same frame of reference as the 3D model of the cardiac fat we are building. The eventual goal is to measure the volume of the fat with ultrasound alone. There are pieces of each of these efforts where URCA assistants can contribute.
- In addition to the cardiac fat imaging project, my lab has several other AI-based development efforts. One is a machine-learning algorithm development for predicting shunts from the left to right side of the circulatory system using blood oxygenation measurements and the other is the prediction of a Miller score from pulmonary CT images.

Brief description of student responsibilities?

- The URCA Assistant will participate in the development of MATLAB or Python-based software for algorithm development or validation. Prototyping will be done in Python (or MATLAB) and GitHub will be used for revision control.

URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals.

What exactly should your student(s) have learned by the end of this experience?

- By the end of the experience, the student will be able to:
 - 1) Develop research software in a scientific-computing environment
 - 2) Implement basic image and signal processing algorithms
 - 3) Use source-code control systems, a critical skill for an engineer working in product development

Requirements of Students

If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:

- There are no set times necessary and the schedule can accommodate the student.

If the location of the research/creative activities involves off campus work, must students provide their own transportation?

- On rare occasion, the student may be asked to travel to the Washington University School of Medicine Center for Clinical Imaging Research to visit the MRI scanner to obtain data or participate in meetings.

Must students have taken any prerequisite classes? Please list classes and preferred grades:

- There are no specific prerequisite classes for this position.

Other requirements or notes to applicants:

- The ideal applicant will have experience with Python.