

## Spring 2019 Lehigh ECE Research Internship Program for ShenYuan Honors College of Beihang University

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| <b>Professor's Name and Bio</b>                           | <p><b>Xiaochen Guo</b> is an Assistant Professor in the Department of Electrical and Computer Engineering at Lehigh University. Dr. Guo received her Ph.D. degree in Electrical and Computer Engineering from the University of Rochester in 2015, and B.S. degree from Beihang University in 2009. Dr. Guo's research interests are in the broad area of computer architecture, with an emphasis on leveraging emerging technologies to build energy-efficient architectures. She received the IBM Ph.D. Fellowship twice. Dr. Guo is also a recipient of the National Science Foundation CAREER Award, Rossin Assistant Professorship, and the Lawrence Berkeley National Laboratory Computing Sciences Research Pathways Fellowship.</p>  |
| <b>Project Description</b>                                | <p><b>Project 1 – Deep Learning Accelerator:</b> Deep neural network models can significantly improve accuracies for various machine learning tasks such as image recognition, language translation, and anomaly detection. But they are not hardware friendly. Both inference and training of deep learning models require high computation power. One reason is that these models typically require to move a large amount of data between memory and processing elements. This project will explore architectural techniques to reduce data movement and improve energy efficiency and performance for deep learning applications.</p> <p><b>Project 2 – Bio Machine Learning:</b> For decades, computer engineers have attempted to design intelligent machines by emulating human brains. Useful artificial neural network models have been developed to run on general purpose processors and specialized accelerators. However, the capabilities and energy efficiencies achieved by running these models on conventional hardware are still lagging far behind those of human brains. In this project, we will use living neural network to perform learning tasks. This is a collaborative project with a lab in neural engineering. The student will help build biological plausible simulation models to explore learning algorithms.</p> |
| <b>Desired number of students, Background, and skills</b> | <p>Two students (one for each project) in EE, CS, or related major with strong background in Programming, Math, and Digital Circuit.</p>   |
| <b>Phone interview required?</b>                          | <p>Phone or Skype interview.</p>   |

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| <p><b>Professor's Name and Bio</b></p>                           | <p>Professor Zhiyuan Yan is currently Professor of Electrical and Computer Engineering. His current research interests are in coding theory, communication theory, signal processing, cryptography, wireless communications, and VLSI implementations of communication and signal processing systems, and he has published over 100 refereed papers in journals and conferences.</p> <p>He is currently an associate editor of Journal of Signal Processing Systems, and was a senior area editor of the IEEE Transactions on Signal Processing from 2011 to 2015 and an associate editor of the IEEE Communications Letters from 2008 to 2012 and IEEE Access from 2013 to 2018. He was a Technical Program Committee Co-Chair of 2015 IEEE Workshop on Signal Processing Systems (SiPS 2015) and a Technical Program Committee Co-Chair and a General Co-Chair for the ACM Great Lakes Symposium on VLSI, in 2007 and 2008, respectively. He was a Guest Co-Editor for a special issue of the Journal of Electrical and Computer Engineering on Implementations of Signal Processing Algorithms for OFDM Systems, and served as Guest Co-Editor for several special issues of Journal of Signal Processing Systems. He is a member of the Circuits and Systems for Communications (CASCOM) and VLSI Systems and Application (VSA) Technical Committees of the IEEE Circuits and Systems Society. He was the chair of the Design and Implementation of Signal Processing Systems (DISPS) Technical Committee of the IEEE Signal Processing Society from 2016 to 2017. He is a member of Tau Beta Pi, Sigma Xi, and Phi Kappa Phi honor societies. He was a recipient of the US National Science Foundation CAREER Award in 2011.</p> |
| <p><b>Project Description</b></p>                                | <p>We will explore the application of machine learning in communication and signal processing systems. The project has both theoretical and practical aspects. On the theoretical side, we will investigate machine learning from a theoretical perspective. We will also explore both software and hardware implementations of machine learning in communication and signal processing systems.</p>  |
| <p><b>Desired number of students, Background, and skills</b></p> | <p>Desired number of students: 2<br/>Desired background and skills: Background in machine learning, communication theory, signal processing are not required but desirable. Strong background in probability theory, and skills in programming and hardware implementations are pluses.</p>   |
| <p><b>Phone interview required?</b></p>                          | <p>Skype interviews with applicants would be great.</p>   |

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| <b>Professor's Name and Bio</b>                           | <p><b>Yahong Rosa Zheng</b> joined Lehigh University in Aug. 2018 after working at Missouri University of S&amp;T for 13 years. Her research interests include underwater cyber-physical systems, real-time embedded systems and signal processing, wireless communications, and wireless sensor networks. Contact information: <a href="mailto:yrz218@lehigh.edu">yrz218@lehigh.edu</a><br/>Detailed bio is available at <a href="https://www.lehigh.edu/~yrz218/">https://www.lehigh.edu/~yrz218/</a></p>  |
| <b>Project Description</b>                                | <ol style="list-style-type: none"> <li>1. Underwater energy harvester: mechanical design and implementation for harvesting ocean or river flow energy and charging a super-capacitor;</li> <li>2. Underwater data logger: miniaturized data logger to utilize micro-controller with gyro sensor and water pressure sensors in a water-proof housing;</li> <li>3. Hardware design of Underwater Magneto-Inductive (MI) communications transceiver: design and implement an H-bridge transmitter power amplifier to replace ATA5276 and shrink coil size.</li> </ol> |
| <b>Desired number of students, Background, and skills</b> | <p>One or two students for each project or three – four students collaborating on some of the projects. Preferred skills of the group:</p> <ol style="list-style-type: none"> <li>1. Mechanical design, SolidWorks</li> <li>2. PCB design (EAGLE, Altium, or Allegro)</li> <li>3. Circuit design and implementation</li> <li>4. Use of instrumentation (scope, signal generator, multimeter, etc.)</li> <li>5. Hardware assembling (soldering, breadboarding) and lab test.</li> <li>6. Programming of MCU (TI MSP430 or ARM) is a plus.</li> </ol>                |
| <b>Phone interview required?</b>                          | <p>WeChat, Skype, telephone, or on site. I'll be visiting Beijing in the week of Nov. 20<sup>th</sup> and can meet students in Beihang then.</p>   |

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| <b>Professor's Name and Bio</b>                           | <p><b>Prof. Chao Zhou</b><br/> <a href="http://www.ece.lehigh.edu/~zhou">http://www.ece.lehigh.edu/~zhou</a></p> <p>Dr. Chao Zhou obtained his B.S. degree in 2001 from Peking University and his Ph.D. degree in 2007 from the University of Pennsylvania under the guidance of Prof. Arjun G. Yodh. After graduation, Dr. Zhou joined Professor James G. Fujimoto's Laser Medicine and Medical Imaging Group at the Massachusetts Institute of Technology (MIT) as a postdoctoral associate. Since then, he has been working on the development of optical coherence tomography (OCT) technologies and their various applications. In 2012, Dr. Zhou joined the faculty at Lehigh University as an assistant professor in Electrical Engineering and Bioengineering. In 2017, he was promoted to the rank of Associate Professor with tenure. Dr. Zhou has extensive experience in the field of biomedical optical imaging and has contributed to the development and validation of novel modalities for imaging of humans and animals with various applications ranging from measuring the brain function to monitoring cancer treatments. Dr. Zhou has published over 60 peer-reviewed journal articles, with a total citation of over 4200 times. Dr. Zhou is a senior member of the Optical Society of America (OSA) and the International Society for Optical Engineering (SPIE). He is a recipient of numerous honors and awards, including the National Institute of Health (NIH) K99/R00 <i>Pathway to Independence Award (2011)</i>, the <i>Libsch Early Career Research Award (2016)</i> and the <i>Alfred Noble Robinson Faculty Award (2018)</i> from Lehigh University, and the <i>National Innovation Award (2017)</i> from TechConnect World Innovation Conference and National Innovation Summit.</p> |
| <b>Project Description</b>                                | <p>Our lab is interested in developing novel optical imaging technologies for biomedical applications, especially in developing optical coherence tomography (OCT) and microscopy (OCM) technologies to perform "optical biopsy" and generate 3D in situ images of tissue morphology, function and pathological status in real-time without the need to remove and process specimens. We are also interested in applying these technologies to a variety of biological and clinical applications, including cancer research, neuroscience, developmental biology and tissue engineering. For the internship, we will have students participate in ongoing projects related to OCT/OCM instrument development and validation, optogenetic pacing in fruit flies, as well as deep-learning image processing and classification based on the students' background and skills.</p>  |
| <b>Desired number of students, Background, and skills</b> | <p>Our group can take up to 3 undergraduate students in the spring semester of 2019. Students with hands-on experience in electronic circuits, optics, Matlab/Python/C++ programming or biology would be preferred.</p>   |
| <b>Phone interview required?</b>                          | <p>Yes. I can setup Zoom or Skype interviews after review the applications.</p>   |