

Introduction

Dr. Sideris' ACME Lab focuses on creating integrated circuits for biomedical devices, wired and wireless communication, and other emerging applications. Under the mentorship of Fangzhou Wang, I worked on designing and training an unsupervised machine learning model which used a GAN network to autonomously design a simple photonic circuit, a splitter. During my time at ACME, I learned not only how to train a neural network, but also how to simulate and test photonic circuits

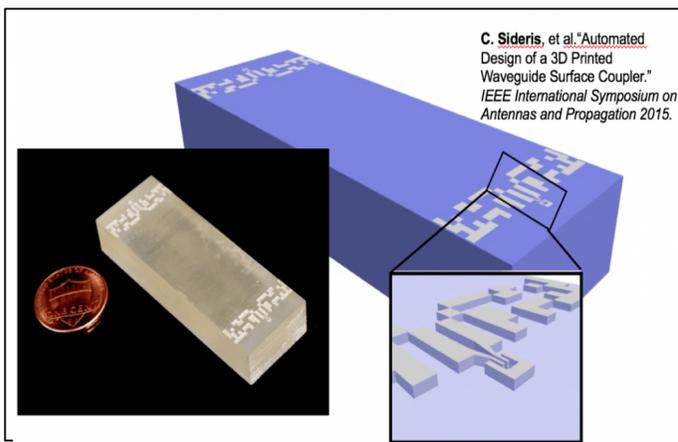


Figure 1. Example of waveguide photonic circuit manufactured as part of Sideris' prior research

Objective & Impact of Professor's Research

Dr. Sideris' research is aimed at training a neural network to find new and more efficient photonic circuit configurations. In order to achieve this, Dr. Sideris uses a simulator and a hill finding algorithm to find local optimum circuits, which are fed into a GAN neural network to find new optimums, which are then tested and ranked. The future applications of this research are numerous, ranging from more efficient circuits, to autonomously designed logistic networks, and even better materials for stealth aircraft.

Skills Learned

- Created Photonic Circuit simulator using MEEP and used gradient descent algorithm to find local optimum for simple splitter circuit
- Learned advantages and limitations of current machine learning techniques
- Created unsupervised machine learning model which autonomously designed a more efficient splitter circuit
- Wrote model using TensorFlow, using AWS for cloud computing



Figure 2. Training GAN network to produce handwriting, after 3500 iterations

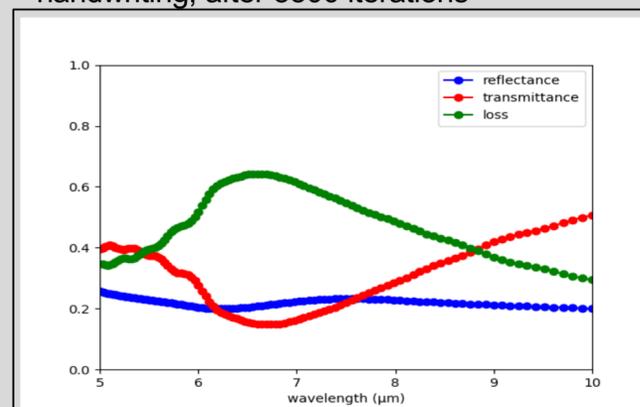


Figure 3. MEEP graph of early photonic circuit efficiency across wavelengths

Works Cited

Sideris, C., Yang, C., Sammoura, F., Lin, L., Hajimiri, A., and Alon, E. "Automated Design of a 3D Printed Waveguide Surface Coupler." *IEEE International Symposium on Antennas and Propagation 2015.*

How This Relates to Your STEM Coursework

My work with GAN neural networks gave me a better understanding of computer generated photonic circuits and some of the limitations of current approaches, such as the tendency to converge on poor local optimums. Having a chance to practice working with TensorFlow in a real lab situation will help me in college, where I plan to pursue research in machine learning, both within Computer Science and in other fields.

Outside of school, I am the founder and leader of a company and LaunchX team called Cord Restored that makes and sells a liquid polymer I invented and patented which can be coated on frayed wires in order to repair the insulation. I have deep concerns about the negative environmental impact of E-Waste and I believe it is crucial that we reduce the amount of waste we produce. Therefore, I invented a product which is used to repair frayed chargers rather than needing to throw them out, saving consumers money, but also saving the planet by attacking the problem of E-Waste at its source. This year, the team I founded and led was one of 7 Regional Demo Day finalists from across the world selected to present at the LaunchX Global Demo Day at MIT.

My interest in the environment and social entrepreneurship stems from my interest in ethics, which was sparked by a college philosophy course I took at Davidson THINK at UNR and through participating in high school debate. I am concerned about how decisions are made by systems or organizations without considering the potential negative effects on society. It is crucial to understand the ethics of what we build so that engineering makes the world a better place. I read philosophy and ethics in order to better understand the challenges that I will face in the future as an engineer or scientist.

ACME Lab

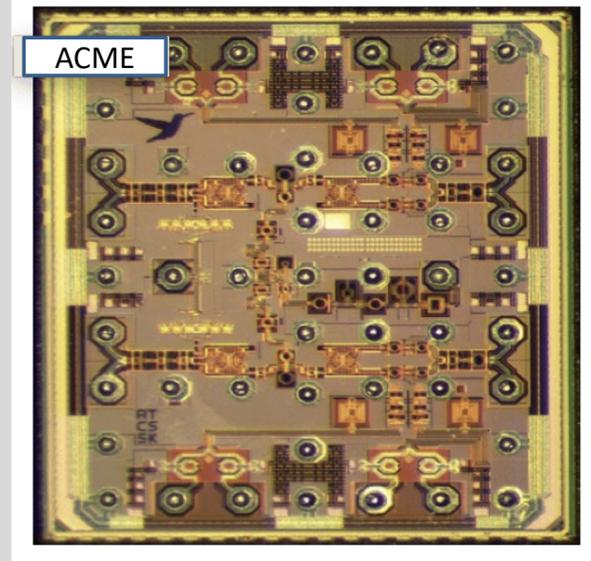


Figure 4. ACME Lab Homepage Image - represents field of wired communication

Next Steps

- Look for research opportunities in machine learning
- Continue pursuing opportunities to apply machine learning
- Apply knowledge obtained from this research experience to future projects
- Reach out to other professors in this field
- Continue to read academic literature in these fields
- Bring back knowledge learned to my school's entrepreneurship and LaunchX club, applications of data science to business
- Continue to mentor students in programming, and math

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