USC Viterbi SHINE 2017
Orientation

Dr. Katie Mills
Office: 213-740-0237
Mobile: 310-592-6477
kmills@usc.edu
USC Viterbi SHINE 2017
Orientation

Dr. Maja Matarić

Emanuel Marquez
Ethan Xiong
Deepika Raghuraman
This Morning’s Agenda:

9:00 – 9:25 a.m.   Welcome to SHINE

9:30 – 10:30 a.m   Campus Tour

10:30 – 10:45 a.m. Break

10:45 – 11:45 a.m. SHINE Orientation

Noon – 1:30 p.m.   Walk to Lab & Lunch Locations

1:30 p.m. Students meet back at RTH 526

2:00 – 5:00 p.m. Lab Safety Training in LVL 17
Welcome SHINE 17 Cohort!

Biomedical Engineering

<table>
<thead>
<tr>
<th>Prof. Chung</th>
<th>Immunotherapy &amp; Nanoparticles</th>
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<tbody>
<tr>
<td>Vivian</td>
<td>Ph.D. mentor: Jonathan Wang</td>
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<tr>
<th>Prof. Shen</th>
<th>Breast Cancer Drug Therapies</th>
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<tbody>
<tr>
<td>Ray</td>
<td>Yuta Ando</td>
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<tr>
<td>Arjun</td>
<td>Peter Ta</td>
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<table>
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<tr>
<th>Prof. McCain</th>
<th>Heart Drug Therapies</th>
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<tr>
<td>Jacqueline</td>
<td>Joycelyn Yip</td>
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<tr>
<td>Sabina</td>
<td>Nethika Ariyasinghe</td>
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</table>
Welcome SHINE 17 Cohort!

Civil Engineering

Prof. Becerik-Gerber

Ph.D. mentor: Ashrant Aryal

Victoria Irie
Welcome SHINE 17 Cohort!

Industrial & Systems Engineering

Prof. Carlsson

Ph.D. mentors:

Milena Schichun Hu
Erik Yang Cao
Welcome SHINE 17 Cohort!

Robotics (Computer Science)

Prof. Schaal

Ph.D. mentors:

Omar  Henry Su
Luigi  Giovanni Sutanto
Welcome SHINE 17 Cohort!

**Electrical Engineering**

<table>
<thead>
<tr>
<th>Prof. Parker</th>
<th>Neural Networks &amp; Music</th>
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<tr>
<td>Jeffery</td>
<td>Ph.D. mentor: Kun Yue</td>
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<tr>
<th>Prof. Kapadia</th>
<th>Innovative Electronic &amp; Photonic Devices</th>
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<tbody>
<tr>
<td>Annie</td>
<td>Fatemeh Rezaeifar/</td>
</tr>
<tr>
<td>Sarah</td>
<td>Debarghya Sarkar</td>
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<tr>
<th>Prof. Wang</th>
<th>Nanoelectronic Devices</th>
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<tr>
<td>Henry</td>
<td>Haimeng Zhang</td>
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</table>
Welcome SHINE 17 Cohort!

Environmental Engineering

Prof. Childress  Wastewater Reuse & Desalination
Elise          Ph.D. mentor: Lauren Crawford
Fangcheng/Steve Allyson McGaughery

Prof. Smith  Recovering Bioenergy from Wastewater
Noel          Stephanie Gee
Welcome SHINE 17 Cohort!

Materials Science

Prof. Ravichandran Emergent Semiconductor Materials

Shravan Ph.D. mentor: Liu Yang
Yizhi (Brian) Thomas Orvis

USC Viterbi
School of Engineering
University of Southern California
Welcome SHINE 17 Cohort!

Aerospace Engineering

Prof. Spedding  Aerodynamics of Small Wings
Matthew  Ph.D. mentor: Yohanna Hanna
Rajvir

Prof. Luhar  Velocimetry Measure of Aerodynamic Flow
Alejandro  Christoph Efstathiou
Timothy  Andrew Chavarin
Welcome SHINE 17 Cohort!

Cybersecurity (Info Systems Institute – M del Rey)

Prof. Mirkovic

New Authentication Systems

Kyle

Dr. Gen Bartlett

Ryan
SHINE Students: High Schools

Arnold O. Beckman High School
Beverly Hills High School
Choate Rosemary Hall
de Toledo High School
Diamond Bar High School
Garfield High School
Harvard-Westlake High School
La Cañada High School
Liceo Scientifico Galileo Galilei
Marshall Fundamental Secondary School
Marymount High School
Oak Park High School
Palisades Charter High School
Phillips Exeter Academy
Pilgrim School
Polytechnic School
San Marino High School
Santa Monica High School
South Gate High School
University High School
Walnut High School

Calabasas
Irvine
2 attend HS out of state
1 from Italy
Carpool or Commuter Buddy Possibilities
<table>
<thead>
<tr>
<th>Meet a SHINE student whose first name begins with an S</th>
<th>SHINE student Henry will be working with PhD mentor Haimeng in Prof. Han Wang's lab, but Henry is in Sacramento today, so say Hi to him next week.</th>
<th>Meet a SHINE student whose first name begins with an I</th>
<th>Meet a SHINE student whose first name begins with an N</th>
<th>Meet a SHINE student whose name begins with an E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet a SHINE student whose birthday occurs during SHINE</td>
<td>Meet someone who speaks a second language</td>
<td>Meet a SHINE student whose first name begins with an R</td>
<td>Meet someone who has a career in STEM</td>
<td>Meet someone who has been to Italy</td>
</tr>
<tr>
<td>Meet someone who lives west of USC</td>
<td>Meet someone who lives south of USC</td>
<td>WILD CARD: Meet someone interesting!</td>
<td>Meet someone who lives north of USC</td>
<td>Meet someone who lives east of USC</td>
</tr>
<tr>
<td>Meet someone who will be joining the USC gym during SHINE</td>
<td>Meet someone who will be driving to campus</td>
<td>Meet someone who will be taking the USC Shuttle to campus</td>
<td>Meet someone who will take the subway (Expo Line) to campus</td>
<td>Meet someone who will be in a lab in Marina del Rey</td>
</tr>
<tr>
<td>Meet a vegetarian</td>
<td>Meet someone who plays a musical instrument</td>
<td>Meet someone who skateboards everywhere</td>
<td>Meet someone who has not seen Wonder Woman</td>
<td>Meet someone who does not like pizza</td>
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Campus Tour
Welcome Back!
USC Viterbi School of Engineering

Today:

Internationally recognized for creating new models of education, research and commercialization firmly rooted in real world needs.
USC Viterbi School of Engineering

- 2,700 undergraduate students
- 5,600 graduate students
- > 65,000 alumni
- >$185 million in research/year
- Overseas offices in Shanghai, Beijing, & Bangalore

https://viterbischool.usc.edu/viterbi-at-a-glance/
USC Viterbi School of Engineering

Dr. Andrew Viterbi
(Ph.D. in EE from USC in 1962)
Viterbi Algorithm (1967)

- Pres. Obama: key post (5/15)
- Co-founded QUALCOMM Inc. (mobile satellite communications & digital wireless telephony)
USC Viterbi School of Engineering

- Aerospace and Mechanical Engineering
- Astronautical Engineering
- Biomedical Engineering
- Computer Science (includes Robotics)
- Daniel J. Epstein Department of Industrial and Systems Engineering
- Ming Hsieh Department of Electrical Engineering
- Sonny Astani Department of Civil and Environmental Engineering
- The Mork Family Department of Chemical Engineering and Materials Science
USC Viterbi School of Engineering

SHINE Process:

1. Professors volunteered for SHINE
2. Students applied
3. Dr. Mills screened applicants
4. Professors reviewed applicants & selected
5. Here you are today!
SHINE Structure

- Professor
- Ph.D. mentors & Labmates
- Cohort & SURE mentors
University Research
(USC = Research 1 University)

Professor

Ph.D. students

Masters & Undergrads

SHINE

SURE & RET

DNA Helix
University Research
(USC = Research 1 University)

Professor

Ph.D. students

Masters & Undergrads

SHINE

SURE & RET

RET = Research Experience for Teachers

SURE = Summer Undergraduate Research Experience
WISE = Women in S&E
University Research
(USC = Research 1 University)

Professor

Ph.D. students

Masters & Undergrads

SURE & RET

SURE = Summer Undergraduate Research Experience
WISE = Women in S&E

RET = Research Experience for Teachers

USC Viterbi
School of Engineering
University of Southern California
University Research (USC = Research 1 University)

Professor

Ph.D. students

Masters & Undergrads

SHINE

SURE & RET

Research Lineage
Need Research Progeny
USC Viterbi School of Engineering PreK-12 Outreach:

VAST – Viterbi Adopt-a-School, Adopt-a-Teacher
K-12 STEM Outreach – Mathematics Engineering Science Achievement (MESA), FIRST Robotics, Discover Engineering, Mission Science
PreK-12 STEM
Research Original Interventions
Research-Based Outreach
Dean Yannis Yortsos
Chemical Engineering

Vice-Dean Research Maja Matarić
Prof. of Computer Science

Dr. Gisele Ragusa
STEM Ed Research
Research Experience for Teachers: Impact on Constituencies since 2011

77 MS/HS teachers
9,742 Students
77 Ph.D. Students

& Viterbi Faculty

BURCIN BECERIK-GERBER RECEIVES NSF CAREER AWARD

Burcin Becerik-Gerber Receives NSF Career Award
January 14, 2014, National Science Foundation (NSF)

National Science Foundation awards Becerik-Gerber a Faculty Career Development grant.

SHINE Mentorship

- Lab Directors (Ph.D.) & other Ph.D. Students
- SURE undergraduates majoring in engineering from universities across the nation
- RET (Research Experience for Teachers) middle school teachers in faculty labs
 Robotics Open House
STEM Spotlight on VSOE Depts
SHINE Summer HS Research
CS@SC Summer Camps
Robotics & Coding Academy
Code Dojo
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<th>Monday</th>
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<tr>
<td>9am - 5pm RTH 526 Orientation Lab Safety Training</td>
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<td>12pm - 1:30pm Epstein/OHE Plaza SHINE 2016 Reunion</td>
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<tr>
<td>26-Jun</td>
<td>27-Jun</td>
<td>28-Jun</td>
<td>29-Jun</td>
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<tr>
<td>10am - 12pm SOS-B41 MATLAB Training (Optional)</td>
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<td>10am - 12pm WPH-B26 MATLAB Training (Optional)</td>
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<td>3-Jul</td>
<td>4-Jul</td>
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<td>6-Jul</td>
<td>7-Jul</td>
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<td>Holiday</td>
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<td>10-Jul</td>
<td>11-Jul</td>
<td>12-Jul</td>
<td>13-Jul</td>
<td>14-Jul</td>
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<tr>
<td>12pm - 1:30pm HNB-107 Cohort Lunch</td>
<td>12pm - 1:30pm HNB-107 College App; 2:15pm CA Science Center 3D Movie</td>
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<td>17-Jul</td>
<td>18-Jul</td>
<td>19-Jul</td>
<td>20-Jul</td>
<td>21-Jul</td>
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<td>1pm - 3:30pm SSL Library Research Training</td>
<td>LIT REVIEW DUE!</td>
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<td>24-Jul</td>
<td>25-Jul</td>
<td>26-Jul</td>
<td>27-Jul</td>
<td>28-Jul</td>
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<td>POSTERS DUE!</td>
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<td>31-Jul</td>
<td>1-Aug</td>
<td>2-Aug</td>
<td>3-Aug</td>
<td>4-Aug</td>
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<td>1pm - 3pm Poster Session; 3pm - 4:30pm Certificate Ceremony</td>
<td>USC Viterbi School of Engineering</td>
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<td>12pm - 1:30pm HNB-107 Cohort Lunch</td>
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Friday Cohort Lunches

June 23 Lunch
SHINE 2016 Cohort Reunion + 2017 Cohort

Friday Lunches (6/30, 7/14, 7/21, 7/28)
Workshops
SURE Mentors
June 27 & 29: Optional MATLAB Training
computer modeling software
BBQ Will Be July 6, 2017
Research Process:

Research Question

Communication:
- Peer Review
- Poster

Literature Review

Results/Discussion

Methods
1. Automated Proxemic Feature Extraction and Behavior Recognition: Applications in Human-Robot Interaction
   by Mancini, Rosà, Arman, Amico, Mataric, M. J.
   Permanent
   In this work, we discuss a set of feature representations for analyzing human spatial behavior (proxemics) motivated by metrics used in the social sciences.
   Journal Article: Full Text Online

2. Using Socially Assistive Human-Robot Interaction to Motivate Physical Exercise for Older Adults
   by Façola, J., Mataric, M. J.
   Proceedings of the IEEE, 2012, Volume 100, Issue 8
   Permanent
   In this paper, we present the design, implementation, and user study evaluation of a socially assistive robot (SAR) system designed to engage elderly users in...
   Journal Article: Full Text Online

3. Editorial
   by Cao, Shuzhi Sam, Mataric, M. J.
   International Journal of Social Robotics, 01/2012, Volume 4, Issue 1
   Permanent
   Journal Article: Full Text Online

4. Robots for Use in Autism Research
   by Scassellati, Brian, Henry Admoni, Mataric, M. J.
   Annual Review of Biomedical Engineering, 08/2012, Volume 14
   Permanent
   Autism spectrum disorders are a group of lifelong disabilities that affect people’s ability to communicate and to understand social cues. Research into...
July 14, 2017

Lunch Speaker
Rebecca Beiter,
USC Viterbi
Admissions

Optional:
Visit CA Sci Center
IMAX film
July 21, 2017

Optional:
3rd annual Women Who Code panel
Mentors Play a Really Important Role in SHINE

I believe SHINE tremendously helped my application to Hopkins. First, SHINE provided me valuable lab research experience. The research that is being conducted in Meng Lab showed me the cutting-edge science that is being pursued by engineers today. Second, SHINE allowed me to make connections with people that already have insight into engineering and medicine. Since Ahuva is a MD/PhD student, she was able to teach me many things about medicine and engineering. Thus, I had a multi-faceted experience in Meng Lab. I was inspired by individuals such as Dr. Meng and Ahuva. Finally, SHINE allowed me to pinpoint what I wanted to do as a career. When I saw Dr. Meng’s research, I was amazed by how she utilized engineering to create revolutionary medical devices. In the future, I hope to continue to pursue the same research projects as Dr. Meng and Ahuva, and perhaps contribute to the field of medicine.

All in all, my experience in SHINE allowed me to explore my passion in engineering and medicine. This was reflected through my college personal statements, as well as a letter of recommendation from Dr. Meng. To this day, I am still in contact with the members in Meng Lab, and they provide me valuable support even though I am no longer part of the lab.

Leo Siow
Admitted to MIT and Johns Hopkins University, attending JHU in Fall ’16
Schedule Agreement between SHINE Student and SHINE Lab:

Name of SHINE student:______________________________

SHINE Professor's name:________________________________

Ph.D. student's name:__________________________________

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<td>SHINE student lunch: 12 – 1:30 p.m.</td>
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Research Process:

- Research Question
- Literature Review
- Methods
- Results/Discussion
- Communication:
  - Peer Review
  - Poster
The main goal of scientific research is to find solutions through trial and error (and statistics) that can be replicated and verified by others. Sharing research findings moves from informal to peer reviewed:

**Informal -> Formal (Peer Reviewed & Published) -> Nobel Prize!**

Poster Sessions are a first step in publicly sharing your findings.

Like a grown-up version of the Science Fair!

http://www.personal.psu.edu/drs18/postershow/
Development of Multi-Electrode Neural Probes for Rat Hippocampal Recordings

L. Slow, slowle@yahoo.com
Glen E. Wilson, Class of 2016
University of Southern California, Department of Biomedical Engineering

Introduction

The primary purpose of MEMS is to engineer extremely minuscule technology, which can be implemented in the medical field. Our research objective strives to fabricate a neural probe designed to observe the neural networks responsible for the formation of memories in the hippocampus. The process to create a device capable of recording electrical signals within a rat’s brain is a long and complex one. First, we created brain probes using the process of photolithography. We fabricated and fabricated flexible, multi-electrode Parylene probes to record spikes from the Cornu Ammonis (CA) areas CA1 and CA3 and the Dentate Gyrus (DG) regions of rat hippocampus. This array of eight, custom-made, flexible neural probes with eight recording sites per probe, targets particular hippocampal cell layers. The array also enables long-term hippocampal recordings of rats as they interact with complex, environmental spatial cues. The flexibility of the probes enables better integration with surrounding brain tissues and less microdamage to nearby neurons when compared to damage caused by metal microwires to neurons. Since the probes are flexible, they must be temporarily stiffened in order to insert into brain tissue. Our research utilizes a block of biocompatible adhesive, Polyethylene Glycol (PEG), to temporarily decrease the effective length of the probe, enabling them to penetrate brain tissue. In parallel to helping develop an effective insertion technique, I designed and fabricated a printed-circuit board to connect the electrical traces on our probe to the appropriate electrical recording system.

Objectives

1. Fabricate flexible neural probes:
   - Inserting probes is a traumatic event for the brain, which causes a scar and dead zone to form around the recording sites and limits the probe’s ability to obtain neural signals.
   - Using a more flexible material, rather than the traditional metal substrates, attenuates this damage.
   - We use Parylene, a USP Class VI material that is flexible and micromachinable to construct the devices.

2. Test various techniques to provide temporary stiffening to neural probes:
   - Flexible probes must be temporarily stiffened during insertion to prevent brain tissue damage.

3. Design a printed-circuit board to connect probes to electrical recording system:
   - We will be using software to design our printed-circuit boards, which will be part of our electrical connection scheme.

Research Process

Neural Probe Fabrication:
- Probes were microfabricated by using photolithographic techniques. (Fig. 5)
- Parylene served as the base substrate and insulation layer for our devices.
- Platinum-electrode recording sites, traces, and contact pads were lithographically patterned on top of the base layer using e-beam deposition at a thickness of 2,000 Å, followed by lift-off.
- Electrode and contact pads will be subsequently exposed by DRIE and the probes will be cut out from the substrate.

Optimizing Insertion of Probes into Brain
- Temporary stiffening techniques range from coating probes with a dissolvable, biocompatible stiffener to using microwires scaffolds to support the probes during insertion.
- We explored the use of Polyethylene Glycol (PEG) blocks to temporarily stiffen flexible probes during insertion into brain phantom gel (Fig. 9).
- The process of creating these PEG blocks involved the use of molds made from the personal computer-aided design (CAD) software.
- The probes were inserted into the mold, and the PEG was poured into the mold.
- In collaboration with the Berge lab, we inserted our sham probes into the rats. First, these rats were ensured to be sterile and clean. Next, we applied anesthesia to the rats with the correct quantity, to ensure the rats will have a painless experience.
- The sham probes were carefully positioned above the proper insertion zone.
- A flexible cement was used to secure the probes in place. When we retracted our insertion apparatus, the probe would remain robust and secure. The procedure was concluded to be successful, as the probes inserted properly without fail.
- A vivisection was performed to drain the blood by flushing formaldehyde through the rat’s body, known as a perfusion.

Fabrication of PCB for Electrically Connecting Probes to Neural System:
- Eagle was used to develop printed-circuit boards and modules for our device. We used Eagle to create multiple parts for our device. This includes schematics, devices, symbols, and packages.
- After we complete all elements of our design, we will send the file to a fabrication house. The fabrication house uses our file to create a printed-circuit board, which will be used in our device to encode the memories from a rat into data readable by computers.

Relativity to my STEM Coursework

The research we did at the lab involves heavy use of theoretical knowledge to implement. For example, when we were exploring different options of inserting our probes into the brain phantom gel, we came up with the possibility of utilizing magnetic fields. Background knowledge from my Advanced Placement physics class provided valuable insight. Without this knowledge, I would not have been able to communicate with my fellow peers in the lab. In addition, our lab group wanted to find the force of insertion of the probe. Again, my experience from Advanced Placement physics provided the ability to suggest mechanistic-based solutions to the given problem. Such solutions included the use of the impulse-momentum formula, as well as Newton’s second law. The scientific method was also presented to me at a higher level. Overall, my research abilities were greatly enhanced and also increased in formality. In high school, this will give my lab reports an edge compared to other peers. The scientific integrity of my lab report will increase, due to the overlapping factors between high school and university science. Overall, my background knowledge from high school courses was beneficial in my participation.

Future of Project

The device will undergo many iterations, potentially perfecting the electrodes and traces. After the device is successfully fabricated, it will be tested on a live rat. The device is expected to analyze brain waves and neural firing in the rat’s hippocampus. This beneficial data will contribute to the study of the formation of memories in the brain. Eventually, if the project proves to be efficient, there is a possibility of commercialization. This may benefit millions of lives, including but not limited to people who suffer from Alzheimer’s disease. Other memory-related disorders may also be treated with this device.

Acknowledgements

Dr. Ellis Meng, Ahsan Weizman, David King, Hujing Xu, Craig Timms, Dr. Katie Mills, Luping Wang, Biomedical Microdevices Lab, Kanny Chan
Ultrathin Single Crystalline Silicon Solar Microcells for Unassisted Photoelectrochemical Water Splitting

Shirley Zhang; shirley8023zhang@gmail.com
Arcadia High School, Class of 2016
Mark Family Department of Chemical Engineering and Materials Science

Introduction
During the eight weeks of SHINE Program, I worked under Professor Jongseung Yoon who focuses his researches on chemical engineering. Even though there were several projects going on at the same time, all they had the same purpose, which is to maximize the performance of monocristalline silicon in photovoltaic systems. This is important because silicon can produce renewable and sustainable power sources. The solar energy produced will not only reduce utility costs, but also minimize effects on global climate.

Objectives & Impact of Professor's Research
- Silicon is the 2nd abundant material on earth and has been dominantly used in photovoltaics. However, massive implementation has been limited due to the high cost as raw material. Even more materials account for more than 56% of the production cost.
- Ultrathin silicon can reduce the amount of silicon used in the device. However, the performance is limited due to the weak optional absorption of silicon with a band gap. (Band gap: energy difference in electron volts between the top of the valence band and the bottom of the conduction band in semiconductors)
- Specific technological areas of interest include high performance, low cost photovoltaic and photoelectrochemical water splitting systems.

Impact of Professor Jongseung Yoon's Research
- The goal is to develop approaches that can achieve an efficient utilization in silicon solar cells without sacrificing their performances.
- Use sunlight instead of battery to drive the water splitting systems.

Principle
- Photovoltaics
  - Photovoltaics (PV) is the method of converting solar energy into direct current electricity using semiconductor materials.
  - The photovoltaic effect refers to photons of light exciting electrons into a higher state of energy, allowing them to act as charge carriers for an electric current.
  - When light energy strikes the solar cell, electrons are knocked loose from the atoms in the semiconductor material, if electrical conductors are attached to the positive and negative sides, forming an electrical circuit, the electrons can be captured in the form of electricity.

- The p-n junction
  - p-n junctions are formed by joining n-type and p-type semiconductor materials.
  - Since the n-type region (n = negative) has a high electron concentration and the p-type region (p = positive) has a high hole concentration, electrons diffuse from the n-type side to the p-type side. Similarly, holes flow by diffusion from the p-type side to the n-type side.
  - Due to the difference in concentration, it creates an electric field inside the semiconductor structure.
  - If the electrons and holes were not charged, this diffusion process would continue until the concentration of electrons and holes on the two sides were the same.

- Water splitting system
  - Electrolysis uses electricity to decompose water molecule into oxygen and hydrogen. When high enough electric potential is applied, anode oxidize water molecule into oxygen and proton, while cathode reduces the proton into hydrogen.
  - Photoelectrochemical water splitting promises a solution to the problem of large-scale solar energy storage. However, its development has been impeded by the poor performance of photocathodes, particularly in their capability for photovoltaic generation.
  - It is an artificial photosynthesis process in a photoelectrochemical cell used for the dissociation of water into its constituent parts, hydrogen and oxygen using sunlight.
  - Hydrogenated microcrystalline silicon thin film promise new solar-cell materials. Their advantages include minimal use of semiconductor resources, large-area fabrication using low-cost methods, and no photodegradation of solar cell characteristics.
  - The minimum potential difference (voltage) needed to split water is 1.23V at 0 pH.

- Silicon Water Fabrication
  - It is a multiple-step sequence of photo lithographic and chemical processing steps during which electronic circuits are gradually created on a silicon wafer.
  - Nitride film deposition
  - It is formed on the wafer by CVD method using silane and ammonia.
  - RCA cleaning is the procedure to remove the organic contaminants, thin oxide layer, and ionic contamination.
  - Photoreist coating
  - The wafer is uniformly coated with a thick ultraviolet (UV) light sensitive liquid called photoresist.
  - The coating is applied while the wafer is spinning.
  - Masking
  - Masking is used to protect one area of the wafer while working on another.
  - This process is referred to as photolithography or photo-mask.
  - Exposure
  - A photomask aligns the wafer to a mask and then projects an intense light through the mask and through a series of reducing lenses, exposing the photoresist with the mask pattern.
  - Opaque regions on the mask block the UV light.
  - Etching
  - The wafer is then "developed" (the exposed photoresist is removed) and baked to harden the remaining photoresist pattern.
  - Doping
  - Atoms with one less electron than silicon (such as boron), or one extra electron than silicon (such as phosphorus), are introduced into the area exposed by the etch process to alter the electrical character of the silicon.
  - These areas are called P-type (boron) or N-type (phosphorus) to reflect their conducting characteristics.
  - Probe testing
  - Mechanical probe station utilizes manipulators which allow the precise positioning of thin needles on the surface of a semiconductor device.
  - It is used to acquire signals from the internal nodes of a semiconductor device

How This Relates to My STEM Coursework
- In my high school science classes, the experiments I do usually have set procedures and known results. We are given the methods to perform the textbook results.
- The actual research labs I have worked in at SHINE requires me to apply the physical, chemistry, and calculus knowledge that I have learned to prove the hypothesis through various experiments.
- This experience strengthened my prior knowledge and expanded my overall skill in STEM research.

Next Steps for Myself and Advice for Future SHINE students
- I will continue to pursue my interest in chemical engineering.
- I am also planning to join a research group in college.
- My advice for future SHINE students:
  - Choose the department that interests you.
  - You do not have to be sure of what you want to major in college because almost all the research done in this program involves different fields of engineering.
  - Even though my research group focused more on chemical engineering, it also required the knowledge of electrical and mechanical engineering. The fun part is that the program gave high school students opportunities to explore their potential majors and participate in the advanced laboratory.

Acknowledgements
- Dr. Jongseung Yoon
- Dr. Gao
- Dr. Kaite Mill
- Tracy Charles
- Liling Wang
The Effects of Oblique Shock Waves on Fluids

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University of Southern California – Department of Aerospace and Mechanical Engineering

Introduction
- Shock waves are types of pressure waves that are able to travel faster than the speed of sound
- Due to their potentially high velocities, they may also carry large amounts of energy – and inflict damage
- Shock waves can be generated by earthquakes, explosions, bullets, and more
- Dr. Veronica Eliasson seeks to understand more about the nature of shock waves

Objectives of Professor’s Research
- Learn more about shock waves
- Find a way to mitigate the harmful effects of shock waves
- Develop a method to focus and redirect shock waves
- Research may lead to:
  - Stronger soldier body vests and helmets
  - Higher structural integrity for buildings
  - Better ships and planes
  - Advanced bomb defenses

Experimental Design
- The inclined shock tube is able to propagate shock waves at any desired angle. Three pressure sensors were placed towards the end of the driven section to retrieve information about the fired shock wave.
- A high-speed camera, capable of capturing a million frames per second, was used in conjunction with a Z-folded schlieren system to visualize the shock waves’ interactions with the test section

Data and Results

<table>
<thead>
<tr>
<th>Incident Mach Number</th>
<th>35 psi</th>
<th>45 psi</th>
<th>77 psi</th>
<th>85 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>

The chart above shows the Mach numbers that we are able to achieve with Hongjoo's inclined shock tube.

The Next Steps
- A wider array of materials should be tested (i.e., non-Newtonian fluids)
- Make experimentation more efficient
- Possible construction of armor incorporating investigated substances

STEM Knowledge: Past & Present
- Calculus
- Physics
- Thermodynamics
- Fluid Mechanics
- Compressible Flow
- Rocket Engineering
- Microsoft Excel
- MATLAB
- Lab tools

Special thanks to Dr. Veronica Eliasson, Hongjoo Jeon, Stylianos Koumilis, Nick Amen, Orlando Delpino González, Shi "Stone" Qiu, Qian Wen, Jonathan "Jack" Gross, Arturo Cajal, Gabe Glasser, Natalie Nguyen, Hang Wei, VAST Administrator Katie Mills, Luping Wang, Justin Purozi, and Dennis Lin
Using Socially Assistive Robots and Creating an Annotator from Scratch

Bhav Patel, bhavpatel1999@ucl.com
La Salle High School ‘16

Introduction

My name is Bhav Patel. I am currently a rising senior at La Salle High School and intend on majoring in Astronautical Engineering. This summer I worked in the Interaction Lab at USC under Dr. Matarić and was mentored by Caitlyn Clabaugh. This lab falls under the discipline of computer science. I had two overarching projects which were: To build an annotation GUI for future use of having children use in data collection and to use "Dash and Dot," two children's robots, to see if they were viable in teaching children how to code/program.

Objectives & Impact of Professor's Research

My lab mentor Caitlyn Clabaugh is currently working on teaching younger children through robots. This holds certain advantages such as learning through play and exploring learning styles (especially with preschoolers where there is little to no research on their learning styles). Contributing to the general goal of the lab, Caitlyn’s work furthers the process of bringing robots into our daily lives. Specifically, these robots are called SAR’s or socially assistive robots.

Skills Learned

I have learned the following skills and techniques:

- **How to build a basic graphical user interface (GUI)**
  - I have learned to code (introductory-proficient level) with the following languages: HTML/CSS, Java, and Python.

- **Using a SAR robot**
  - How to use various sensors at the right moment to create a fluid and life-like movement.

Beyond the lab, I took tours with my SURE lab mentor, Eric, and learned of the vast differences that encompass various labs. It was interesting seeing my lab, which looks like a line of computers on desks as opposed to a classic “basement lab” that Eric worked in.

How This Relates to My STEM Coursework

I now see STEM as something completely different. I have learned that half the battle is grants, paperwork, and management. An example of which being the countless IRB’s I saw in the Interaction Lab. On top of that, I have now seen that although research is much of finding out what works, it is also just as much finding out what doesn’t work.

Overall, bringing this back to my high school (La Salle High School), I can now see, at least within STEM, classes and clubs with a fresh outlook. Mostly, this will go towards the robotics club, where I have now realized the frustration of people in the club (myself included) when something doesn’t work. I now find it critical to know what doesn’t work as opposed to just what works. Finding out what doesn’t work will always improve the final product.

My Next Steps

The biggest thing I will take back from this is programming. I learned around 4 different languages this summer and their different areas of expertise. Originally I knew C++ and struggled immensely, but now I have a newfound respect for programming and its uses. I now want to build several GUI’s and other Java/Python applications, and perhaps practice HTML & CSS websites.

Acknowledgements

Special thank you to: Dr. Matarić, Caitlyn Clabaugh, Dr. Katie Mills, Luping Wang, Steven Tsung-Han Sher, Eric Westphal, and Tracy Charles
How to shine at SHINE:

1. Communicate with your Mentor & research team – introduce yourself to others, don’t be shy
2. Check in with your Mentor each morning, before taking lunch & when leaving at day’s end
3. Confirm lunch w/ Mentor: refrigerator? Time?
4. Work out general schedule with your Mentor
5. Ask your Mentor how to communicate if you become ill or late – text, email, phone?
6. Bring a notebook & laptop each day. Make sure it is safe when you leave the lab for lunch, etc.
7. Bring your USC ID each day
How to shine at SHINE:

• Take notes – in your lab notebook & laptop
• Ask questions of everyone in your lab
• Consider keeping a diary or journal of your experiences – how does your understanding of research change over these 7 weeks? What can you learn about people, about yourself?
• Use downtime in the lab to:
  • Study the lab’s Website
  • Read the lab’s publications – assignment
  • Review past SHINE Posters
  • Do your literature search in USC library databases
How to shine at SHINE:

• Always follow lab safety procedures – failure to do so may result in termination from the SHINE program
• Don’t post to any social media about the lab or your fellow SHINE students unless you have explicit permission to do so
• Try to have lunch with someone new from SHINE every day – don’t stick with the people you know
How to shine at SHINE:

If you have any problems, concerns, or questions, contact Dr. Mills right away:

kmills@usc.edu
Office: 213-740-0237   DRB 254
Cell: 310-592-6477
USC Transportation - Shuttle

Union Station Tram Pick-Up Location

Map Not to Scale
USC Transportation – Metro Expo Line

Expo/Vermont
Expo/USC
Parking

Gate 6 = Downey Way Entrance

Get a summer school parking pass

(may not be in Downey Way Parking Structure)

WHO WANTS TO CARPOOL OR BUDDY UP ON PUBLIC TRANSPORTATION?

⭐ We are here @ RTH
School of Cinematic Arts Screenings
https://cinema.usc.edu/events/

12 FEET DEEP
JUNE 19, 2017, 7:00 PM
The Ray Stark Family Theatre, SCA 108, George Lucas Building, USC School of Cinematic Arts Complex, 900 W. 34th Street, Los Angeles, CA 90007

Sisters Bree (Nora-Jane Noone) and Jonah (Alexandra Park) are unwittingly trapped under the fiberglass cover of an Olympic sized pool after it closes for the holiday weekend. With the chilling cold of night settling in and her sister growing weaker with every passing hour, Jonah must reconcile her past guilt and find the hidden strength buried inside her. Only after confronting the “monsters” inside and out, do the sisters have any chance of surviving.
USC Department of Public Safety

Campus is closed to people without USC ID between 9 p.m. – 6 a.m.

Public Safety officers and campus ambassadors stationed all around.

More information in the SHINE Orientation Packet.

SHINE students will not be left alone in the lab.

Add Public Safety phone #s to your cell phone
NEXT STEPS:

1. Report to your labs on day(s) set
2. SHINE Poster Session & Certificate Ceremony Wednesday, 8/2
LUNCH

Deepika – Electrical & Materials Sci
Emanuel – Aerospace
Ethan – Biomed
Robotics – RTH 422  Everyone else – here
SHINE Students: Return Here 1:30