

## Education

**Bachelor of Engineering, Electrical and Computer Engineering**  
University of Toronto, St. George St. Campus, Ontario, Canada

2017

## Past Research Focus

Augmented Reality, Wearable Computing, High Dynamic Range Imaging, Computational Photography, Fluid User Interface, Internet of Things and Cellular Mechanobiology.

## Technical Skills

**Programming:** C++, C#, C, Verilog, Assembly, Java, Python, Visual Basic, HTML

**Applications:** Altium Designer(PCB designing), LabVIEW, MATLAB, Quartus, Qsim, Unity, Blender

## Publications

- **Sarang Nerkar**, Max Hao Lu, Sen Yang, Alex Papanicolaou, Cindy Jinhee Park and Steve Mann. Open Source EyeTap: Empowering Every Maker with Phenomenal Augmented Reality and Wearable Computing. Accepted at The ACM International Symposium on Wearable Computers 2017. (ACM ISWC 2017)
- Pete Scourboutakos, **Sarang Nerkar**, Max Hao Lu, Steve Mann 2017, "Phenomenologically Augmented Reality With New Wearable LED Sequential Wave Imprinting Machines" Proc. ACM TEI 2017, pp. 751-755. **Won "The Most Futuristic Award", TEI 2017 Awards.** ([http://eyetap.org/docs/ACM\\_TEI\\_2017\\_SWIM\\_p751.pdf](http://eyetap.org/docs/ACM_TEI_2017_SWIM_p751.pdf))
- **Sarang Nerkar**. "Augmenting Reality with High Dynamic Range Imaging and Sequential Wave Imprinting Machines", Undergraduate Thesis, supervisor Steve Mann, December 2016, University of Toronto. (<https://www.sarangnerkar.com/s/Thesis.pdf>)
- **Sarang Nerkar**, Ryan Janzen, Pete Scourboutakos, and Steve Mann (2016), "Extrapolative Lightspace Method for HDR Video Exposure Selection" Proc. IEEE ISM 2016, pp. 397-398. ([http://eyetap.org/docs/ExtrapolativeExposure\\_NerkarJanzenScourboutakosMann2016.pdf](http://eyetap.org/docs/ExtrapolativeExposure_NerkarJanzenScourboutakosMann2016.pdf))
- S. Mann, Brett Leonard, David Brin, Ana Serrano, Robin Ingle, Ken Nickerson, Caitlin Fisher, Samantha Mathews, R. Janzen, M. A. Ali, K. Yang, D. Braverman, **S. Nerkar**, K. M.-Sanchez, Zack P. Harris, Zach A. Harris, Jesse Damiani, Edward Button. Code of Ethics on Human Augmentation. In VRTO Virtual & Augmented Reality World Conference + Expo, 2016. (<http://wearcam.org/code.pdf>)
- My work is mentioned here as a collaborator: Steve Mann. Surveillance (oversight), Sousveillance (undersight), and Metaveillance (seeing sight itself). In 2016 IEEE Conference on Computer Vision and Pattern Recognition Workshops. (<http://wearcam.org/kineveillance.pdf>)

## Conference Posters and Presentations

- Presentation: Max Hao Lu, **Sarang Nerkar** and Steve Mann. Open Source EyeTap - Wearable Computing and Augmented Reality for Billions.. VRTO Virtual & Augmented Reality World Conference + Expo, 2017.
- Presentation: **Sarang Nerkar** and Steve Mann. Visualizing Gravitational Waves in Augmented Reality. At 2016 Centre for Power and Information (CPI) Research Showcase.
- Keynote Presentation: Dan Braverman, **Sarang Nerkar** and Steve Mann. Code of Ethics on Human Augmentation. VRTO Virtual & Augmented Reality World Conference + Expo, 2016.
- Poster and Presentation: **Sarang Nerkar**, Aileen Zhong and Dr. Craig A. Simmons. Development and Application of a Method to Establish Pressure-Strain Calibration Curves for Cell Stretching Systems. At 2015 University of Toronto Undergraduate Engineering Research Day.
- Poster: **Sarang Nerkar**, Haijiao Liu and Dr. Craig A. Simmons. Developing a Bulging Elastic Membrane Cell Stretching Device to Systematically Screen and Optimize the Effect of 3D Mechanical Stimulation on Cell Functions and Tissue Formation in Vitro. At 2015 University of Toronto Institute of Biomaterials and Biomedical Engineering Summer Research Day.

## **Media Interviews and Exhibitions**

- Zhejiang provincial news, China. Presented at Foreign Talents in Hangzhou Entrepreneurship & Innovation Achievements Exhibition. (<https://youtu.be/pDRDFlcrrc>)
- Interviewed by “Through the Wormhole with Morgan Freeman” show for my wearable microSWIM device (details in the Hardware Projects section) for their episode on privacy. Title: Is Privacy Dead? Season 7 Episode 2. (<https://youtu.be/OwnLVcKqJjk>)
- Hello Tomorrow Korea 2017. Open Source EyeTap.
- Asian Leaders Forum 2017. Open Source EyeTap - Wearable Computing and Augmented Reality for Billions.
- Mobile World Congress 2017. EcoCyborg fashion tech show.
- Canadian National Exhibition 2016. Augmenting Reality Exhibit.

## **Work Experience**

### **Researcher | Humanistic Intelligence Lab**

**January 2016 – Present**

- Research focus: wearable computing, augmented reality, natural user interface and high dynamic range (HDR) Represented the lab as a part of a delegation to various cities in China. (Hangzhou, Shenzhen and Shanghai)
- Wrote 4 research papers at ACM ISWC 2017(first author), IEEE ISM 2016(first author), ACM TEI 2017(Most Futuristic Award) and VRTO 2016. Mentioned as a collaborator in Prof. Steve Mann’s paper at CVPR 2016.
- Led various HDR projects. These projects were presented at various prestigious venues and won the University of Toronto Capstone Certificate of Distinction. Currently leading the GUI team for open source AR glasses project.
- Presented my work at various prestigious venues such as the show "Through the Wormhole with Morgan Freeman" on Science Channel, Canadian National Exhibition, Mobile World Congress, CES Las Vegas, University of Toronto CPI Research Showcase, Discovery Channel News, StarTalk Radio with Neil deGrasse Tyson etc.
- Presented at keynote speeches of various prestigious events with Prof. Mann.

### **Firmware Engineering Intern | Zeitdice**

**May 2016 – September 2016**

- Designed a 6-layer PCB for a time-lapse camera.
- Programmed the MCU (Atmel SAM S70) and MPU (Atmel SAMA5D2) in the 6-layer PCB using Atmel Studio and Atmel SAM-BA. Contributed to GUI development for the frontend software for the device.
- Developed state of the art high dynamic range functionality for time-lapse photography.
- Developed auto-exposure algorithm for high-dynamic range photography and time-lapse flicker removal algorithm.
- Helped the CEO with marketing/business plans for the company.

### **Researcher and Software Designer | Icarus Interstellar**

**June 2014 – September 2016**

3D space trajectory and mission planning software. Now Voyager Space Exploration Corporation.

- Designed the GUI and 3D models of all the celestial bodies used in the software.
- Led the GUI development team.
- Implemented the cloud version of the software. Responsible for development of business model for the company.
- Developed an n-body simulator in C++ using order 10 Runge-Kutta method, which was used to simulate the gravity of all the celestial bodies within the radius of 15 lightyears.

### **Research Assistant | Cellular Mechanobiology Lab**

**May 2015 – September 2015**

- Designed and built five devices that regulate vacuum pressure and stretch cells. Being used to generate 3D mechanical stimulations in the cells at various labs at the University of Toronto, including to study the behavior of heart valve cells under stress and strain.
- Developed an image processing algorithm and software to analyze images taken from a cell stretching system and used the data to obtain pressure-strain curves for the system. Designed and developed GUI for the software.
- Developed a software using LabVIEW and LiveCode to control the cell stretching devices. The software can control up to eight devices at the same time. Responsible for GUI design and development of the software.
- Presented at the Undergraduate Engineering Research Day (UnERD), 2015 at University of Toronto and at the IBBME Research Day, 2015.

## **Recent Achievements**

- Most Futuristic Award at ACM TEI [2017]
- Certificate of Distinction for University of Toronto Capstone Project: High Dynamic Range Augmented Reality (HDR AR) [2017]
- Steven Mann Award in Wearable Computing (\$500) [2016]
- Ontario Centres of Excellence TalentEdge Internship Program (\$10,000) for “Efficient Embedded Firmware Implementation of High Dynamic Range Imaging” [2016]
- IBBME Undergraduate Summer Research Program funded by the NSERC Undergraduate Summer Research Award (\$6,000) [2015]
- University of Toronto Scholar (\$5,000) [2013]
- Scholarship for Higher Education under Innovation in Science Pursuit for Inspired Research (INR80,000 per year till PhD) [2013, declined].
- Interviewed by “Through the Wormhole with Morgan Freeman” show for my wearable microSWIM device (details in the Hardware Projects section) for their episode on privacy.
- Quarterfinalist - The Hackaday Prize [2014 & 2015]
- Sir Isaac Newton Exam (World Rank- 20) [2013]
- Performance in top 1% in Class 12 Board examination [2013]

## **Recent Projects**

### **Open Source EyeTap**

**January 2017 – Present**

- Open Source Augmented Reality glasses to empower every maker with wearable computing and phenomenal augmented reality. The overall cost of making these glasses is less than \$200 (almost an order of magnitude lower than consumer AR glasses). Got a paper accepted on this project at ACM ISWC 2017 (first author).
- Open source not only in software but also in hardware, so that makers can 3D print their own EyeTap at home and develop AR solutions to problems in their localities, realizing hidden potential of AR through open innovation.
- Part of MannLab, a global network of research, innovation and entrepreneurship. (I am a founding member)

### **Automatic Exposure Selection for High Dynamic Range Imaging**

**May 2016 – March 2017**

- Enhanced Prof. Steve Mann’s HDR invention by adding automatic exposure selection functionality to it.
- Implemented the automatic exposure selection algorithm for real-time HDR on android. This was then used to make a cheap mediated reality system which enhanced human vision.
- Deployed the algorithm in two consumer products: Zeitdice Smart Timelapse Camera and Visionertech’s VMG.
- This project was used to win the Certificate of Distinction for University of Toronto Capstone Project. A research paper was published on this project.

### **Variable Exposure Value Comparametric Camera Response Function for HDR**

**July 2016 – December 2016**

- Adding the variable exposure value functionality to the already existing comparametric camera response function(CCRF) technique for high dynamic range image composition.
- Working with the people who invented CCRF and hold the patent for the technology, ie. Mir Adnan Ali and Prof. Steve Mann.
- Implementing the technique on a FPGA for real-time high dynamic range video streaming for augmented reality, using high level synthesis techniques for FPGA development.

### **Augmented Reality Hearing Aid using SWARM Modulation**

**January 2016 – April 2016**

- Hearing aid for people who cannot hear sounds of certain frequency.
- Implemented SWARM Modulation in C++ for real-time frequency shift of the sound that the person with hearing disability cannot hear sounds of certain frequency ranges.
- Implemented the same on a MCU (PIC32MZ) for a real-time frequency shift device.

### **Micro Sequential Wave Imprinting Machine (microSWIM)**

**January 2016 – April 2016**

- Designed a PCB for microSWIM.
- Used the device to visualize gravitational waves as a complex waveform by overlaying the waveform on real space.
- Used the device to make a wearable bug sweeper that detects hidden microphones and shows the capacity of the hidden microphones to hear in real space.
- Interviewed by “Through the Wormhole with Morgan Freeman” show for this device.