

# Keshav Bimbraw

Google CSRMP 2021B | [bimbraw.github.io](https://github.com/bimbraw) | (678)-436-9426 | [bimbrawkeshav@gmail.com](mailto:bimbrawkeshav@gmail.com) | [linkedin.com/in/bimbraw/](https://www.linkedin.com/in/bimbraw/) | F1 Student

## EDUCATION

### Worcester Polytechnic Institute (WPI), Worcester, MA

Ph. D. student in Robotics Engineering (Medical FUSION Lab)

Aug '20 – now

Concentration – Ultrasound Image Processing, Medical Robotics & Human Computer Interaction

4.00/4.00 GPA

### Georgia Institute of Technology, Atlanta, GA

M. S. with Robotics Focus (Music Technology, Computer Software & Media Applications)

Aug '17 – May '19

Concentration – Human Augmentation, Medical Robotics & Robotic Musicianship

3.56/4.00 GPA

### Thapar University, Patiala, India

B. E. in Mechatronics Engineering (Research Intern - IIT Delhi, Jan – Jul '16)

July '13 – June '17

Concentration – Robotics & Mechatronics

GPA - 4.00/4.00 GPA (8.34 CGPA)

## EXPERIENCE

### Nokia Bell Labs

New Providence, NJ

#### Augmented Human Sensing Intern (Data and Devices Group, AI Research Lab)

June '22 – now

- Developing low latency pipelines using biological data (sEMG, etc.) to estimate limb movements for Human-Machine Interaction.

### WPI

Worcester, MA

#### Research Assistant (Medical FUSION Lab)

March '20 – now

- Developed a deep learning and machine learning based pipeline to predict finger joint angles & hand configurations from forearm ultrasound images. Achieved an error of 7.35° for finger joint angle prediction (IEEE ICRA '22). [ArXiv preprint](#). [Video](#).
- Developed a novel augmented reality based lung ultrasound scanning guidance system (MICCAI ASMUS '20). [Paper](#). [Video](#).
- Helped develop a real-time ultrasound data acquisition software framework for a tele-operative low-cost lung ultrasound robot. [Paper](#).
- Mentoring and assisting undergraduate teams for their major qualifying projects and independent research studies.

### Agile Resources Inc.

Peachtree City, GA

#### Audio DSP Engineer (Panasonic Automotive Systems of America)

Oct '19 – March '20

- Worked on Qualcomm's Hexagon SDK for audio applications in Eclipse on Android framework development.
- Utilized Qualcomm tools to evaluate audio modules such as Bass Mid Treble, Parametric Equalizer, Fade & Balance etc.

### Bose Corporation

Stow, MA

#### Active Noise Control Engineering Intern (Automotive Systems Division)

May '19 – Oct '19

- Worked on sound synthesis for electric vehicles and implementing processor optimized signal processing algorithms.
- Developed a physical car sound simulation system using Logitech pedals to evaluate models and reduce testing time.

### Georgia Tech

Atlanta, GA

#### Research Assistant (Robotic Musicianship Lab)

Aug '17 – May '19

- Lead the [Skywalker project](#) from Aug '18 – May '19. My robot and code were featured in the first episode of The Age of A.I. [Link](#).
- Investigated a combination of Ultrasound & EMG data using supervised learning algorithms to enhance assistive robot control. [Link](#).
- Assisted a team to improve the expressivity of Shimon (a marimba playing robot) by replacing its actuators & control scheme. [Link](#).
- Translated Piano playing to robots using a single DOF system and designed a robotic hand with one DOF per finger. [Link](#).
- Developed an ultrasound in the loop tendon based wearable exoskeleton for upper extremity rehabilitation of stroke survivors. [Link](#).
- Computer-Aided Design (CAD), Fusion 360, 3D printing and Mechatronics Instructor for Project Studio Course. [Link](#).

### IIT Delhi

New Delhi, India

#### Research Intern (Autonomous Robotics Lab)

Jan '16 – Aug '16

- Programmed two KUKA KR-5 robotic arms to collaboratively play a guitar. [Link](#).
- Developed a Control Module for RoboAnalyzer using C# to simulate control of mass spring damper & single-link robotic arm systems.
- Improved performance of a 6 DOF motion platform at Simulator Development Division, Secunderabad, India. [Link](#).
- Helped with the development of a Teach pendant to control virtual robots in RoboAnalyzer software. [Link](#).
- Modified the mechanical and electrical design of Tulsi Bead making device under the rural development initiative of IIT Delhi.

## SKILLS

### Software Skills

Python, MATLAB, TensorFlow, ROS, Linux, NumPy, matplotlib, OpenCV, C++

## ACADEMIC PROJECTS

---

### **Comparing low & high-dimensional forearm ultrasound based hand state classification (WPI, Machine Learning)** Spring '22

- Investigated the feasibility of using image compression techniques for extracting latent structure of ultrasound images. [Link](#).
- Designed a real-time ML pipeline for training and testing models for hand motion classification based on forearm ultrasound.

### **Navigation of a Raspberry-Pi based Robot using camera and Lidar data (Georgia Tech, Intro. To Robotics Research)** Fall '18

- Used camera data to [find center of a ball](#) and track it by actuating Dynamixel motors attached to a mobile robot. Used Lidar data to avoid obstacles and maintaining a specific distance from them while [moving towards a goal](#) (waypoint classification using SVM).

### **Design of an ultrasound guided vein cannulation robot (Georgia Tech, Medical Robotics)**

Spring '18

- Oversaw a 5-person multi-discipline team to develop a medical robot that can hold an ultrasound probe to detect jugular vein. [Link](#).
- Designed and programmed a PRRRP configuration robot for its end effector to reach specific positions in the robot workspace.

## LEADERSHIP

---

### **Leadership Experience at WPI**

Fall '20 – now

- Senator and representative of the Robotics Engineering Department for the Graduate Student Government at WPI.
- Member of the Rho Beta Epsilon Robotics Engineering society at WPI. Hosted a C++ workshop for beginners at WPI.
- Graduate Student Officer at The Alliance: the social, educational, & professional support network of LGBTQIAP+ students at WPI.

### **Vertically Integrated Projects (VIP) Instructor** at Robotic Musicianship Lab at Georgia Tech

Fall '17 – Spring '19

- Lead teams of undergraduates to involve them in robotics and mechatronics research.
- Mentored students to work on real life robotics projects & improving their project presentation skills.

## HONORS & AWARDS

---

- Selected for 2021B cohort of Google Research's CSRMP program. First person at WPI to have ever been selected. September '21
- Awarded PhD positions at WPI & Georgia Tech. Accepted the WPI offer. (Tuition support & \$31824 yearly award) March '20
- Selected to be Diversity and Inclusion Fellow by Georgia Tech Institute Diversity (\$1000 award) February '19
- Selected as NSF-NRT ARMS (Accessibility, Rehabilitation, & Movement Science) Trainee (\$1500 award) August '18
- Scholarship to pursue masters at Georgia Tech (Tuition support & \$14100 yearly award) August '17
- Awarded merit scholarships and grants totaling INR 336,000 at Thapar University. June '17

## PUBLICATIONS

---

- [1] **Bimbraw, K.**, Nycz, C. J., Schueler, M., Zhang, Z., & Zhang, H. K. (2021). Prediction of Metacarpophalangeal joint angles and Classification of Hand configurations based on Ultrasound Imaging of the Forearm. In: *arXiv preprint:2109.11093*. [Link](#). [Video](#).
- [2] Tsumura, R., Hardin, J.W., **Bimbraw, K.**, Grossestreuer, A.V., Odusanya, O.S., Zheng, Y., Hill, J.C., Hoffmann, B., Soboyejo, W. and Zhang, H.K., 2021. Tele-Operative Low-Cost Robotic Lung Ultrasound Scanning Platform for Triage of COVID-19 Patients. *IEEE Robotics and Automation Letters*, 6(3), pp.4664-4671. [Paper Link](#). [Video](#).
- [3] **Bimbraw, K.**, Ma, X., Zhang, Z., Zhang, H. (2020). Augmented Reality-Based Lung Ultrasound Scanning Guidance. In: *Medical Ultrasound, and Preterm, Perinatal and Paediatric Image Analysis. ASMUS 2020, PIPPI 2020*. Lecture Notes in Computer Science, vol 12437. Springer, Cham. doi.org/10.1007/978-3-030-60334-2\_11. [Paper Link](#). [Video](#).
- [4] **Bimbraw, K.**, Fox, E., Weinberg, G. and Hammond, F. L. (2020). Towards Sonomyography-Based Real-Time Control of Powered Prosthesis Grasp Synergies. In: *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Montreal, QC, Canada, 2020, pp. 4753-4757, doi: 10.1109/EMBC44109.2020.9176483. [Paper Link](#). [Video](#).
- [5] Mehta, I., **Bimbraw, K.**, Chittawadigi, R. G., & Saha, S. K. (2016). A teach pendant to control virtual robots in Roboanalyzer. In: *2016 Int. Conference on Robotics and Automation for Humanitarian Applications (RAHA)* (pp. 1-6). IEEE. [Paper Link](#).
- [6] **Bimbraw, K.**, Mehta, I., Venkatesan, V., Joshi, U., Sabherwal, G. S., & Saha, S. K. (2016). Performance improvements of a 6-DOF motion platform. In: *2016 Int. Conference on Robotics & Automation for Humanitarian App. (RAHA)* (pp. 1-5). IEEE. [Paper Link](#).
- [7] Kaur, M., Singh, G., **Bimbraw, K.**, & Uniyal, P. (2015). Study of phase transformation and microstructure of alcohol washed titania nanoparticles for thermal stability. In: *AIP Conference Proceedings* (Vol. 1675, No. 1, p. 030049). AIP Publishing. [Paper Link](#).
- [8] **Bimbraw, K.** (2015). Autonomous cars: Past, present, and future. In: *2015 12th International Conference on Informatics in Control, Automation and Robotics (ICINCO)* (Vol. 1, pp. 191-198). IEEE. [Paper Link](#).