# Keshav Bimbraw

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## EDUCATION

**Worcester Polytechnic Institute (WPI)**, Worcester, MA
Ph. D. student in Robotics Engineering (Medical FUSION Lab) — Aug '20 – now
Concentration – Medical Robotics, Ultrasound Image Processing & Machine Learning — 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

**WPI** — Worcester, MA
**Research Assistant (Medical FUSION Lab)** — March '20 – now
- Lead the development of a Deep Learning based pipeline to predict finger joint angles and hand configurations from forearm ultrasound images. Results communicated to ICRA '22. ArXiv preprint. Video.
- Developed a novel Augmented Reality based lung ultrasound scanning guidance system (MICCAI ASMUS '20). Paper. Video.

**Agile Resources Inc.** — Peachtree City, GA
**Audio DSP Engineer at 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 in Automotive Systems Division** — May '19 – Oct '19
- Worked on sound synthesis for electric vehicles and implementing processor optimized signal processing algorithms.
- Implemented and evaluated a variable bandwidth shifting bandpass filter (in MATLAB) on an electric vehicle with a random noise source. 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.
- Upgraded the expressivity of Shimon (Marimba playing robot) by replacing its actuators and 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.
- Developed a Teach pendant to control virtual robots in RoboAnalyzer. Link.
- Modified the mechanical and electrical design of Tulsi Bead making device under rural development initiative of IIT Delhi.

## ACADEMIC PROJECTS

**Navigation of a Raspberry-Pi based Robot using various sensors** — Fall '18
- Used data from Raspberry Pi camera to find center of a ball and track it by actuating Dynamixel motors attached to the robot.
- Used Lidar data to avoid obstacles and maintaining a specific distance from them while moving towards a goal.
- Achieved goal position by classification & real time prediction of various waypoints using support vector machine.

**Design of an ultrasound guided vein cannulation robot** Spring ‘18

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

## SKILLS

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| **Software Skills** | Python, C++, MATLAB, TensorFlow, ROS, Linux, NumPy, matplotlib, OpenCV |
| **3D Design/3D printing** | SolidWorks, Autodesk Inventor, Autodesk Fusion 360, Tinkercad, PreForm |
| **Electrical/Electronic skills** | Arduino, Raspberry Pi, Motors, Actuators, Hardware & software interfacing |

## LEADERSHIP

**Leadership Experience** at WPI Fall ’20 – now

- Senator representing 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.

**Diversity and Inclusion Fellow** at Georgia Tech Spring ‘19

- Lead efforts in making Georgia Tech a more inclusive campus by organizing student and faculty activities at GTCMT.
- Took an initiative to enroll students & faculty in campus activities related to promoting a diverse & inclusive community.

## 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] (Communicated to ICRA 2022) **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*. Paper 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 International Conference on Robotics and Automation for Humanitarian Applications (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.