

Keshav Bimbrow

Google CSRMP 2021B | <https://bimbrow.github.io/> | 678-436-9426 | bimbrowkeshav@gmail.com | <https://www.linkedin.com/in/bimbrow/> | F1-Visa Status

EDUCATION

Worcester Polytechnic Institute

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

Concentration – Ultrasound Image Processing, Medical Robotics & Human-Machine Interfacing

Worcester, MA

Aug '20 – May '25 (tentative)

4.00/4.00 GPA

Georgia Institute of Technology

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

Concentration – Human Augmentation, Medical Robotics & Robotic Musicianship

Atlanta, GA

Aug '17 – May '19

3.56/4.00 GPA

Thapar University

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

Concentration – Robotics & Mechatronics

Patiala, India

July '13 – June '17

4.00/4.00 GPA (8.34 CGPA)

EXPERIENCE

Nokia Bell Labs

New Providence, NJ

Augmented Human Sensing Co-Op (Data and Devices Group, AI Research Lab)

June '22 – Dec '22

- Designed low-latency biosignal based pipelines (sEMG, IMU) to estimate bodily motion for Human-Machine Interaction. [Video](#).
- Submitted and presented a paper ([IEEE SII 2023](#)) and multiple invention reports. Offered a Co-Op extension, which was accepted.
- Developed demonstrations for biosignal-based remote multi-sensor real-time shared-autonomy industrial robotic applications.
- Investigated multi-channel sEMG based hand movement classification for robotic control using deep learning (MLP, CNN).
- Utilized transfer learning approach for improving performance of sEMG based hand configuration classification from 91% to 96%.

Worcester Polytechnic Institute (WPI)

Worcester, MA

PhD student and Researcher (Medical FUSION Lab)

March '20 – now

- Developed a deep learning based pipeline to predict finger angles & hand configurations from forearm ultrasound images. Achieved an error of 7.35° for finger joint angle prediction (IEEE ICRA '22). [Paper](#). [Video](#). Extended version published in [IEEE T-MRB](#).
- Conceptualized a novel augmented reality based lung ultrasound scanning guidance system (MICCAI ASMUS '20). [Paper](#). [Video](#).
- Established the real-time ultrasound data acquisition software framework for a tele-operative low-cost lung ultrasound robot. [Paper](#).
- Designing an ultrasound based American Sign Language classification system using machine learning. [Poster](#) presented at ICRA '22.
- Mentoring and assisting undergraduate teams with 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

- Developed 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

- Designed sound synthesis framework for electric vehicles and implemented processor-optimized signal processing algorithms.
- Devised a physical car sound simulation system using Logitech pedals to evaluate models and reduce testing time.

Georgia Institute of Technology (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](#).
- Utilized ultrasound data from the forearm to classify hand grasping configurations for controlling a soft robotic gripper. [Paper Link](#).
- Investigated a combination of Ultrasound & EMG data using supervised learning algorithms to enhance assistive robot control.
- Translated Piano playing to robots using a single DOF system and designed a robotic hand with one DOF per finger. [Link](#).
- Created an ultrasound in the loop tendon-based wearable exoskeleton for upper extremity rehabilitation of stroke survivors. [Link](#).
- Taught Computer-Aided Design (CAD), Fusion 360, 3D printing, and Mechatronics for Project Studio Course. [Link](#), [Link](#).

IIT Delhi

New Delhi, India

Research Intern (Autonomous Robotics Lab)

Jan '16 – Aug '16

- Conceptualized and programmed the system framework for two KUKA KR-5 robotic arms to collaboratively play a guitar. [Link](#).
- Improved performance of a 6 DOF motion platform at Simulator Development Division, Secunderabad, India. [Link](#).
- Developed a teach pendant and a control module 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.

Research Interests

Human-machine interfaces & robotics applications; AI-enabled robotics & medical image processing; Gesture & pose classification, estimation, & detection; Wearable robotics & wearable sensor systems; Design & development of robots for human-robot interaction; New technologies & methodologies in medical robotics; IoT; Industrial robotics & automation.

SKILLS

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

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 the 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 the center of a ball](#) and tracked it using Dynamixel actuators 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 Department for the Graduate Student Government for academic year '21- '22.
- Member of the Rho Beta Epsilon Robotics Engineering society. Co-hosted a C++ workshop for beginners.
- Graduate Student Officer at The Alliance: the social, educational, & professional support network of LGBT+ students.

Vertically Integrated Projects (VIP) Instructor at Robotic Musicianship Lab at Georgia Tech Fall '17 – Spring '19

- Lead teams of undergraduates in robotics and mechatronics research. Assisted with continual mentorship and guidance.

HONORS & AWARDS

- Selected for the 2021B cohort of Google Research's CSRMP. The 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 master's 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.**, Bimbraw, K., & Zheng, M. (2023, January). Towards The Development of a Low-Latency, Biosignal-Controlled Human-Machine Interaction System. In 2023 IEEE/SICE International Symposium on System Integration (SII) (pp. 1-7). [Paper](#). [Video](#).
- [2] **Bimbraw, K.**, Nycz, C. J., Schueler, M. J., Zhang, Z., & Zhang, H. K. (2022, May). Prediction of Metacarpophalangeal joint angles and Classification of Hand configurations based on Ultrasound Imaging of the Forearm. In: *2022 International Conference on Robotics and Automation (ICRA)* (pp. 91-97). IEEE. [Paper Link](#). [Video](#). [Journal Paper](#) published in *IEEE Transactions on Medical Robotics and Bionics*.
- [3] 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](#).
- [4] **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](#).

- [5] **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](#).
- [6] 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](#).
- [7] **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](#).
- [8] 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](#).
- [9] **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](#).

PRESENTATIONS AND POSTERS

- [1] **Bimbraw, K.**, Rothenberg, J., & Zhang, H. K. (2022). Forearm Ultrasound Images can be Classified to Predict Static American Sign Language Letters. In: *2022 International Conference on Robotics and Automation Workshop on Human-centered Autonomy in Medical Robotics (IEEE ICRA)*. [Poster Link](#). [Abstract](#).
- [2] **Bimbraw, K.**, Fox, E., Weinberg, G. & Hammond, F. L. (2019). Sonomyography based real-time hand grasp configuration identification via supervised learning to control a soft robotic gripper. In: *2019 Spring School on Medical Robotics (SSMR) and 2019 International Symposium on Medical Robotics (ISMR)*, Atlanta, GA, USA. [Poster Link](#).
- [3] **Bimbraw, K.** (2018). Imparting expressivity and dynamics to percussive musical robot Shimon. In: Three Minute Thesis (3MT™) at Georgia Tech. [Link](#).
- [4] Rosa, L., **Bimbraw, K.**, Hammond, F. L. & Weinberg, G. (2018). Comparison and Integration of SMG and EMG. In: *BMES 2018 Annual Meeting*. Atlanta, GA, USA. [Poster Link](#).

PROFESSIONAL AFFILIATIONS

IEEE, IEEE RAS, BMES, ACM

REFERENCES

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