Ruchik Mishra

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2501 S Fourth Street, Louisville, KY, 40208

Education

University of Louisville Jan 2022 - present
Doctor of Philosophy in Electrical and Electronics Engineering *GPA: 3.966/4*
Dissertation Topic: *Multimodal Human-Robot Interaction, an Affective Computing Approach for Interventions*

Birla Institute of Technology and Science, Pilani, Hyderabad campus Aug 2015 -May 2019
Bachelor of Engineering (Hons.) in Manufacturing Engineering *GPA: 7.4/10*

Research Interests

My research lies at the intersection of robotics, AI, affective computing, and healthcare. I am passionate about leveraging technology to create intelligent machines that are emotionally capable of delivering high-end care and assistance. I strongly believe in a multidisciplinary approach to research through collaborations to understand multimodal data and improve machine perception.

Skills

Programming: Python, MATLAB
Frameworks and Toolkits: Pytorch, TensorFlow, Keras, CUDA
Softwares: Minitab, Ardupilot, LaTeX, Arduino
Deep Learning models: CNN, RNN, Vision Transformers, and related models (ViT, BEiT, DEiT, ViViT), BERT.
Machine Learning models: Logistic Regression, Support Vector Machines, Decision Tree, Random Forest etc.
Data Modalities: Images, Videos, Physiological signals, Speech, and Text.

Professional Experience

Research

Graduate Research Assistant May 2022- present
Louisville Automation and Robotics Research Institute, University of Louisville *Advisor: Dr. Dan O. Popa*

- Human subjects' research for robotic intervention of children with Autism Spectrum Disorder.
- Alternating Treatment Design (single-case experimental design) for comparing robot-led vs human-led interventions.
- Multimodal data analysis using transformers and other deep learning architectures for human-robot interaction.
- Statistical analysis to analyze user data.
- Multi-department collaborative project to predict affect using physiological signals for individuals with eating disorders.
- Experience with vision, language, speech, and time series data to make predictions about human emotions.

Graduate Research Assistant, University of Kentucky May 2021- August 2021
University of Kentucky *Advisor: Dr. Hasan Poonawala*

- Online estimation of flight envelope using Artificial Intelligence (AI).
- Used Gaussian processes for formulating the envelope in terms of the inputs to the control surfaces.
- Used an active learning strategy to sample new data points for exploring the envelope based on the Gaussian processes

Research Assistant/Intern May 2019 – March 2020
International Institute of Information Technology, Hyderabad *Advisor: Prof. K. Madhava Krishna*

- Worked in collaboration with Rockwell Collins Aerospace Company for collision avoidance of unmanned aerial vehicles.
- The algorithm used for collision avoidance is called the Inverse Velocity Obstacle (IVO) to perform real-time collision avoidance.
- Developing new control algorithms for collision avoidance

Undergraduate thesis June 2018 – December 2018
Artificial Intelligence and Robotics Lab (AIRLab), Politecnico di Milano *Advisor: Prof. Andrea Bonarini*

- Worked on Physically Interactive Robo-Games.
- Implemented a probabilistic algorithm called "Entropy Learning Pruned Hypothesis Space".
- This algorithm was used as an entropy measure to find the probable spaces of a human player.
- Game simulations to classify players into 'attacking' or 'defensive' categories.

Teaching and Mentoring

- Mentored seven undergraduates, one graduate student at the University of Louisville, and three undergraduates at Birla Institute of Technology and Science for research projects.
- Teaching Assistant for Network Analysis Lab (Spring 2022), Control Systems Lab (Spring 2022), Logic Design Lab (Summer 2022).
- Mentored a group of participants at the 5^{th} Engineering the Eye Hackathon, 2017, organized by LV Prasad Eye Institute and MIT Media Labs for developing innovative game prototypes for the visually impaired through rapid prototyping.

Conference and Journal reviewing

- Reviewer for IEEE Robotics and Automation Letters (2022), IEEE Transactions on Affective Computing (2023), Affective Computing and Intelligent Interaction (2023), and IEEE/ACM International Conference on Human-Robot Interaction (HRI 2025).

Grants and Proposals

- **Role:** Graduate Research Assistant, National Science Foundation NSF-funded research project # 1838808 SCH: INT: Adaptive Partnership for the Robotic Treatment of Autism, 2019-2024, Budget: $1,228,361
- Grant proposal (in-making) on using Physiological features in eating disorders. (contact Dr. Christina Ralph-Nearman for more details. Contact shared in the references section)

Invited Talks/Workshops/Demos

- **Talking robotics podcast**: "Personalized robotic intervention for children with Autism Spectrum Disorder"
- Organized a three-part workshop on **ML and DL** methods for time series classification for the Department of Psychology, University of Louisville.
- Organized a two-part workshop on Transformers architectures for language and vision data, AIMs Lab, Department of Computer Science, University of Louisville.
- Demo with the NAO and MILO robots at St. Aloysius Catholic School as a part of NSF grant's outreach activity.
- Demo to Navy at Louisville Automation and Robotics Research Institute (LARRI), 2022
- Demo for Doss High School at LARRI, 2023
- Summer Open House, LARRI, 2023
- Demo for National Science Foundation at LARRI, 2023

Publications and Posters

Journal and pre-prints

- Maria V Kondaurova, Alan Smith, **Mishra, Ruchik**, Qi Zheng, Irina Kondaurova, Alexander L Francis, and Emily Sallee. Empatica e4 assessment of child physiological measures of listening effort during remote and in-person communication. *American Journal of Audiology*, pages 1–10, 2024
- Ali Ashary, **Mishra, Ruchik**, Madan M Rayguru, and Dan O Popa. Mira: Multi-joint imitation with recurrent adaptation for robot-assisted rehabilitation. *Technologies*, 12(8):135, 2024
- Aamira Shah, Maria V Kondaurova, Robert Pennington, **Mishra, Ruchik**, Karla C Welch, Grace M Kuravackel, and Qi Zheng. The effect of a social robot mediator on speech characteristics of children with autism spectrum disorder. *The Journal of the Acoustical Society of America*, 152(4):A139–A139, 2022
- **Mishra, R.**, Welch K.C., and Popa D, 2024. Human-mediated Large Language Models for Robotic Intervention in Children with Autism Spectrum Disorder. (under review at the International Journal of Social Robotics)
- **Mishra, Ruchik**, Andrew Frye, Madan Mohan Rayguru, and Dan O Popa. Personalized speech emotion recognition in human-robot interaction using vision transformers. *arXiv preprint arXiv:2409.10687*, 2024 (under review at IEEE Robotics and Automation Letters)

Conferences

- **Mishra, R.**, Frye, A., Surupa S., Duggan D., Pennington R., Kuravackel G., Barnes G., Popa D., 2023. Affective Analysis of Robot-Led Social Stories for Children with Autism Spectrum Disorder. (under review at IEEE HRI 2025)
- **Mishra, Ruchik** and Karla Conn Welch. Social impressions of the nao robot and its impact on physiology. In *2023 11th International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (ACIIW)*, pages 1–8. IEEE, 2023
- **Mishra, Ruchik** and Karla Conn Welch. Towards forecasting engagement in children with autism spectrum disorder using social robots and deep learning. In *SoutheastCon 2023*, pages 838–843, 2023
- **Mishra, Ruchik**. Towards adaptive and personalized robotic therapy for children with autism spectrum disorder. In *2022 10th International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (ACIIW)*, pages 1–5. IEEE, 2022
- Pallavi Saxena, Ritika Mishra, Kwanit Gupta, Rishabh Gupta, and **Mishra, Ruchik**. A low-cost and portable subcutaneous vein detection system using a combination of segmentation methods. In *Proceedings of Sixth International Congress on Information and Communication Technology: ICICT 2021, London, Volume 4*, pages 869–878. Springer, 2022
- **Mishra, Ruchik**, C Vineel, and Arshad Javed. Indoor navigation of a service robot platform using multiple localization techniques using sensor fusion. In *2020 6th International Conference on Control, Automation and Robotics (ICCAR)*, pages 124–129. IEEE, 2020
- **Mishra, Ruchik**, Yug Ajmera, Nikhil Mishra, and Arshad Javed. Ego-centric framework for a three-wheel omni-drive telepresence robot. In *2019 IEEE International Conference on Advanced Robotics and its Social Impacts (ARSO)*, pages 281–286. IEEE, 2019
- **Mishra, Ruchik** and Arshad Javed. Ros based service robot platform. In *2018 4th International Conference on Control, Automation and Robotics (ICCAR)*, pages 55–59. IEEE, 2018

Peer-reviewed workshops

- **Ruchik Mishra**, Karla Conn Welch. Social Impressions of the NAO Robot and Applications in Robotic Intervention of Autism Spectrum Disorder. In Socially-acceptable robots Workshop at the International Conference on Robotics and Automation (ICRA 2023).

Posters

- Prasanna, L., Adair, A., **Mishra, R.** and Welch, K., 2024. Simulated Industrial Assembly: Robot vs. Paper Instructions. In Proc. of the 22nd Annual Kentucky Posters at the Capitol Undergraduate Research Poster Session, Frankfort, KY, March 7, 2024.
- Kondaurova, M., Smith, Alan., **Mishra, R.**, Zheng, Q., Kondaurova, I., Francis, A.,Wooten, E. and King, S. Assessment of Child Physiological Measures of Listening Effort During Telepractice. In Kentucky Speech-Language-Hearing Association (KASHA), 2024.
- **Ruchik Mishra**, Gerhardus Olde Loohuis, and Karla Conn Welch. Real-time Biomedical Data as a Shaper of Robot Behavior in Human-Robot Interaction. In Annual SuperCollider Conference for Kentucky NSF EPSCoR Research Poster Session, Louisville, KY, February 2, 2024.
- **Ruchik Mishra**, Karla Conn Welch. Social Impressions of the NAO Robot and Applications in Robotic Intervention of Autism Spectrum Disorder. In Socially-acceptable robots Workshop at the International Conference on Robotics and Automation (ICRA 2023).
- Armand Zedric Greenwell, **Ruchik Mishra**, and Karla Conn Welch. Accuracy Analysis of Program Compliance and Additional Developments for Human Robot Interaction in the Observation of Autism Spectrum Disorder. In Proc. of the 21st Annual Kentucky Posters at the Capitol Undergraduate Research Poster Session, Frankfort, KY, March 2, 2023
- **Ruchik Mishra**, Irina Kondaurova, and Nazita Taghavi. Severity metric development for diagnosis of autism using social robots. Research!Louisville, University of Louisville, KY

Awards and Certificates

- Dissertation Completion Award for Spring 2025, University of Louisville.
- **Winner** (Mark of Distinction), In Annual SuperCollider Conference for Kentucky NSF EPSCoR Research Poster Session, Louisville, KY, February 2, 2024.
- **Finalist** for the 2023 IEEE-HKN Best Student Paper Award presented at IEEE SoutheastCon 2023 in Orlando, Florida.
- **Winner** at Research!Louisville poster presentation 2022 on Severity metric development for autism diagnosis using social robots.
- "Control of Mobile Robots by Georgia Institute of Technology on Coursera. Certificate earned at Sunday, December 25, 2016, 1:20 PM GMT".

References

- **Dr. Dan O. Popa, Professor, Endowed Chair of Advanced Manufacturing**
  Department of Electrical & Computer Engineering , University of Louisville, Louisville, KY, USA
  dopopa01@louisville.edu

- **Dr. Robert Pennington, Bryan T. Williams Endowed Chair in Special Education Technology**
  College of Education , University of Kentucky, Lexington, KY, USA
  robert.pennington@uky.edu

- **Dr. Christina Ralph-Nearman, Assistant Research Professor and the Assistant Director of the EAT Lab**
  Department of Psychological and Brain Sciences , University of Louisville, Louisville, KY, USA
  christina.ralph-nearman@louisville.edu