Saurav Singh

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Ph.D. Student | Robotics and AI Researcher | Machine Learning | Multimodal Fusion | Human-Robot Collaboration

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Education

- **Rochester Institute of Technology, Rochester, NY** *Aug 2020 – May 2025*
  Ph. D. in Electrical and Computer Engineering *GPA: 4.0/4.0*
  (Robotics, Artificial Intelligence & Human Factors)
  Thesis: Human Aware Reinforcement Learning for Adaptive Human-Robot Teaming
  Faculty Advisor: Jamison Heard
- **Rochester Institute of Technology, Rochester, NY** *Jan 2018 – July 2020*
  M. S. in Electrical Engineering (Robotics) *GPA: 4.0/4.0*
  Thesis: Push Recovery for Humanoid Robots using Linearized Double Inverted Pendulum
  Faculty Advisor: Ferat Sahin
- **Guru Gobind Singh Indraprastha University, New Delhi, India** *Aug 2013 – May 2017*
  B. Tech. in Electronics & Communication Engineering *CPI: 81.85%*

Relevant Skills

- **Technical Skills**
  Robotics | Human Factors | Human Robot Interaction | Reinforcement Learning | Deep Learning | Multimodal Data Fusion | Machine Learning | Cybernetics | Embedded Systems | Computer Vision | Generative AI | Large Language Models (LLMs) | Natural Language Processing (NLP)
- **Programming Skills**
  Python [Advanced] | C/C++ [Intermediate] | MATLAB [Intermediate] | G-code [Basic] | MELFA Basic [Intermediate] | Fanuc TP Programming [Intermediate] | CNC-Machines [Basic]
- **Toolboxes**
  PyToch| Keras | TensorFlow | Robot Operating System (ROS) | Moveit Motion Planning Framework (ROS) | OpenCV | Git | Version Control System (VCS/SCM) | Onshape (3D Modeling) | Fusion 360 (3D Modeling)
- **Soft Skills**
  Leadership | Collaboration | Research | Time management | Adaptability | Lifelong learner | Curiosity | Critical Thinking | Communication

Work Experience

- **Rochester Institute of Technology, Rochester, NY** *May 2022 – Present*
  Graduate Research Assistant, Department of Electrical & Microelectronics Engineering
  - Developed a multimodal limited-data fusion method for Aerial Imagery.
  - Developed a Modality Utilization metric for multimodal network, contributing towards the explainability aspect of the data fusion.
  - Developed a Modality Utilization based training method for multimodal networks, promoting noise robustness in dominant modalities.

- **Emtech Foundation, New Delhi, India** *Jun 2017 – Dec 2017*
  Firmware Engineer
  - Developed embedded software for industry specific applications and systems including air cushion machine, Transcutaneous electrical nerve stimulation (TENS) machine, and water pump control system.
  - Formulated a flow diagram for the system based on client requirement and implemented state-machine based firmware.

Teaching Experience

- **Rochester Institute of Technology, Rochester, NY** *Jan 2019 – May 2022*
  Graduate Teaching Assistant, Department of Electrical & Microelectronics Engineering
  - EEEE-536/636: Biorobotics/Cybernetics, Spring 2022.
  - EEEE-585/685: Principles of Robotics, Fall 2020 & Fall 2019.
  - EEEE-602: Random Signals and Noise, Spring 2020.
  - EEEE-709: Advanced Engineering Mathematics, Spring 2020 & Spring 2019.
  - EEEE-707: Engineering Analysis, Spring 2020 & Spring 2019.
  - Multi-Agent BioRobotics Lab (MABL), Summers 2019.

Publications

Journal Papers

[J1] **S. Singh**, E. Rantanen and J. Heard, "Human-Robot Teaming: A Comprehensive Survey on Collaboration, Communication, and Cognition", **submitted to** *ACM Transactions on Human-Robot Interaction.*

[J2] **S. Singh**, E. Saber, P. P. Markopoulos, and J. Heard, "Regulating Modality Utilization within Multimodal Fusion Networks," *Sensors*, *vol. 24*, no. 18, p. 6054, 2024.

Conference Proceedings

[C1] **S. Singh** and J. Heard, "Measuring state utilization during decision making in human-robot teams," in *Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction*, 2024, pp. 985–989.

[C2] K. Subramanian, **S. Singh**, J. Namba, J. Heard, C. Kanan and F. Sahin, "Spatial and Temporal Attention-Based Emotion Estimation on HRI-AVC Dataset," *2023 IEEE International Conf. on Systems, Man, and Cybernetics (SMC)*, Honolulu, Oahu, HI, USA, 2023, pp. 4895-4900.

[C3] **S. Singh** and J. Heard, "Probabilistic Policy Blending for Shared Autonomy using Deep Reinforcement Learning," *2023 32nd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, Busan, Korea, Republic of, 2023, pp. 1537-1544.

[C4] **S. Singh**, M. Sharma, J. Heard, J. D. Lew, E. Saber, and P. P. Markopoulos, "Multimodal aerial view object classification with disjoint unimodal feature extraction and fully-connected-layer fusion," in *Big Data V: Learning, Analytics, and Applications*, vol. 12522, p. 1252206, SPIE, 2023.

[C5] **S. Singh**, P. P. Markopoulos, E. Saber, J. D. Lew and J. Heard, "Measuring Modality Utilization in Multi-Modal Neural Networks," *2023 IEEE Conference on Artificial Intelligence (CAI)*, Santa Clara, CA, USA, 2023, pp. 11-14.

[C6] A. Dust, C. Gonzalez-Lebron, S. Connell, **S. Singh**, R. Bailey, C. O. Alm, and J. Heard, "Understanding differences in human-robot teaming dynamics between deaf/hard of hearing and hearing individuals," in *Companion of the 2023 ACM/IEEE International Conference on Human-Robot Interaction*, pp. 552–556, 2023.

[C7] L. Nagahanumaiah, **S. Singh** and J. Heard, "Diagnostic Human Fatigue Classification using Wearable Sensors for Intelligent Systems," *2022 17th Annual System of Systems Engineering Conference (SOSE),* 2022, pp. 424-429.

[C8] **S. Singh** and J. Heard, "A Human-Aware Decision Making System for Human-Robot Teams," *2022 17th Annual System of Systems Engineering Conference (SOSE)*, 2022, pp. 268-273.

[C9] **S. Singh** and J. Heard, "Human-aware reinforcement learning for adaptive human robot teaming," in *Proceedings of the 2022 ACM/IEEE International Conference on Human-Robot Interaction, ser. HRI '22*. IEEE Press, 2022, p. 1049–1052.

[C10] R. Devasia, A. Gupta, S. Sharma, **S. Singh**, and N. Rathee, "Electronic guitar midi controller for various musical instruments using charlieplexing method," in *Innovations in Computer Science and Engineering: Proceedings of the Sixth ICICSE 2018*, pp. 315–325, Springer, 2019.

[C11] N. Rathee, A. Gupta, **S. Singh**, R. Devasia, and A. Bansal, "Digital resistance box: An approach to generate desired value of resistance by automatically varying the potentiometer," in *2016 IEEE 1st International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES)*, pp. 1–4, IEEE, 2016.

Dissertations

[D1] **S. Singh**, "Push Recovery for Humanoid Robots using Linearized Double Inverted Pendulum," Research Master Thesis, Rochester Institute of Technology, Rochester, NY, 2020.

Presentations

- Measuring State Utilization in Reinforcement Learning (*Invited Talk*)
  - Performance Engineering Laboratory (PEL) and Network Softwarization and Security Labs (NetsLab), University College Dublin; November 2023; Dublin Ireland.
- Probabilistic Policy Blending for Shared Autonomy using Deep Reinforcement Learning (*Presentation*)
  - 2023 32nd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN); August 2023; Online (Held at Busan, Republic of Korea)
- Measuring Modality Utilization in Multi-Modal Neural Networks (*Poster*)
  - 2023 IEEE Conference on Artificial Intelligence (CAI), June 2023, Santa Clara, CA, United States
- Multimodal aerial view object classification with disjoint unimodal feature extraction and fully connected-layer fusion (*Presentation*)
  - Society of Photo-Optical Instrumentation Engineers (SPIE), Defense + Commercial Sensing Conference, May 2023, Orlando, FL, United States.
- Human-Aware Reinforcement Learning for Adaptive Human Robot Teaming (*Poster*)
  - AI@RIT Summit 2022; October 2022; Rochester, NY, United States
- A Human-Aware Decision-Making System for Human-Robot Teams (*Presentation*)
  - 2022 17th Annual System of Systems Engineering Conference (SOSE); June 2022; Rochester, NY, USA
- Human-Aware Reinforcement Learning for Adaptive Human Robot Teaming (*Presentation*)
  - 2022 17th ACM/IEEE International Conference on Human-Robot Interaction (HRI); March 2022; Online (Originally Sapporo, Hokkaido, Japan).

Professional Services

- IEEE SMC 2023 Conference Event Coordinator for 2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC). Responsibilities included working on the registration desk, streaming the conference live, hosting/chairing virtual sessions, and preparing/managing the in-person events.
- Technical Program Committee member for System of Systems Engineering (SoSE) Conference, 2024
- Reviewer for:
  - ACM/IEEE International Conference on Human-Robot Interaction, ACM/IEEE HRI
  - System of Systems Engineering Conference, SoSE
  - IEEE International Conference on Systems, Man, and Cybernetics, IEEE SMC
  - IEEE International Conference on Robot and Human Interactive Communication, IEEE RO-MAN, Robotics and Automation Society

Mentoring, Leadership and Activities

- Served as the RIT AWARE-AI NRT Trainee Council Member for the 2nd Cohort (2023-2024). Responsibilities include representing the student body in the executive committee meetings, pursuing outreach activities and hosting cohort events.
- Student Mentor, NSF Research Experience for Undergraduates (REU), Rochester Institute of Technology, Summer 2022.
- Undergraduate Student Mentor, Head and Instructor for Embedded Systems & Robotics Special Interest Group (SIG), IEEE-MSIT chapter, Aug 2015 to July 2016, Guru Gobind Singh Indraprastha University, India.

Honors and Awards

- Dublin-Rochester International CRT-NRT Mobility Program Traineeship (Oct 2023 – Nov 2023). Selected as one of the four AWARE-AI NRT trainees at RIT to visit the ML-Labs (Science Foundation Ireland - Centre for Research Training in Machine Learning) in Ireland as a part of Dublin-Rochester International CRT-NRT Mobility Program.
- RIT AWARE-AI NSF Research Traineeship (NRT) (Aug 2022 – Present). Awarded a position as a trainee in an NSF-funded program to support underrepresented students in AI research. Conducted research work as a part of NRT AWARE-AI research, Hardware track (Track 2), developing and publishing work on image based emotion estimation system using transformers.
- 1st Runner Up at the Finals selection for World Skills Competition-Sao Palo, Brazil 2015, World Skills India, India, 2015.
- Winner of the National Selection for World Skills India, 2015 in the skill of Electronics (India)
- Winner of the Regionals Selection for World Skills India, 2015 in the skill of Electronics (India)

Media Coverage

- AWARE-AI Newsletter – June 2024, Trainee Spotlight. My efforts towards AWARE-AI research and improvement of the program were recognized.

Certifications

- Introduction to Git and GitHub (Course Certificate), an online non-credit course authorized by Google and offered through Coursera, 2024.

- Generative AI Fundamentals (Specialization) an online non-credit Specialization authorized by IBM and offered through Coursera, 2024. The specializations cover the following courses:
  - Generative AI: Introduction and Applications (Course Certificate)
  - Generative AI: Prompt Engineering Basics (Course Certificate)
  - Generative AI: Foundation Models and Platforms (Course Certificate)
  - Generative AI: Impact, Considerations, and Ethical Issues (Course Certificate)
  - Generative AI: Business Transformation and Career Growth (Course Certificate)
- Fundamentals of Reinforcement Learning (Course Certificate), an online non-credit course authorized by University of Alberta, Alberta Machine Intelligence Institute and offered through Coursera, 2020.
- Neural Networks and Deep Learning (Course Certificate), an online non-credit course authorized by DeepLearning.AI and offered through Coursera, 2020.
- FANUC CERT Handling Tool Operations and Programming, Fanuc, 2019.
- Machine Learning (Coures Certificate), an online non-credit course authorized by Stanford University and offered through Coursera, 2016.