Roya Sabbagh Novin

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EDUCATION

The University of Utah, Salt Lake City, UT *Sep. 2015 - Dec 2020*
PhD in Mechanical Engineering (Robotics Track), GPA: 3.9/4
Dissertation title: Patient fall prevention through risk-aware robotic assistance
Committee: Andrew Merryweather (chair), Tucker Hermans (co-chair), John Hollerbach, Jake Abbott, and Ron Alterovitz (University of North Carolina at Chapel Hill)

The University of Tehran, Tehran, Iran *Sep. 2012 - Feb. 2015*
MSc in Mechatronics Engineering, GPA: 19.1/20
Thesis title: Collision-free path planning and fault-tolerant control of serial robots via MPC and convex optimization

Sharif University of Technology, Tehran, Iran *Sep. 2006 - Jun. 2011*
BSc in Mechanical Engineering, GPA: 16.6/20

AWARDS AND HONORS

- The Outstanding Graduate Student Researcher of the Year Award, ME, University of Utah *2020-2021*
- Dr. Paul Richard's Safe Workplace Scholarship *2018 & 2019*
- American Society of Safety Engineering Foundation Scholarship *2018*

RESEARCH/WORK EXPERIENCES

Behaviour Planning
Embark Trucks, Inc.
Software Engineer *2021 - Present*

- Design and development of probabilistic behaviour planning approach
- Improving vehicle on shoulder handling behaviour
- Improving lane change decision making

Perception, Prediction and Planning
E&S Lab, LL4MA Lab, University of Utah
Research Assistant, Mentors: **Prof. Andrew Merryweather**, **Prof. Tucker Hermans** *2015 - 2020*

Optimization and Planning

- Investigated probabilistic risk-aware planning for assistive robots and introduced a novel framework that leverages predictive models and minimizes the risk of patient falls in hospital rooms.
- Researched & empirically validated a hybrid mobile manipulation planning scheme to push or pull legged objects.
- Designed and developed an under-actuated robotic hand for grasping legged objects with various leg diameters.
- Implemented and benchmarked several optimization techniques for solving inverse kinematics and trajectory optimization of robot arms as a collaborative optimization mini course.

Probabilistic Modeling and Prediction

- Estimated object dynamics parameters using Bayesian regression model for three different approximated dynamics models based on real-world collected dataset.
- Generated realistic optimization-based patient trajectory dataset and learned highly accurate predictive models of patient motion using Gaussian process models.
- Developed a computational patient fall risk assessment model that can provide fall probability in hospital rooms.

Perception, Computer Vision and Machine Learning

- Implemented visual SLAM using RGB-D and monocular cameras on an iRobot Create2 robot.
- Generated a CNN for object recognition and classification tested on MNIST and CIFAR-10 datasets.
- Collaborated in a project on 3D human posture estimation, ergonomic analysis and optimization in teleoperation.
- Collaborated in development of a neural network model for RULA risk assessment with 99.7% accuracy.

Simulation

- Provided an open-source simulation plugin to model patients in Gazebo simulator. This includes realistic trajectories and animations of human motion with the capability of adding new motion from collected data.
- Collaborated on development of a full teleportation simulation environment in Gazebo including leader and follower robots as well as the human teleopereator.

Motion Generation *TaarLab, University of Tehran*
Research Assistant, Mentor: **Prof. Mehdi Tale Masouleh** *2012 - 2015*

- Explored a general optimal collision-free motion generation algorithm based on convex optimization and model predictive control and implemented it on various mobile, serial and parallel robots with minor modifications.
- Created PGNGN, a neural gas network algorithm for finding the singularity-free workspace of parallel robots resulting in precise workspace estimation.
- Collaborated on a project focusing on fault-tolerant trajectory tracking for redundant serial manipulators.

Medical Robots *Research Center of Science and Technology in Medicine*
Robotics Research Intern, Mentor: **Dr. Alireza Mirbagheri** *2010*

- Improved the design of a robotic hand rehabilitation system used for post stroke patients.
- Contributed in development of a surgery assistant robot for camera handling during laparoscopic surgery.

Industrial Pneumatic Robots *Camozzi*
R&D Research Intern, Mentor: **Dr. Fereidoon Babaie** *2009*

- Worked with researchers on design, development and control of a pneumatic pick-and-place industrial robot.

Rehabilitation Devices *Biomechanics Lab, Sharif University of Technology*
Research Assistant, Mentors: **Prof. Farzam Farahmand**, **Prof. Roya Narimani** *2006 - 2011*

- Designed a finger rehabilitation robotic device for post-stroke patients.
- Supervised a senior design team working on an adjustable head holder for Cerebral Palsy patients.

SKILLS (Python, C/C++, MATLAB)

AI & ML	Probabilistic modeling, Deep learning, State estimation & SLAM, (PO)MDP, HMM, PF, GMMs, GPs
ML packages	OpenCV, Tensorflow, PyTorch, Skorch, sklearn, pymc
Robotics	ROS/ROS2, Rviz, Gazebo, MoveIt, KDL
Planning	Optimal & search-based motion planning, MPC, LQR, A*, RRT, CEM, MIQP
Software	Motive, SolidWorks, MATLAB Simulink, Gurobi Optimization, CVX

SELECTED PUBLICATIONS

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1. A. Yazdani, **R. Sabbagh Novin**, A. Merryweather, T. Hermans, *"Ergonomically Intelligent Physical Human-Robot Interaction: Postural Estimation, Assessment, and Optimization"*, AI-HRI, 2021.
2. **R. Sabbagh Novin**, A. Yazdani, A. Merryweather, T. Hermans, *"Risk-Aware Decision Making in Service Robots to Minimize Risk of Patient Falls in Hospitals"*, ICRA, 2021.
3. **R. Sabbagh Novin**, A. Yazdani, A. Merryweather, T. Hermans, *"A model predictive approach for online mobile manipulation of nonholonomic objects using learned dynamics"*, IJRR, 2021.
4. A. Yazdani, **R**.**SabbaghNovin**, A. Merryweather, T. Hermans, "DULA: A Differentiable Ergonomics Model for Postural Optimization in Physical HRI", RSS 2021 Robotics for People Workshop, 2021.
5. A. Yazdani, **R. Sabbagh Novin**, A. Merryweather, T. Hermans, *"Is The Leader Robot an Adequate Sensor for Posture Estimation and Ergonomic Assessment of A Human Teleoperator?"*, IEEE CASE, 2021.
6. S. Chaeibakhsh, **R. Sabbagh Novin**, T. Hermans, A. Merryweather, A. Kuntz, *"Optimizing Hospital Room Layout to Reduce the Risk of Patient Falls"*, ICORES, 2021.
7. **R. Sabbagh Novin**, E. Taylor, T. Hermans, A. Merryweather,*"A computational model for patient fall risk evaluation in healthcare facilities considering extrinsic factors"*, Health Environments Research & Design Journal (HERD), 2020.
8. **R. Sabbagh Novin**, A. Yazdani, T. Hermans, A. Merryweather, *"Dynamics model learning and manipulation planning for objects in hospitals using a patient assistant mobile (PAM) robot"*, IROS, 2018.