# Roya Sabbagh Novin

https://royasabbagh.github.io/ roya-sn roya.sabbaghnovin@utah.edu

## 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*

## RESEARCH/WORK EXPERIENCES

### Probabilistic Modeling, Robot Perception and Planning
*LL4MA Lab, University of Utah*
*Research Assistant*, Mentors: **Prof. Andrew Merryweather**, **Prof. Tucker Hermans** *2015 - present*

- Developed a probabilistic risk-aware planning scheme that leverages predictive models to minimize the risk of patient falls in hospital rooms by providing supporting objects during ambulation using a mobile manipulator.
- Developed an optimal hybrid mobile manipulation planning framework based on MPC and convex optimization to push or pull legged objects.
- Designed and developed an under-actuated robotic hand for grasping legged objects with various leg diameters.
- Generated predictive models of (1) object dynamics using Bayesian regression model, (2) patient motion using Gaussian process models, and (3) patient fall risk probability in hospital rooms.
- Collaborated in developing a framework for human posture estimation in teleoperation from the robot's trajectory without any extra sensor.
- Collaborated in developing a package for online ergonomics analysis and finding the ergonomically-optimal posture correction using RULA risk assessment tool and CEM optimization.
- Collaborated in optimization of hospital patient room layouts considering patient fall probability.
- Collaborated in a project on visual SLAM using RGB-D and monocular cameras on an iRobot Create2 robot.

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

- Developed an 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.
- 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 (Wrist RoboHab) used for post stroke patients.
- Collaborated on 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 a team of engineers focused on design, development and control of a pneumatic pick-and-place robot for demonstration as an industrial pneumatic robot.

**Rehabilitation Devices** *Biomechanics Lab, Sharif University of Technology*

*Research Assistant*, Mentors: **Prof. Farzam Farahmand**, **Prof. Roya Narimani** *2006 - 2011*

- Developed a finger rehabilitation robotic device for post-stroke patients with a novel design.
- Supervised a senior design team working on design and development of an adjustable head holder for Cerebral Palsy patients.

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

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| **AI** | Probabilistic modeling, HMM, MDP, CNN, Deep learning, Particle filters, SLAM |
| **Robotics** | ROS (Rviz, Gazebo, MoveIt), OpenCV, Tensorflow, PyTorch, Skorch, sklearn, pymc, KDL |
| **Planning** | Optimal & search-based motion planning, MPC, LQR, A*, RRT, MIQP optimization |
| **Software** | Motive, SolidWorks, MATLAB Simulink, Gurobi Optimization, CVX |

## SELECTED PUBLICATIONS

1. **R. SabbaghNovin**, A. Yazdani, A. Merryweather, T. Hermans, *"Risk-Aware Decision Making in Service Robots to Minimize Risk of Patient Falls in Hospitals"*, Submitted to ICRA/RA-L, 2020.
2. A. Yazdani, **R. SabbaghNovin**, A. Merryweather, T. Hermans, *"Is The Leader Robot an Adequate Sensor for Posture Estimation and Ergonomic Assessment of A Human Teleoperator?"*, Submitted to ICRA, 2020.
3. **R. SabbaghNovin**, Ellen Taylor, T. Hermans, A. Merryweather,*"A computational model for patient fall risk evaluation in healthcare facilities considering extrinsic factors"*, Health Environments Research & Design Journal, 2020.
4. S. Chaeibakhsh, **R. SabbaghNovin**, T. Hermans, A. Merryweather, A. Kuntz, *"Optimizing Hospital Room Layout to Reduce the Risk of Patient Falls"*, Submitted to the International Conference on Operations Research and Enterprise Systems (ICORES), 2020.
5. **R. SabbaghNovin**, A. Yazdani, A. Merryweather, T. Hermans, *"A model predictive approach for online mobile manipulation of nonholonomic objects using learned dynamics"*, Conditionally Accepted to the International Journal of Robotics Research, 2019.
6. **R. SabbaghNovin**, 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.
7. **R. SabbaghNovin**, A. Karimi, M. T. Masouleh, *"Optimal motion planning for parallel robots via convex optimization and receding horizon"*, Advanced Robotics, 2016.
8. **R. SabbaghNovin**, M. T. Masouleh, M. Yazdani, *"A new neural gas network approach for obtaining the singularity-free workspace of 3-DOF planar parallel manipulators"*, Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 2016.
9. M. Zarei, **R. SabbaghNovin**, M. T. Masouleh, *"Experimental study on optimal motion planning of wheeled mobile robot using convex optimization and receding horizon concept"*, ICROM, 2016.
10. **R. SabbaghNovin**, M. T. Masouleh, M. Yazdani, *"Optimal motion planning of redundant planar serial robots using a synergy-based approach of convex optimization, disjunctive programming and receding horizon"*, Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering, 2015.
11. M. Yazdani, **R. SabbaghNovin**, M. T. Masouleh, M. Menhaj, H. Abdi, *"An experimental study on the failure tolerant control of a redundant planar serial manipulator via pseudo-inverse approach"*, ICROM, 2015.
12. P. Nozari, H. Kazemi, M. T. Masouleh, **R. SabbaghNovin**, *"Collision-free path planning of a novel reconfigurable mobile parallel mechanism"*, ICROM, 2015.
13. **R. SabbaghNovin**, M. T. Masouleh, A. Karimi, *"Path planning of two and three link planar serial manipulators via convex optimization and receding horizon concept"*, ISME, 2014.
14. **R. SabbaghNovin**, M. Yazdani, M. T. Masouleh,M.B. Menhaj, *"Workspace determination of planar parallel robots via progressive growing neural gas network"*, ICROM, 2014.