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

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*

- 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.
- Generated highly accurate 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 a project on human posture estimation, ergonomic analysis and optimization in teleoperation.
- Implemented 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*

- 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 (Wrist RoboHab) used for post stroke patients considering human joint motion.
- Collaborated with researchers on development and control 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	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, CEM, MIQP optimization
Software	Motive, SolidWorks, MATLAB Simulink, Gurobi Optimization, CVX
Hardware	Robots : Baxter, KUKA lbr4, iRobot Create 2, Quanser HD2
	Sensors: RGB cameras, Kinect Azure & v2, Laser range finders, Motion capture

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, 2021.

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, 2021.

3. S. Chaeibakhsh, **R. SabbaghNovin**, T. Hermans, A. Merryweather, A. Kuntz, *"Optimizing Hospital Room Layout to Reduce the Risk of Patient Falls"*, the International Conference on Operations Research and Enterprise Systems (ICORES), 2021.

4. **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.

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.

15. **R. SabbaghNovin**, M. Salehi, R. Narimani, F. EsfandiarPour, *"Design of a rehabilitation robotic device for fingers"*, ICBBB, 2011.