Hamidreza Raei

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Research Interests

- **Autonomous System Control**
- **Computer vision and machine learning**
- **Data-Driven/model-based Control**

Education

Polytechnic University of Milan — Milan, Italy
PhD Department of Electronic, Information and Bio-engineering — *Sep 2023 - so far*

Gwangju Institute of Science and Technology — Gwangju, Republic of Korea
MSc Mechanical Engineering; ***Thesis: Camera and LiDAR fusion for autonomous landing on moving target*** — *Aug 2022*
GPA (3.5/4.0)

Isfahan University Of Technology — Isfahan Province, Iran
BSc Mechanical Engineering ; ***Thesis: Controller Design for a Ball and Beam system using time-response analysis*** — *June 2020*
last two year GPA (3.46/4.0)

Publications

- **H.Raei, Y.Cho, K.Park: "Autonomous landing on moving targets using LiDAR, Camera and IMU sensor Fusion"**
  , in proceedings of the 13th Asian Control Conference (ASCC 2022, International Conference) — Mar 2022
  DOI: 10.23919/ASCC56756.2022.9828342
- **Y.Cho, H.Raei, K.Park: "Design of the Auto Gain Control amplifier based on a resistance modeling of the MOSFET" for a distance accuracy of the ToF LiDAR** , 2021 The 21st International Conference on Control, Automation and Systems (ICCAS 2021) Jeju, Korea, Oct. 12-15, 2021 — Oct 2021
  DOI: 10.23919/ICCAS52745.2021.9649900

Projects

- **The implementation of a visual odometry-based teleportation system for the Franka Emika Panda robot**: — Dec 2022 - Feb 2023
  - A visual odometry-based teleportation system has been developed for a 7-axis robotic arm.
  - The system utilizes RGBD camera and IMU data to estimate the gripper (operator's hand) position and orientation, enabling it to be teleported to a desired location without relying on environmental sensors.
  - The implementation of this system increases operational efficiency for the operator by facilitating ease of use.
- **(Thesis) Linear and optimal position controller for Quadrotor (Python: mavsdk, Asyncio)**: — Dec 2021- Feb 2022
  - PID and fuzzy-PID controller implementation
  - Kalman Filter and altitude LQR controller implementation
  - horizontal position LQR controller implementation
- **Fitting GPR and RBNN models on a dataset created based on Michalewicz Function (MATLAB)**: — Jan 2022- Feb 2022
  - global exploration and local exploitation comparison for RBNN and GPR surrogate models
  - comparison of Kfold and MLE hyperparameter optimization for GPR model
  - RBNN and GPR model efficiency for global exploration using **particle swarm optimization (PSO)**
- **Implementation of an RNN in a hackathon for sentiment analysis with amazon reviews (Python: TensorFlow)** : — Nov 2021- Dec 2021
  - Input vectorization and model training by pretrained embedding layer
  - CNN and LSTM model training and performance comparison
  - My Neural Network accuracy ranked 4 among 56 participants in my university
- **(Thesis) LiDAR, camera and IMU fusion for UAV relative localization (Python: MAVSDK, OpenCV, Asyncio)**: — Mar 2021- Aug 2021
  - Achieving 30 Hz relative localization using LiDAR, IMU and camera fusion-based
  - camera view object detection and localization
  - UAV landing maneuver control using 3D relative localization
- **Implementation of a CNN for Speed Estimation using dash Camera (Python: TensorFlow, OpenCv)**: — Mar 2021- July 2021

- Vision processing for light condition effect elimination (Canny view Filter)
- Optical Flow generation for consecutive frames
- Constructing and testing different Neural Network structure with different drop out

- **Simulation of implementing a fuzzy controller on an Inverted Pendulum System (Matlab Simulink):** : Jan 2020- Mar 2020
  - System model implementation in Matlab
  - PID controller and fuzzy controller implementation
  - fuzzy-PID tuner implementation and performance comparison
- **Designing a PID controller for a Ball and Beam System using time-response analysis (C++, MATLAB)**: Dec 2019- Jan 2020
  - Defining the system equation and linearizing the equation
  - fuzzy-PID tuner implementation

Skills

- **Programming Languages**: Python, C++, Matlab
- **Software**: ROS, MATLAB & Simulink, PX4, CATIA, EES, QGroundControl, MuJoco

Work Experience

- **Research Fellow in Human-Robot Interfaces and Interaction Lab at IIT under the supervision of Dr.Ajoudani**: Dec 2022 - So Far
  - **Development of a teleoperation gripper**: for Franka Emika manipulation without dependency on environmental sensors using visual odometry
- **Research Assistant in the Dynamics and Control lab at Gwangju Institute of Science and Technology**: Sep 2020 - Nov 2022
  - **Developing Autonomy algorithm using LiDAR**: I developed a LiDAR, camera, IMU sensor fusion for autonomous landing on a moving target using a quadrotor
  - **Involvement in developing various types of LiDARs**: I participated in stm32 programming for DC motor control used for 3D LiDAR cooperatively made by SOSLAB company **http://soslab.co/**
- **Internship at Shahid Mohammad Montazeri Power plant**: Jan 2018 - Aug 2018
  - **Analysing the vibrations of different parts of water and vapor cycle**: to find out the problems and send for fixing center of the power plant
  - **Fixing Pumps**: Balancing pumps (Statics and Dynamic Balance) in order to minimize pump's vibration **Link**

Teaching Experience

- **Teacher Assistant for System Modeling and Control course**: Sep 2021 - Dec 2021
  Under the supervision of professor Kyihwan Park
  - **Teaching student** implementation of their text book examples system in matlab and simulink
- **Teacher Assistant for Entrepreneurship Course** : Feb 2019 - Aug 2019
  Under the supervision of Dr.Alinaghian and Dr.Reisi-Nafchi
  - **facilitating projects:**Helping the students of this course at the beginning to understand bases of the Entrepreneurship and then Helping them to make strategies for SWOT Matrix

Honor and Awards

- *Awarded admission to the prestigious Marie Curie program for doctoral studies.* *Sep 2023 - Aug 2026*
- *Awarded by Korean Government, full Scholarship for MSc at GIST, South Korea covering tuition fee, and stipend* Sep 2020 - Aug 2022

Relevant Courses

- **Mechatronics System Signal Analysis and Circuit Design (MSc: A+)**
- **AI Experience LAB (MSc: B+)**
- **Automatic Control (BSc: A+)**
- **Machine Learning and Deep Learning (MSc: B+)**
- **Introduction to self-driving cars (MSc: B+)**
- **Fundamental of Mechatronics Systems (BSc: A)**

References

- **Director of Human-Robot Interfaces and Interaction (HRI²) laboratory at IIT, Arash Ajoudani - email: Arash.Ajoudani@iit.it**
- **Professor of Electronic Information and Bioengineering Department, Elena De Momi - elena.demomi@polimi.it**
- **Professor of Mechanical Engineering department (GIST), Kyihwan Park - email: khpark@gist.ac.kr**
  MSc Thesis advisor