Shuai LIANG | PhD. in Robotics

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EDUCATION

Université Pierre et Marie Curie (Paris VI), Paris, France
*PhD in Robotics (**Defense date: 04/Oct/2019**)*   *Sep. 2015 - Oct.2019*
Harbin Institute of Technology (C9), China
M.S. in Robotics   *Sep. 2012 - Jul. 2014*
Changchun University of Science and Technology, China
B.S. in Mechatronics   *Sep. 2008 - Jul. 2012*

PROJECTS

Micro-robotic localization from microscope by CNN-based Machine Learning network   *Jul. 2018 - Jun. 2019*
- Built clean, customized database for ML training, by collecting micro-robotic images from microscopy, within which labeled robot locations with a self-prototyped Matlab interface.
- For the first time conducted and trained CNN-based regression network for micro-robot localization by Python with Tensorflow-GPU, achieving precise prediction of RMSE 3.32 pixel out of 612×460 pixel image.
- Build architecture in C++ to feed CNN-based visual tracking output to path following control unit in real-time.
- CNN-based tracking experimentally performs more robust against image complexity, compared with Template Matching tracking.

Robotic obstacle avoidance manipulation through Model Predictive Control (MPC)   *Aug. 2017 - Jun. 2018*
- Pattern recognized, interpolate and linearized micro-robotic velocity map in MATLAB for optimizing the best input parameters.
- Built discrete iterative Frenet-Frame kinematic model with velocity map for MPC obstacle avoidance, simulated in MATLAB.
- Collaborated with software engineers to debug qpOASES compilation in dSPACE for online optimized velocity control.
- Developed a software in C++, combining vision, QP optimization and control to ensure robotic to implement path following and obstacle avoidance simultaneously.

Vision-based collision-free robotic Path Following Control   *Aug. 2016 - Jul. 2017*
- Simulated path planing and path following by the combination of OMPL, ROS and MoveIt for feasibility test on micro-robotic.
- Built Template Matching-based module by OpenCV for real-time robotic tracking under microscopy imaging.
- Developed path following algorithm with Frenet-Frame kinematic model for multi-dementional robotic velocitiy determinations
- Built user-friendly API in C++, to create an intuitive interface making the cutting-edged micro-manipulation a "baby-game".

Led master interns for vision-based collision-free robotic path planing   *Jul. 2015 - Jul. 2016*
- Led interns and scheduled staged tasks to implement CV processing by OpenCV for working environment description.
- Instructed to employ A*/D* by C++ for collision-free reference path generation.

Inertial actuated micro-robotic velocity control for end-effector landing manipulation   *Sep. 2014 - Jun. 2015*
- Built a multi-states robotic dynamic model (Modified Prandtl-Ishlinskii (MPI) hysteresis model, Elasto-Plastic friction model). Develop controllers for coarse-fine positioning for automated landing AFM probe on spaceman without depth information.
- For the first time achieve velocity control on inertial stick-slip micro-robotic, which remarkably shortens the AFM landing process (15s) compared with coarse-fine landing (10mins).

Design, modeling and control of inertial actuator for accurate positioning inside SEM   *Sep. 2012 - Jul. 2014*
- Designed, analyzed and fabricated a inertial actuator using Solidworks and ANSYS for accurate robotic positioning.
- Built dynamic model and proposed LuGre-Elasto-Plastic friction model for State Observer, for control loop in Simulink.
- Designed a PCB signal filter of strain-gauge sensor using ZenitPCB.
- Built LabVIEW program for sensing and controlling the actuator to achieve nano-resolution within millimeter working range.

SKILLS

Tools: MATLAB, Simulink, Qt, OpenCV, Anaconda, ROS, Gazebo, dSPACE, qpOASES, LabVIEW, MoveIt

Coding: C/C++, Python, MATLAB   **CAD**: SolidWorks, ANSYS, ZenitPCB

AI: Keras, TensorFlow, MATLAB, Jupyter notebook   **Other**: MS Office, LaTeX, Inkscape, Blender

LANGUAGES

Chinese: Mother tongue   **English:** Fluent   **French:** Fluent

HONORS/AWARDS

2014: Best Paper Finalist in ICMA (International Conference of Mechanical and Automation)
2014: Outstanding Graduate of Harbin Institute of Technology, China
2013: Third Prize of P&G Challenging Contest, China
2010: First Prize of China National Mathematical Modeling Competition
2010: Second Prize of Engineering Contest of Jilin Province, China

PUBLICATION

JOURNAL:

[1]: Rong, Weibin, ***Shuai Liang***, Lefeng Wang, Shizhong Zhang, and Wei Zhang. "Model and control of a compact long-travel accurate-manipulation platform." IEEE/ASME Transactions on Mechatronics 22, no. 1 (2016): 402-411.

[2]: ***Shuai Liang***, Mokrane Boudaoud, Jonathan Cailliez, Stéphane Régnier.Path Following Based On Velocity Control For Inertial Actuated Nano-Robotic Systems Inside Scanning Electron Microscopy, IEEE Transactions on Automation Science and Engineering(T-ASE) (Under review).

[3]: ***Shuai Liang***, Mokrane Boudaoud, Pascal Morin, Barthélemy Cagneau, Weibin Rong, Jonathan Cailliez, Stéphane Régnier.Model predictive control-based obstacle avoidance of inertial actuator inside Scanning Electron Microscope, IEEE Robotics and Automation Letters (RA-L),2020 ICRA option (Under review).

[4]: Boudaoud, Mokrane[1], Tianming Lu[1], ***Shuai Liang***, Raouia Oubellil, and Stéphane Régnier. "A Voltage/Frequency Modeling for a Multi-DOFs Serial Nanorobotic System Based on Piezoelectric Inertial Actuators." IEEE/ASME Transactions on Mechatronics 23, no. 6 (2018): 2814-2824.

[5]: Jonathan Caillez, Mokrane Boudaoud, ***Shuai Liang***, Stéphane Régnier. Robust multi-model hybrid control of a self sensing atomic force microscope at the nano-scale IEEE Transactions on Control Systems Technology.

CONFERENCE:

[6]: Boudaoud, Mokrane, ***Shuai Liang***, Tianming Lu, Raouia Oubellil, and Stéphane Régnier. "Voltage/frequency rate dependent modeling for nano-robotic systems based on piezoelectric stick-slip actuators." In 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 5297-5303. IEEE, 2016.

[7]: ***Shuai Liang***, Mokrane Boudaoud, Barthélémy Cagneau, and Stéphane Régnier. "Velocity characterization and control strategies for nano-robotic systems based on piezoelectric stick-slip actuators." In 2017 IEEE International Conference on Robotics and Automation (ICRA), pp. 6606-6611. IEEE, 2017.

[8]: Cailliez Jonathan, Mokrane Boudaoud, ***Shuai Liang***, and Stéphane Régnier. "A multi-model design for robust hybrid control of non-linear piezoelectric actuators at the micro/nano scales." In 2018 Annual American Control Conference (ACC), pp. 5131-5137. IEEE, 2018.

[9]: ***Shuai Liang***, Mokrane Boudaoud, Catherine Achard, and Stéphane Régnier. Atomic force microscope tip localization and tracking through learning based vision inside an electron microscope (2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS Accepted)

[10]: Mohammad Al Janaideh, Mokrane Boudaoud, Mohammad I. Al Saaideh, ***Shuai Liang***, Stéphane Régnier. Inverse Hysteresis Control of Stick-Slip SEM Integrated Nano-Robotic Systems. IEEE Control Systems Society Conference, Journals, Award Management System (CDC Accepted) .

[11]: ***Shuai Liang***, Weibin Rong, Shizhong Zhang, and Wei Zhang. "A novel friction model for stick-slip driving." In 2014 IEEE International Conference on Mechatronics and Automation (ICMA), pp. 429-434. IEEE, 2014. ***(Best Paper Finalist)***

REFEREES

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