

Harry Zhe Su

CONTACT INFORMATION

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RESEARCH INTEREST

My research interests lie in integrating sensory signals to different levels of planning and control for autonomous manipulation tasks by leveraging machine learning techniques. I investigated tactile servoing where robots directly adapt actions at the rate of perception while gaining better perceptual information. I also worked on learning reactive policies using deep learning techniques, which map erroneous sensory inputs and corrective actions to cope with unconstructed environment. More recently, I have been investigating learning predictive models which update feedforward models based on current sensory inputs. I have evaluated these work on a bimanual manipulation platforms equipped with various sensors. In addition to software development, I also lead in maintaining, debugging, fixing, and upgrading the electrical and mechanical aspects of the robot platform.

EDUCATION

- 01.2011-Present Ph.D. in Biomedical Engineering, **University of Southern California**, Los Angeles, USA
Computation Learning and Motor Control Lab, Adviser: Prof. Stefan Schaal
- 08.2008-05.2011 M.S. in Biomedical Engineering, **University of Southern California**, Los Angeles, USA
Medical Device Development Facility Lab, Adviser: Prof. Gerald E. Loeb
- 09.2003-07.2008 B. S. in Biomedical/Electrical Engineering, **Shenyang University of Technology**, Shenyang, China
Medical Image Processing Lab, Adviser: Prof. Li Ke

RESEARCH EXPERIENCE

- 01.2015-Present Robotics Researcher, **Autonomous Manipulation Department**,
Max Planck Institute for Intelligent Systems, Tuebingen, Germany
Research Assistant, **Computational Learning and Motor Control Lab**,
University of Southern California, Los Angeles, USA
- Developed a hierarchical manipulation framework for autonomous manipulation, which integrates sensory feedback at different levels of planning and control inside perception-action loops.
- 09.2009-12.2014 Research Assistant, **Medical Device Development Facility**,
University of Southern California, Los Angeles, USA
- Developed a haptic-enabled robotics system with state-of-the-art manipulators and sensors.
 - Developed perceptual models and control algorithms for this system to characterize system properties and various material properties of external objects, such as contact forces, shapes, and compliance.
- 01.2007-06.2008 Undergraduate Researcher, **Medical Image Processing Lab**,
Shenyang University of Technology, Shenyang, China
- Developed a EEG classification method for a Brain Computer Interface system using Principal Component Analysis and Nearest Neighbor Classifier.
 - Developed a noise reduction method for optical coherence tomography images and coauthored a journal paper.

TEACHING EXPERIENCE

08.2012 – 12.2017 Teaching Assistant, Department of Biomedical Engineering,
University of Southern California, Los Angeles, USA
BME 620 Applied Electrophysiology,

01.2012 – 05.2018 Teaching Assistant, Department of Computer Science,
University of Southern California, Los Angeles, USA
CSCI 545 Introduction to Robotics

PUBLICATIONS

Z. Su, O. Kroemer, G. E. Loeb, G. S. Sukhatme, and S. Schaal, **Learning Manipulation Graphs from Demonstrations Using Multimodal Sensory Signals**, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2018.

G. Sutanto, **Z. Su**, S. Schaal, and F. Meier, **Learning Sensor Feedback Models from Demonstrations via Phase-Modulated Neural Networks**, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2018.

Z. Su, S. Schaal, and G. E. Loeb, **Surface Tilt Perception with a Biomimetic Tactile Sensor**, in *IEEE International Conference on Biomedical Robotics and Biomechatronics*, 2016.

Y. Chebotar, K. Hausman, **Z. Su**, G.S. Sukhatme, and S. Schaal, **Self-supervised Regrasping Using Spatio-temporal Tactile Features and Reinforcement Learning**, in *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2016.

A. Molchanov, O. Kroemer, **Z. Su**, and G. S. Sukhatme, **Contact Localization on Grasped Objects Using Tactile Sensing**, in *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2016.

Z. Su, O. Kroemer, G. E. Loeb, G. S. Sukhatme, and S. Schaal, **Learning to Switch Between Sensorimotor Primitives Using Multimodal Haptic Signals**, in *International Conference Simulation of Adaptive Behavior (SAB)*, 2016.

Z. Su, K. Hausman, Y. Chebotar, A. Molchanov, G. E. Loeb, G. S. Sukhatme, and S. Schaal, **Force Estimation and Slip Detection/Classification for Grip Control Using a Biomimetic Tactile Sensor**, in *IEEE International Conference on Humanoid Robotics (Humanoids)*, 2015.

Z. Su, J. A. Fishel, T. Yamamoto and G. E. Loeb, **Use of Tactile Feedback to Control Exploratory Movements to Characterize Object Compliance**, in *Frontiers in Neurorobotics*, 2012.

Z. Su, Y. Li and G.E. Loeb, **Estimation of Curvature Feature Using a Biomimetic Tactile Sensor**, in *35th Annual Meeting of the American Society of Biomechanics*, 2011.

N. Wettels, J.A. Fishel, **Z. Su**, C.H. Lin, G.E. Loeb, **Multi-modal Synergistic Tactile Sensing**, in *IEEE International Conference on Humanoid Robotics (Humanoids)*, 2009.

L. Ke, Q. Du, **Z. Su**, **An OCT Image De-noising Method Based on Multi-scale Wiener Filtering**, in *Optics and Precision Engineering*, 2008.

L. Ke, Q. Du, **Z. Su**. **The Correlation between the Wavelet Base Properties and Image Compression**, in *International Conference on Computational Intelligence and Security*, 2007.

REVIEWED WORKSHOP PAPERS AND ABSTRACTS

Z. Su, O. Kroemer, G.E. Loeb, G. S. Sukhatme, and S. Schaal, **Learning to Switch between Sensorimotor Primitives using Multimodal Haptic Signals**, in *Robotics Science and Systems (RSS) Workshop on Bootstrapping Manipulation Skills*, 2016.

A. Molchanov, O. Kroemer, **Z. Su**, and G.S. Sukhatme, **Model-free Contact Localization for Manipulated Objects using Biomimetic Tactile Sensors**, in *IEEE International Conference on Humanoid Robotics (Humanoids) Workshop on Tactile sensing for manipulation: new progress and challenges*, Cancun, Mexico, 2016.

Y. Chebotar, K. Hausman, **Z. Su**, A. Molchanov, O. Kroemer, G.S. Sukhatme, and S. Schaal, **Bigs: Biotac grasp stability dataset**, in *IEEE International Conference on Robotics and Automation (ICRA) Workshop on Grasping and Manipulation Datasets*, Stockholm, Sweden, 2016.

Z. Su, K. Hausman, Y. Chebotar, A. Molchanov, G. Loeb, G. Sukhatme, S. Schaal, **Slip Classification Using Tangential and Torsional Skin Distortions on a Biomimetic Tactile Sensor**, in *The British Machine Vision Association (BMVA) Workshop on Visual, Tactile and Force Sensing for Robot Manipulation*, 2015

Z. Su, K. Hausman, Y. Chebotar, A. Molchanov, G. Loeb, G. Sukhatme, S. Schaal, **Slip Detection and Classification for Grip Control using Multiple Sensory Modalities on a Biomimetic Tactile Sensor**, in *IROS Workshop on Multimodal Sensor-Based Robot Control for HRI and Soft Manipulation*, 2015.

Z. Su, and G. E. Loeb. **Haptic robot and human psychophysical studies: A complementary framework to decode haptic perception**, in *Biomedical Engineering Society Annual Meeting*, 2014

Z. Su, J. A. Fishel, T. Yamamoto and G. E. Loeb, **Use of Tactile Feedback to Control Robotic Palpation to Characterize Object Hardness**, in *Biomedical Engineering Society Annual Meeting*, 2012

Z. Su, C. H. Lin, Y. Li and G. E. Loeb, **Spatial Feature Extraction for a Biomimetic Tactile Sensor**, in *Biomedical Engineering Society Annual Meeting*, 2011.

SCHOLARSHIPS AND AWARDS

2015-2018 Max Planck Institute Fellowship (Germany)

2014-2015 NSF Body Engineering Fellowship

2011-2014 Best Poster Award in USC Fred S. Grodins Research Symposium

09.2007 1st place, Liaoning Province, 7th Chinese National Undergraduate Electronic-Design Contest

2004-2007 Shenyang University of Technology Annual Scholarship

2004-2007 Outstanding Academic Achievements Award, Shenyang University of Technology

07.2004 Honor for Social Work, Shenyang University of Technology

PROFESSIONAL ACTIVITIES

Reviewer:

ICRA 2017-2018, IROS 2016-2017, CoRL 2018, RSS 2017, Robotics and Autonomous Systems, IEEE Transactions on Haptics, IEEE Transactions on Robotics

Organizer:

IROS 2018 Workshop: RoboTac: New Progress in Tactile Perception and Learning in Robotics, accepted
Humanoids 2016 Workshop: Tactile sensing for manipulation: new progress and challenges

ENTREPRENEURIAL ACTIVITIES

2014-2015 Our Medical, Inc., Chief Executive Officer and Chief Technology Officer

Responsible for team building, product development of an inflatable hip protector

HARDWARE AND SOFTWARE SKILLS

Programming Languages: C/C++, MATLAB, Python, Assembly, ROS, LaTeX

Operating Systems and Tools: Linux and Xenomai (real-time), Git, programming embedded systems (microprocessors)

Machine Learning: Supervised, unsupervised, reinforcement learning, deep learning (Tensorflow)

Design: Solidworks, Mastercam