Sanghyun Kim

Current Affiliation

Ph.D. Candidate at the Department of Transdisciplinary Studies,
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Education

Seoul National University, Seoul, Korea

Ph.D. Candidate of Dept of Trandisciplinary Studies

- Lab: Dynamic Robotic System Lab (DYROS Lab)
- Advisor: Professor Jaeheung Park

Seoul National University, Seoul, Korea

B.A., Mechanical Engineering, March, 2012

Research Experience

During Ph.D. student

Task and Motion Planning for Social Robot **2017 - Presence**

- Control of mobile manipulator to perform various tasks in human-centered environment such as opening the door, grasping a can in refrigerator.
- Implementation of existing trajectory planning algorithms for robot manipulator in C++: Control-limited DDP (Y. Tassa *et al.*, IROS 2014), Constrained DDP (Z. Xie *et al.*, ICRA 2017), Constrained BiRRT (D. Berenson *et al.*, ICRA 2009), Task Space Regions (D. Berenson *et al.*, IJRR 2012), Tangent bundle RRT (B. Kim *et al.*, ROBOTICA 2016), and so on.

Multiple task execution algorithm **2017 - 2017**

- Task-based control framework to generate complex behavior
- Continuous transitions between arbitrary tasks including joint-limit, obstacle avoidance, and singularity.

Singularity avoidance algorithm **2016 - 2017**

- Comparative analysis of six representative singularity avoidance algorithms: Damped Pseudo Inverse, Error Damped Pseudo Inverse, Jacobian Transpose, Selectively Damped Inverse, Filtered Inverse, and Task Transition Method

Development of humanoid system for DRC(DARPA Robotics Challenge) **2014 - 2016**

- Student leader of Team SNU (My main role is to manage whole framework of robot and develop the upper-body and lower-body position controller).
- Development of software architecture and controllers with humanoid, THORMANG
- Two main characteristics for disaster situation: Increasing stability and modularization
- No falling down during the competitions and 12th in DRC Finals 2015

Artificial intelligence robot CPR system **2014 - 2016**

- Robot manipulator to perform CPR in emergency situations
- Automatic System based biological data from a patient
- Simulation on mannequin and animal test

Robot hand tele-operation control **2012 - 2016**

- Robot hand synergy mapping using multi-factor model

- Extracting synergy by considering individual characteristic as well as grasping motion
- EMG-based Force Feedback

Tele-opeartion control of ultrasonic examination system **2012 - 2013**
- Tele-operated robotic arm for remote ultra-sound exam
- Automated orientation control for ultrasound
- Contact force feedback using haptic device

Internship Experience

Gwangju Institute of Science and Technology (GIST), Gwangju Korea

Friction and Gravity Compensator for Surgery Simulator **June 2010 - Sept 2010**
- Research and development on the Laparoscopic simulator
- Haptic Feedback using friction and gravity compensator

Technical skills

C/C++ and Matlab programing for robotic/haptic hardware and for simulation (Especially V-Rep and gazebo). The libraries mainly used to develop robot system are following.
- Eigen
- RBDL
- Boost
- FCL

Honors and Awards

Best paper award in Journal of Korea Robotics Society (JKROS), 2018.
Cum laude from Dept. of Mechanical Engineering at Seoul National University, 2012.

Patent

Sanghyun Kim, Jaeheung Park, Mingon Kim, Jimin Lee, Jounghuem Kwon, Bumjae You. APPARATUS FOR ESTIMATING GRASPING POSTURE AND GRASPING FORCE. Korea Patent No.10-2016-0075150, 2016.

Sanghyun Kim, *et al.* APPARATUS FOR AUTOMATIC CARDIOVASCULAR PULMONARY RESCITATION. Korea Patent No.10-2016-0172286, 2016.

International Journal Articles

S. Kim, M. Kim, J. Lee, S. Hwang, J. Chae, B. Park, H. Cho, J. Sim, J. Jung, H. Lee, S. Shin, M. Kim, W. Choi, Y. Lee, S. Park, J. Oh, Y. Lee, S. Lee, M. Lee, S. Yi, K. Chang, N. Kwak, and J. Park. Team SNUs Control Strategies to Enhancing Robots Capability: Lessons from the DARPA Robotics Challenge Finals 2015. Journal of Field Robotics, Vol. 34, No. 2 (2017)

Domestic Journal Articles

J. Kim, **S. Kim**, and J. Park. The Trends of HRI: Focusing on Task Oriented Robot User Interface, Robot and Human, Vol. 14, No. 4 (2017).

S. Kim and J. Park. Singularity Avoidance Algorithms for Controlling Robot Manipulator: A Comparative Study, Journal of Korea Robotics Society, Vol. 12, No. 1 (2017)

S. Shin, M. Kim, J. Ahn, **S. Kim**, and J. Park. Development of Tele-operation Interface and Stable Navigation Strategy for Humanoid Robot Driving, Journal of Institute of Control, Robotics and Systems, Vol. 22, No. 11 (2016)

S. Kim, B. Park, and J. Park. DRC Finals 2015 Analysis of Participants, Robot and Human, Vol. 12, No. 4 (2015).

S. Kim, C. Lee, J. Kim, and J. Ryu. Approximate Friction and Gravity Compensation in Haptic Laparoscopic Surgery Simulator, Transactions of the KSME, Vol. 35, No. 8, 2010.

International Conference Articles

M. Kim, J. Kim, **S. Kim**, J. Sim, and J. Park. Disturbance Observer based Linear Feedback Controller for Compliant Motion of Humanoid Robot, International Conference on Robotics and Automation, Australia, Accepted, 2018.

M. Kim, **S. Kim**, and J. Park. Human Motion Imitation for Humanoid by Recurrent Neural Network. The 13th International Conference on Ubiquitous Robots and Ambient Intelligence, Xian, China, 19-22 Aug, 2017.

J. Jung, J. Kim, **S. Kim**, W. Kwon, S. Na, K. Kim, J. Lee, G. Suh, and J. Park. Application of Robot Manipulator for Cardiopulmonary Resuscitation, International Symposium on Experimental Robotics, Tokyo, Japan, 2016.

S. Kim, M. Kim, J. Lee, S. Hwang, J. Chae, B. Park, H. Cho, J. Sim, J. Jung, H. Lee, S. Shin, M. Kim, N. Kwak, Y. Lee, S. Lee, M. Lee, S. Yi, K. K.C. Chang, and J. Park. Approach of Team SNU to the DARPA Robotics Challenge Finals. 2015 IEEE-RAS International Conference on Humanoid Robots, Seoul, Korea, 3-5 Nov 2015.

M. Schwartz, S. Hwang, Y. Lee, J. Won, **S. Kim**, and J. Park. Aesthetic Design and Development of Humanoid Legged Robot. The 2014 IEEE-RAS International Conference on Humanoid Robots, Madrid, Spain, 18-20 Nov 2014.

S. Kim, M. Kim, J. Lee, and J. Park. Robot Hand Synergy Mapping Using Multi-factor Model and EMG signal. International Symposium on Experimental Robotics, Marrakech/Essaouira, Morroco, 15-18 June 2014.

S. Kim, C. Lee, and J. Ryu. Data-driven Haptic Rendering of Friction between Surgical Device and Trocar for Laparoscopic Surgery Simulator, ACCAS 2010, Busan, Korea, 2010.

Domestic Conference Articles

K. Jang, **S. Kim**, S. Park, and J. Park, Joint limit avoidance of non-holonomic mobile manipulator using weighting matrix in generalized pseudo-inverse, Conference on Korean Society for Precision Engineering, Korea, 2017.

M. Kim, R. Destenay, **S. Kim**, J. Kwon, K. Yeom, J. Park, and B. You. Avatar Motion Generation by Null-Space Mapping Based on Minimum Number of Markers. 2015 Conference on Information and Control Systems, Sokcho, Korea, 2015.

S. Kim, M. Kim, and J. Park. Extracting Postural Synergies Using Grasping Taxonomy, The 9th Korea Robotics Society Annual Conference (KROC), Korea, 2014.

J. Lee, M. Kim, **S. Kim**, and J. Park. Estimation of Hand Posture and Grasping Force Using Surface EMG, The 9th Korea Robotics Society Annual Conference (KROC), Korea, 2014.

S. Kim, C. Lee, J. Kim, and J. Ryu. Friction and Gravity Compensation in Haptic Laparoscopic Surgery Simulator, Conference on KSME, Korea, 2010.

S. Kim, C. Lee, J. Kim, and J. Ryu. Trocar Friction modelling for Friction and gravity Compensation, Conference on KSME, Korea, 2010.

Workshop

S. Kim and J. Park. Control Strategies of Team SNU for DRC Finals, and Future Directions for Robots in Human Environment. Invited speaker at Workshop on What did we do for the DARPA Robotics Challenge?, 2015 IEEE-RAS International Conference on Humanoid Robots, Seoul, Korea, 3-5 Nov 2015.

S. Kim, J. Lee, M. Kim, and J. Park. Teleoperated Robot Hand Control using Tensor Decomposition. Full-day Tutorial on Robotics-based Methods for the Identification, Recognition, and Synthesis of Human Motions, IEEE/RSJ International Conference on Intelligent Robots and Systems, Tokyo, Japan, 3 Nov 2013.

Ongoing Papers

S. Kim, J. Kim, and J. Park. Real-time Inverse Kinematics Technique for Controlling Humanoid Avatar with Redundant Arm, Ubiquitous Robot 2018, Hawaii, USA, 2018.

S. Kim, M. Kim, J. Kim, S, Kim, and J. Park. Grasping Force Prediction by EMG Signals and Arm Posture: Tensor Decomposition Based Approach, International Journal of Bionic Engineering, 2018.

K. Jang, **S. Kim**, S. Park, and J. Park. Unified Framework for Overcoming Motion Constraints of Robots Using Task Transition Algorithm, Journal of Korea Robotics Society, 2018.

G. Suh, J. Park, J. Lee, S. Na, W. Kwon, K. Kim, J. Jung, J. Kim, **S. Kim**, J. Sim, B. Yoo, J. Choi, W. Cho, B. Lee, T. Kim, Y. Jung, J. Ko, S. Shin, and K. You. End-tidal CO2-guided Automated Robot CPR System, Resuscitation, 2018.