Chankyo Kim

https://chankyokim.github.io

RESEARCH INTERESTS

Non-linear Optimization, Control Theory, Learning-based Control, Robotic Vision, Motion Planning and Localization, Human-Robot Interaction, Multi-agent Robotics

EDUCATION

Seoul National University (SNU), Seoul, Korea — Mar. 2015 – Present
Department of Mechanical & Aerospace Engineering
Interdisciplinary Major in Artificial Intelligence
- Graduation with Honors, Summa Cum Laude, Advanced GPA : 3.98/4.0, Physics TA for 2 semesters

University of Florida (UF), English Language Institute, Florida, USA — Fall. 2015

RESEARCH EXPERIENCES

Undergraduate Researcher — Aug. 2021 – Present
Visual Information Processing Lab, SNU (*Advisor: Prof. Joonseok Lee*)
Project Title: ***Domain Generalization in Human Pose Estimation via Meta-learning***
- Suggested idea of applying modified Model-Agnostic Meta-Learning (MAML) for domain generalization in human pose estimation
- Developed human pose dataset of various view points, resolution, and luminous intensity for few-shot training using COCO, Supervisely, and personal collection.
- Designed architecture of pretrained model and meta-learner based on PoseNet and Model Regression Network
- In preparation of conference paper publication in ECCV, 2022

Undergraduate Researcher — Mar. 2021 – Present
Clean Energy & Nanoheat Lab, SNU (*Advisor: Prof. Sangwook Park*)
Project Title: ***Design and Optimization of Intelligent Renewable Power System***
- Led intelligent power system research of renewable energy; research project selected as undergraduate research funding from SNU
- Designed power-tracking method from city-size electricity demand considering operational limit of every power system component using MATLAB and HOMER software
- Organized novel renewable power plant of combined floating PV, hydrogen system to improve power generation efficiency with decreased cost of energy and zero greenhouse gas emissions
- Established reliability completeness by presenting analysis criteria, Loss of Power Supply Probability
- Wrote paper about optimization in intelligent power system

Undergraduate Research Internship, UROP — Mar. 2020 – Sep. 2020
Biorobotics Lab, SNU (*Advisor: Prof. Kyujin Cho*)
Project Title: ***Development of Novel Tendon-clutching Algorithm Integrated of Trajectory Estimation and Feedback Control in Soft Teleoperation Glove***
- Suggested idea of applying one-way clutch mechanism on tendon-driven method to provide feedback control and trajectory estimation in one way
- Integrated data of encoder and force sensor for robust/real-time operation of wearable teleoperated master system
- Manufactured soft teleoperation gloves and virtual environment with robot hand using MATLAB

Full-Time/Part-Time Researcher — Dec. 2019 – Jun. 2020
Dynamic Robotic Systems Lab, SNU (*Advisor: Prof. Jaeheung Park*)
- Participated as first member of TEAM SNU for ANA Avatar Xprize Competition, worldwide robot control challenge sponsored over $10M in prizes by ANA, judges included Ed Colgate, Thomas K. Ferris, Guy Hoffman

Main Contributions:

Project Topic: ***MPC-based Teleoperation / Control of Slave Robot***

- Developed a non-linear control framework codes for torque distribution and joint elasticity using QP solver to achieve stability in upper body
- Developed virtual space environment to test control of teleoperated robot hands using Unity

Project Topic: ***Design and Manipulation for Master System***

- Proposed conversion matrix to extract joint trajectories from Kinect data and transfer to manipulation actuators in slave robot
- Determined the threshold of latency by comparing physical and extrapolated marker for estimation of teleoperation performance

PUBLICATIONS

[1] Y. Choi, **C. Kim**, Y. Hwang, C. Park, $J.Lee^*$, Domain generalization in human pose estimation via meta-learning, *European Conference on Computer Vision (ECCV)*, 2022. Manuscript in preparation. [pdf]

[2] **C. Kim**, $S.Park^*$, Optimization and Efficiency analysis of intelligent power system of Floating PV and Hydrogen System, *Sustainable Cities and Society*, 2021. Target Journal. [pdf]

[3] **C. Kim**, et al., AI Python Coding in Easy Words with MIT Autonomous Race Car, *Hongreung Publishing Company*, Korea, 2021. (expected Dec. 2021). [excerpt]

WORK EXPERIENCES

Co-founder and Engineering Team Leader Jan. 2021 – Present

AI Tech Play, Initiative for AI development and education Boston, USA / Seoul, Korea Main Contributions:

- Co-Founded non-profit organization AI Tech Play with support of KAIT Foundation, Knowledge AI Inc., Boston, USA and Dr. Robert Shin, director at MIT Beaver Works
- Launched 2021 Autonomous Racecar AI coding Competition in South Korea

Project Topic: ***Simultaneous Localization and Mapping (SLAM) and Control of Mobile Robots***

- Led Engineering Team of AI Tech Play; constructed graph of robot position and visualized map using LIDAR, developed Python code for control and mapping of autonomous driving car
- First-author academic book of control theory, image processing, SLAM, and Python

Game Developer/Internship July. 2020 – Feb. 2021

Intellicon Meta Lab, R&D Startup Seoul, Korea

Online Game Development: CCTV

- Participate in full software development life-cycle for production of 'CCTV'; including HTML designing, coding, debugging, data analysis, and documenting game flows

Main Contributions:

- Developed interactive text-based game system applying non-linear network managing 'Twine' software, inspired by concept of Multi User Dungeon (MUD)
- Constructed Database Management System for game traffic analysis using MySQL and Python
- Released complete version of game on Dec. 2020

Police Officer Oct. 2017 – June. 2019

Seoul Public Security Force Command, Seoul Metropolitan Police Agency Seoul, Korea

- Served as data collecting and riot control agent; trained and equipped to confront protests and maintain public order
- Led and trained 30 agent team member through instruction of specialized tactical programs for 6 months; notable events including security service management for U.S. Embassy & Consulate in the Republic of Korea

RESEARCH FUNDINGS, AWARDS, HONORS

SNU X-Corps, College of Engineering, SNU 2021
- $7,000 Grant for research on Optimization of Autonomous Renewable Power Plants

Sinyang Undergraduate Scholarship, Sinyang Cultural Foundation Spring. 2020 – Present
- Full tuition, Eminence Scholarship

Certificate of Appreciation, Dean of the College of Engineering, SNU July. 2021
- Acknowledgement of genuine and creative efforts at the forefront of AI education in Korea: generating autonomous driving AI program for domestic youth

Special Award, Creative Design Fair, College of Engineering, SNU Sep. 2020
- $1,000 Award for research on *Teleoperation and Soft Robotics*

1^{st} **Prize, Engineering Design**, SNU ME Mechanical Product Design July. 2020
- "Design and Control of Classification/Recognition Robot"

Best Teaching Assistant Award, SNU Fall. 2019

Eminence Scholarship (full tuition), SNU Spring. 2017, Fall. 2019

Merit-Based Scholarship (50% tuition), SNU Fall. 2016

Bronze Award, Samsung Humantech Paper Award, Samsung Feb. 2014 – Feb. 2015
- $3,000 Award, "Assessment of auto-immune responses for nanoparticle toxicity from protein corona analysis"

ORAL PRESENTATIONS

[1] **C. Kim**, J. Song, J. Seol, J. Park, S. Park, Optimization and efficiency analysis of intelligent power system of floating PV and hydrogen system, SNU X-CORPS, 2021.

[2] **C. Kim**, Modern control system and robotics in autonomous driving, Northeast Asia Student Round Table Conference, 2021.

[3] **C. Kim**, S. Hwang, K. Cho, Development of Novel Tendon-clutching Algorithm Integrated of Trajectory Estimation and Feedback Control in Soft Teleoperation Glove, Creative Design Fair, SNU, 2020.

TEACHING EXPERIENCES

Teaching Assistant

Physics (034.006 001), Department of Physics & Astronomy, SNU Fall. 2021

Physics (034.006 002), Department of Physics & Astronomy, SNU Fall. 2019
- Tutored 5-10 undergraduate students 2 hours per week for 2 semester.
- Developed contents for weekly recitation on diverse theories in field of dynamics, electronics, modern physics
- Designed practice exams to assist and chart their progress
- Provided periodical one-on-one instruction and Q&A session for additional advice in background knowledge of calculus and linear algebra
- Discussed with professor and other TA to systematize teaching method and supplementary materials
- Awarded Best Teaching Assistant

LEADERSHIP AND EXTRA CURRICULAR ACTIVITIES

10th Vice Chairman/ Team Leader of General Affairs Mar. 2020 – June. 2021

STEM: SNU Tomorrow's Edge Membership, SNU Engineers Honor Society Seoul, Korea
- Wrote book for future engineers: "I want to go to engineering school" (pub : Jan. 2022)
- Organized teenager mentoring program "2021 Vision Mentoring for Prospective Engineer"
- Recruited $10,000 in sponsorship with DB Cultural Foundation (DB group), Innovation Center for Engineering Education (Seoul National University)

Educational Mentor in Under-represented Area

NGO Dream Consultant Seoul, Korea
- Organized education program to introduce science and engineering for high school students
- Bukwon Girl's High School, Korea Summer. 2017
- Gokseong High School, Korea Summer. 2016

SKILLS AND LANGUAGES

Robotics: Convex Optimization, Pose estimation, Meta-learning, Sensitivity Analysis
Software: MuJoCo, Unity, MATLAB, Python, C++, CAD, HOMER, MySQL, Kinect, LaTex
Libraries: ROS, OpenCV, PoseNet, Faster-RCNN
Language: Korean (Native), English (Fluent), Spanish (Conversational)

REFERENCES

Sangwook Park
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