Chankyo Kim

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RESEARCH INTERESTS

Non-linear Optimization, Control Theory, Dynamics, Energy Efficient Approach, Learning-based Control, Robotic Vision, Multi-agent Robotics

EDUCATION

Seoul National University (SNU), Seoul, Korea — Mar. 2015 – Present
B.Sc, Department of Mechanical & Aerospace Engineering
B.Sc, Interdisciplinary Major in Artificial Intelligence
- Graduation with Honors, Summa Cum Laude, Major GPA : 3.96/4.0, Physics TA for 2 semesters

University of Florida (UF), ELI, Florida, USA — Fall. 2015
- Course: Listen/Speaking, Reading/Writing (Grade:A)
- International Connection with Engineering Students and Faculty

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 MAML (Model-Agnostic Meta-Learning) for domain generalization in human pose estimation
- Developed human pose dataset of various view points, resolution, and luminous intensity for few-shot training using MPII, Supervisely, and personal collection on Youtube.
- 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: ***Optimization and Analysis of Intelligent Floating PV/ Hydrogen System for Large Scale Power Generation: a Case Study from Hapcheon Dam***
- 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 COE (cost of energy) and zero GHG (greenhouse gas) emissions
- Established reliability completeness by presenting analysis criteria of LPSP (system reliability drawback)
- Wrote paper about novel optimization algorithm in integrated renewable power plant

Undergraduate Research Internship, UROP — Mar. 2020 – Sep. 2020
Biorobotics Lab, SNU (*Advisor: Prof. Kyujin Cho*)
Project Title: ***Development of Tendon-clutching Mechanism for Integrated Tracking and Constraining Hand Motion in Soft Teleoperation Glove***
- Suggested idea of applying one-way clutch mechanism on established tendon-driven method to give haptic feedback with reduction of complexity in glove design
- Integrated data of encoder and force sensor for robust/real-time operation of soft teleoperation glove
- Manufactured soft teleoperation gloves as well as virtual environment with robot hand using MATLAB

- Oral presentation awarded special prize in Creative Design Fair 2020, sponsored over $1.5M by DB Cultural Foundation (DB group), screened by the committee in College of Engineering

Full-Time /Part-Time Researcher Dec. 2019 – Jun. 2020

Dynamic Robotic Systems Lab, SNU (*Advisor: Prof. Jaeheung Park*)

- Participated as first member of team for ANA Avatar Xprize Competition, worldwide robot control challenge that 77 teams have qualified, sponsored over $10M in prizes by ANA, judges included Ed Colgate, Thomas K. Ferris, Guy Hoffman

Main Contributions:

Project Topic: ***Design and Manipulation for Slave Robot***

- Developed space control framework codes for torque distribution, joint elasticity, trajectory tracking control in slave robot using inverse dynamics and QP optimization algorithm
- Programmed cartesian control of one arm 7 DOF manipulators based on impedance control theory under gravity

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

- Led initial development of integrated master system of HMD, Exosuit, Haptic Gloves
- Defined conversion matrix to extract joint trajectories from Kinect data and transport to manipulation actuators in slave robot
- Determined the threshold of latency by comparing physical and extrapolated marker for estimation of teleoperation performance
- Developed virtual space environment to test control of teleoperated robot hands using Unity
- Selected to advance as the Verified Semifinalists, 37 teams have been selected, expected to participate on Semifinals Tests in Miami, Florida, 2021

PUBLICATIONS

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

[2] **C. Kim**, S. Park, Optimization and Efficiency analysis of intelligent renewable energy production system based on Floating PV/Hydrogen System: a case study from Hapcheon Dam, *Sustainable Cities and Society*, 2021. Manuscript revision.

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

WORK EXPERIENCES

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

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

- Launched 2021 Autonomous Racecar AI coding Competition in South 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
- Led full procedure of Engineering Team of AI Tech Play; developed Python code for recognition/control algorithm of autonomous driving car
- First-authored academic book of control theory, robotic vision, and Python programming

Game Developer/ Internship Sep. 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 MUD (Multi User Dungeon)

- Constructed DBMS (Database Management System) for game traffic analysis using MySQL and Python
- Presented complete version of game

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 Autonomous Renewable Power Plants in the context of optimized energy-efficient system

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 with support of MIT Beaver Works

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**, S. Park, et al., Design and Optimization of intelligent renewable energy plant of floating PV and hydrogen system, SNU X-CORPS, 2021.

[2] **C. Kim**, Modern System Control and Robotics in Autonomous Driving, Northeast Asia Student Round Table Conference, 2021.

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 systemize 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
SNU TOMORROW's EDGE MEMBERSHIP (STEM) Seoul, Korea

- Led initiative to create industry-academic exchange and assisted in implementation of membership bylaws
- 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)

SKILLS AND LANGUAGES

Robotics: Convex Optimization, Control, Pose estimation, MAML (Model-Agnostic Meta-learning), CNC Milling
Energy: Sensitivity Analysis, Solar Cell & Hydrogen Production Analysis
Software: MuJoCo, Unity, MATLAB, Python, C++, CAD, HOMER, MySQL, Kinect, LaTex
Libraries: ROS, OpenCV, PoseNet, Faster-RCNN, TensorFlow
Language: Korean (Native), English (Fluent), Spanish (Conversational)