Simon (Hwanwoong) Kang

simon.kang@columbia.edu
Portfolio | GitHub
(929) 989-8042

Education

- **Columbia University** — New York, NY
  M.S. in Mechanical Engineering — Concentration: Robotics & Controls
- **Chung-Ang University** — Seoul, Republic of Korea
  B.S. in Mechanical Engineering

Experience

- **Rover Diagnostics** — New York, NY
  Embedded Systems Development Engineer — *Mar 2024 – Present*
  - Designed and implemented embedded firmware on a 32-bit ARM Cortex-M7 microcontroller (NXP RT1062) for PCR sample-prep thermal and motion control; built state-machine sequencing with hybrid PID/Bang–Bang loops, interlocks, watchdogs, and safe-state recovery, achieving thermal stability of $\sigma = 0.01°C$ across lysis → elution.
  - Integrated MAX31856 thermocouples and ADS1115 thermistors for high-frequency temperature sensing; developed pipelines to acquire and process time-series biomedical sensor data.
  - Built a host-side Python multithreaded pipeline for time-series analysis, feature extraction, and model evaluation—implemented $Q/\dot{Q}$ computations, profiling, and robust CSV/logging to support data-driven control optimization.
- **Creative Machines Lab** — New York, NY
  Graduate Researcher, Columbia University — *May 2023 – May 2024*
  - Built AprilTag vision system (OpenCV + dt_apriltags) with calibrated intrinsics/extrinsics, achieving < 1 cm 6-DoF pose accuracy @25 Hz across 70+ tags / 20+ modular links.
  - Reconstructed link kinematics (centroid/tip axes) and exported noise-reduced per-link states via Pandas aggregation for downstream control.
  - Integrated localization with closed-loop controllers (1D/2D/3D) using event-driven threading, positional/rotational error computation (norms, dot/cross), and watchdog-style safe stops.
  - Demonstrated autonomous behaviors (crawl, rotate, topple, fetch) with real-time vision → control feedback.
  - Results published in *Science Advances* (2025) and presented at *IEEE/IFToMM ReMAR* (2024); see Publications.
- **Hyundai Motor Group** — Seoul, Republic of Korea
  Systems Design Lead, ML Data Analytics Infrastructure — *Mar 2022 – Sep 2022*
  - Led the co-design of a cross-brand ML safety data analytics system architecture—partnering with Hyundai, Kia, and Deloitte—to parse qualitative field reports, flag emerging issues, standardize real-time quality metrics across Hyundai/Kia/Genesis, and ensure compliance with NHTSA regulatory requirements.
- **NAVER LABS** — Seongnam, Republic of Korea
  ML Data Assistant, AI Translation Team — *Dec 2016 – Mar 2017*
  - Provided data assistance for a DNN initiative in TensorFlow designed to strengthen PAPAGO's translation.

Publications

- P. M. Wyder, R. Bakhda, M. Zhao, Q. A. Booth, M. E. Modi, A. Song, **S. Kang**, et al. "Robot Metabolism: Toward machines that can grow by consuming other machines," *Science Advances*, vol. 11, no. 29, 2025. [Link]
- P. M. Wyder, R. Bakhda, M. Zhao, Q. A. Booth, **S. Kang**, et al. "Robot Links: Towards Self-Assembling Truss Robots," in *Proc. IEEE/IFToMM ReMAR*, 2024, pp. 525–531. [Link]

Technical Skills

- **Machine Learning & Computer Vision**: TensorFlow, PyTorch, scikit-learn; OpenCV (AprilTags, PnP geometry, feature extraction); Bayesian/Kalman filters; system identification
- **Data & Analysis**: Python (NumPy, pandas, SciPy, matplotlib); multithreaded data pipelines
- **Robotics & Controls**: PID, LQR, state-space control; kinematics (FK/IK); Isaac Sim, ROS, Gazebo
- **Embedded Systems**: C/C++, Embedded Linux, QNX; SPI/I^2C, UART, CAN/CAN-FD; device drivers; performance profiling
- **Build & Dev Tools**: CMake, Git, Bash; gdb; GoogleTest; MATLAB/Simulink