

Minsung Kim

CURRENT AFFILIATION	Ph.D. candidate (2021.08) , Dynamic Robotic System Lab (DYROS Lab, http://dyros.snu.ac.kr/), Dept of Transdisciplinary Studies, Seoul National University	
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EDUCATION	Seoul National University , Seoul, Korea Ph.D. of Dept of Transdisciplinary Studies (Robotics) <ul style="list-style-type: none">• Lab: Dynamic Robotic System Lab (DYROS Lab, https://dyros.snu.ac.kr)• Advisor: Professor Jaeheung Park (park73@snu.ac.kr) 2011.3 - 2021.8	
	Chung-Ang University , Seoul, Korea B.A., Electrical and Electronics Engineering, Feb., 2010 2003.3 - 2010.2	
RESEARCH EXPERIENCE	Advanced Institute of Convergence Technology (AICT) , Korea Internship <ul style="list-style-type: none">• Lab: Dynamic Robotic System Lab (DYROS Lab, https://dyros.snu.ac.kr)• Advisor: Professor Jaeheung Park (park73@snu.ac.kr), Junghoon Kwon (Ph.D., AICT) 2010.7 - 2011.02	
RESEARCH INTERESTS	Path planning and Path following control of an Autonomous Vehicle using Optimal Control method (Model Predictive Control, etc.) Sampling and Search Method based Motion Planning of a Nonholonomic Mobile Robot Decision Making using Model Predictive Control scheme Deep Learning method for Parking Lot Detection (YOLO v3, etc.) and Drivable Area Detection (VGG net) Machine Learning for Human Gait Recognition Manipulation of Industrial Robot (6-DoF)	
RESEARCH EXPERIENCE	During Ph.D. student <i>Intelligent Vehicle In Unstructured Environment</i> 2016 - Presence <ul style="list-style-type: none">• Path planning, Decision making and Integration researches [DC5],[DC7],[DC8],[J8]<ul style="list-style-type: none">✓ Autonomous parking algorithm using automatic selection of forward and backward switching points via model predictive control (MPC)✓ [DC7] Presentation : https://youtu.be/OQXkArMRLTw• Path following and Collision Avoidance researches [DC3],[DC4],[DC6],[J6],[J9]<ul style="list-style-type: none">✓ Model Predictive Control Method for Autonomous Vehicles using Time-Varying and Non-uniformly Spaced Horizon	

- ✓ [J9] Presentation : <https://youtu.be/eo7fYDLGQcg>
- Recognition researches [J4],[J5],
 - ✓ Parking Line Based SLAM approach using AVM/LiDAR Sensor Fusion for Rapid and Accurate Loop Closing and Parking Space Detection
 - ✓ [J5] Presentation : <https://youtu.be/DCaltpi9X0s>
- (Ongoing Work and Papers)
 - Autonomous Parking Method Using Model Predictive Control: a feasibility and stability study
 - ✓ Presentation : <https://youtu.be/KJVo-7RSWbk>
 - Carsim: Variable Interval Prediction Model Predictive Control (VIP-MPC) for the local planning and following of an autonomous vehicle
 - ✓ Presentation : <https://youtu.be/zjRWDb2kr3o>

Valet Parking PROJECT, Phantom AI

2020 - Presence

- Path following algorithm development
- ✓ site: <https://phantom.ai/>

SMART CAMPUS PROJECT, SAMSUNG (SAIT)

2016 - 2020

- From 2017 to 2019, project leader
- Development Autonomous Valet Parking System
- ✓ Presentation: <http://dyros.snu.ac.kr/project/%EC%9E%90%EC%9C%A8-%EB%B0%9C%EB%A0%9B-%ED%8C%8C%ED%82%B9/>

Study on Vehicle Lateral Control for Backward Driving

2015 - 2016

- Design and development of backward driving algorithm for autonomous vehicle [C3]

DARPA ROBOTICS CHALLENGE FINAL 2015, USA

2014 - 2015

- United States Department of Defense
- Complete the first mission (Drive the vehicle using Humanoid)
- Development of a guided user interface (UI) using a camera via Inverse Perspective Mapping (IPM) scheme [J2]
- ✓ Video: <https://youtu.be/KrjQxV53e0g>
- No falling down during the competitions and 12th in DRC Finals 2015 [J3]
- ✓ Video: <https://youtu.be/YJlkYRONB9k>

Path Planning research

2013 - 2014

- Modified A star, Search algorithm
- Robust path planning for autonomous vehicle in position uncertainty [C1]

KOREA AUTONOMOUS VEHICLE CONTEST

2012 - 2013

- Line recognition using 2D lidar data and autonomous vehicle testing (Hyundai, Grandeur 240)
- Full course complete, 5th in overall, 1st among the teams that participated in the self-driving competition for the first time
- ✓ Video: <https://youtu.be/EyjRJQamkrg>
- ✓ Presentation: <http://dyros.snu.ac.kr/project/korea-autonomous-vehicle-contest-2013/>

Torque-based control on industrial robot for human-robot cooperation **2011 - 2012**

- NT Robot. <http://www.ntrobot.net/main>
- Implementation of Torque-based Control on Industrial Robot for Human-Robot Cooperation
- Inverse Kinematics for 6-DoF manipulator

✓ Video: <https://youtu.be/vshUS2uSchQ>

Human recognition by gait analysis using motion capture system 2011.3 - 2013.2

- Research and Development on Human recognition algorithm by using 3D Motion Capture System
- Machine Learning based approach to identify individual humans.
- Feasibility study of gait recognition using points in three-dimensional space [J1]
- The Research of 2D GEI using Motion Capture Data [DC1]

During internship in AICT, Suwon *Research on the 3D motion capture system* 2010.7 - 2011.2

- Survey and Research on the Motion Capture System
- Pilot project

TECHNICAL SKILLS **Hardware Experience**

Intelligent Vehicle, Mobile Platform

- Hyundai Grandeur HG 240, *DYROS-Spirit1*
- Wheeled Mobile Robot, *TETRA-DS*

Manipulator

- 6-DoF arm, *Roman-3D*
- 6-DoF arm, *Hyundai HA020*

Software Experience

Programming Skills

- Intermediate C++, Python, and Matlab programming for robotics (Windows, Ubuntu 16.04)
- Carsim: Comparison of Path-following algorithms, Autonomous Parking (Perpendicular, Parallel and Angle Parking, Highway navigation, Collision avoidance)
- ROS (Robot Operating System), V-Rep, CARLA, Gazebo
- OpenCV

Libraries

- Math - Eigen, Lapack, MKL
- Optimization - CVXGEN, Gurobi, qpOASES, IPOPT and IPOPT

AWARDS

Scholarship Half Scholarship for academic excellence at Seoul National University, 2013.

KOREA AUTONOMOUS VEHICLE CONTEST 5th in overall (1st among the teams that participated in the self-driving competition for the first time) 2013.

✓ Video: <https://youtu.be/EyjRJQamkrg>

DARPA Robotics Challenge Finals, USA 12th in overall (World No.1 team using platform THORMANG) 2015.

✓ Video: <https://youtu.be/YJlkYRONB9k>

JOURNAL ARTICLES [J9] **M. Kim**, G. Lee, J. Ahn, M. Kim, and J. Park. Path Following and Collision Avoidance for Autonomous Vehicles using Non-uniformly Spaced Optimization-based Model Predictive Control. IEEE ACCESS (under review), 2021.

[J8] M. Kim, J. Ahn, **M. Kim**, and J. Park. A Comparative Analysis of Path Planning and Tracking Performance According to the Consideration of Vehicle's Constraints in Automated Parking Situations. Minor Revisions Required (2021,04,27), The Journal of Korea Robotics Society, 2021.

[J7] J. Ahn, S. Shin, **M. Kim**, and J. Park. ACCURATE PATH TRACKING BY ADJUSTING LOOK-AHEAD POINT IN PURE PURSUIT METHOD. International journal of automotive technology 22 (1), 119-129, 2021.

[J6] **M. Kim**, G Im, and J. Park. A Comparative Study of Parking Path Following Methods for Autonomous Parking System, The Journal of Korea Robotics Society 15 (2), 147-159, 2020.

[J5] G Im, **M. Kim**, and J. Park. Parking line based SLAM approach using AVM/LiDAR sensor fusion for rapid and accurate loop closing and parking space detection. Sensors 19 (21), 4811, 2019.

[J4] K. Park, G. Im, **M. Kim**, and J. Park. Parking space detection based on camera and LIDAR sensor fusion. The Journal of Korea Robotics Society 14 (3), 170-178, 2019.

[J3] 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 SNU's Control Strategies to Enhancing Robot's Capability: Lessons from the DARPA Robotics Challenge Finals 2015, The DARPA Robotics Challenge Finals: Humanoid Robots to the Rescue, Springer, pp. 347-379, 2018.04

[J2] S. Shin, **M. 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 22 (11), 904-911, 2016.

[J1] **M. Kim**, M. Kim, S. Park, J Kwon, and J. Park. Feasibility study of gait recognition using points in three-dimensional space. International Journal of Fuzzy Logic and Intelligent Systems 13 (2), 124-132, 2013.

INTERNATIONAL
CONFERENCE
ARTICLES

[C4] J. Ahn, **M. Kim**, S. Kim, S. Lee, and J. Park. Formation-based tracking method for human following robot. 15th International Conference on Ubiquitous Robots (UR), 2018.

[C3] **M. Kim**, S Shin, and J. Park. Study on vehicle lateral control for backward driving. 13th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), 2016.

[C2] 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.

[C1] J. Im, **M. Kim**, S. Shin, and J. Park. Robust path planning for autonomous vehicle in position uncertainty. 11th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI), 2014.

DOMESTIC
CONFERENCE
ARTICLES

[DC8] M. Kim, J. Ahn, **M. Kim**, and J. Park. Intersection Detection and Navigation at Unstructured Environment using Candidate Trajectory. The Korean Society of Automotive Engineers Annual Autumn Conference, 2020.

[DC7] **M. Kim**, G. Im, J. Ahn, M. Kim, and J. Park. Autonomous parking algorithm using automatic selection of forward and backward switching points via model predictive control. The Korean Society of Automotive Engineers Annual Autumn Conference, 2018.

[DC6] J. Ahn, M. Kim, G. Im, **M. Kim**, and J. Park. Development of Autonomous Valet Parking System and Simulation Result. The Korean Society of Automotive Engineers Annual Conference, Korea, 2018.

[DC5] G. Im, **M. Kim**, J. Ahn, M. Kim, and J. Park. V-Rep Simulator for Autonomous Vehicle Research in Parking lot Environment. The Korean Society of Automotive Engineers Annual Conference, Korea, 2018.

[DC4] **M. Kim**, and J. Park. Autonomous Parking using Sampling-Based Path Planning and Model Predictive Control, The Korean Society of Automotive Engineers Annual Conference, Korea, 2018.

[DC3] **M. Kim**, J. Ahn, and J. Park. A comparative study on the steering controller for autonomous parking, The 13th Korea Robotics Society Annual Conference, Korea, 2018.

[DC2] S. Kim, **M. Kim**, and J. Collision-free motion planning based on elastic band theory for autonomous driving, The Korean Society of Automotive Engineers Annual Conference, Korea, 2014.

[DC1] **M. Kim**, J. Park, and J. Kwon. The Research of 2D GEI using Motion Capture Data, Human Computer Interaction Conference, pyeongchang, Korea, 13.01.2012.

ACADEMIC
SERVICES

Reviewer for IEEE Intelligent Vehicles Symposium (IV), 2020.

Reviewer for IEEE Conference on Decision and Control (CDC), 2020.

Reviewer for IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018.

Reviewer for IEEE International Conference on Ubiquitous Robots (UR), 2018.