Jungmo **Koo**

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"The only limit is your imagination."

Research interest

Artificial intelligence in computer vision

I aim for a recognition system that can be run in a real world environment.

- Synthesized segmentation dataset for data hungry problem
- Object detection/segmentation/tracking [Video]
- Efficient neural network modeling

Education

Ph.D. in Electrical Engineering (Adviser: Prof. Hyun Myung) — *Daejeon, South Korea*

KAIST (Korea Advanced Institute of Science and Technology) — *Feb. 2017 - Present*

M.S. in Civil and Environmental Engineering (Adviser: Prof. Hyun Myung) — *Daejeon, South Korea*

KAIST (Korea Advanced Institute of Science and Technology) — *Feb. 2015 - Feb. 2017*

- Monitoring system of jellyfish distribution using an unmanned aerial vehicle in ocean environment [Video]

B.S. in Electronic Engineering — *Gyeonggi-do, South Korea*

Kyung Hee University — *Mar. 2009 - Feb. 2015*

Experience

Seadronix Corp. — *Seoul, South Korea*

Senior Researcher — *Mar. 2020 - Feb. 2021*

- Object detection & segmentation in marine environment
- Deep learning for embedded system(robot system)

DJI Developer Challenge [Video] — *New York, United States*

Finalist — *Mar. 2016 - Aug. 2016*

- Fast object detection on embedded system
- Development of autopilot for UAV

KRISO (Korea Research Institute of Ships & Ocean Engineering) — *Daejeon, South Korea*

Research Intern — *June 2015 - July 2015*

- Development of analysis application for underwater 3D mapping using a fast analog sensor sampling device.

Publications

International Journal

- **Jungmo Koo** & Hanguen Kim, Donghoon Kim, Byeolteo Park, Yonggil Jo and Hyun Myung & Donghwa Lee, "Vision-Based Real-Time Obstacle Segmentation Algorithm for Autonomous Surface Vehicle," *IEEE Access*, vol.7, no.1, pp.179420-179428, [DOI], Dec. 2019. (SCIE, Q1)
- Donghoon Kim, Seung-Mok Lee, Sungwook Jung, **Jungmo Koo** and Hyun Myung, "Particle swarm optimization-based receding horizon formation control of multi-agent surface vehicles," *ARR (Advances in Robotics Research)*, vol.2, no.2, pp.161-182, [DOI], Jun. 2018. (non-SCI)
- Seunghee Lee, **Jungmo Koo**, Jinki Kim and Hyun Myung, "Robust 2D human upper-body pose estimation with fully convolutional network," *ARR (Advances in Robotics Research)*, vol.2, no.2, pp.129-140, [DOI], Jun. 2018. (non-SCI)
- Hanguen Kim, **Jungmo Koo**, Donghoon Kim, Sungwook Jung, Jae-Uk Shin, Serin Lee, and Hyun Myung, "Image-Based Monitoring of Jellyfish using Deep Learning Architecture," *IEEE Sensors*, vol.16, no.8, pp.2215-2216, [DOI], Apr. 2016. (SCI)

Domestic Journal

- **Jungmo Koo**, Hyun Myung, "Deep Neural Network–based Jellyfish Distribution Recognition System Using a UAV (무인기를 이용한 심층 신경망 기반 해파리 분포 인식 시스템)," *Journal of Korea Robotics Society* (in Korean), vol.12, no.4 pp.432-440, [DOI], Dec. 2017.
- Sungwook Jung, **Jungmo Koo**, Kwangyik Jung, Hyungjin Kim, Hyun Myung, "Vision-based Autonomous Landing System of an Unmanned Aerial Vehicle on a Moving Vehicle (무인 항공기의 이동체 상부로의 영상 기반 자동 착륙 시스템)," *Journal of KROS (Korea Robotics Society)* (in Korean), vol.11, no.4, pp.262-269, [Link], Nov. 2016.

International Conference

- **Jungmo Koo**, Changgue Park, Hyung Tae Lim and Hyun Myung, "Light-weight Deep Neural Networks for Multi-target Classification," in *Proc. of the 19th International Conference on Control, Automation and Systems (ICCAS)*, pp.1108-1109, Jeju, Korea, Oct.15-18, 2019.
- Hyungtae Lim, **Jungmo Koo**, and Hyun Myung, "Effective Indoor Robot Localization by Stacked Bidirectional LSTM using Beacon-based Range Measurements," in *Proc. of Int'l Conf. on Robot Intelligence Technology and Applications (RiTA)*, Putrajaya, Malaysia, Dec.16-18, 2018.
- Hyungtae Lim, **Jungmo Koo**, Jieum Hyun, and Hyun Myung, "Recurrent Neural Networks for Range-based Indoor Robot Localization", in *Proc. of IEEE/RSJ Int'l Conf. on Intelligent Robots and Systems (IROS)*, Madrid, Spain, Oct.1 - 5, 2018.
- **Jungmo Koo**, Seunghee Lee, Hyungtae Lim, and Hyun Myung, "Improving Play Method of Robot Soccer Game using Ball Position Estimation with Deep Neural Networks," in *Proc. of IEEE Int'l Conf. on Robotics and Automation (ICRA)*, Brisbane, Australia, May 2018.
- Sungwook Jung, **Jungmo Koo**, Jieun Hyun, Jongheon Kim, and Hyun Myung, "Development of Lifting Device-Type Jellyfish Removal Robot System for Large Jellyfish," in *Proc. Int'l Conf. on Robot Intelligence Technology and Applications (RiTA)*, Daejeon, Korea, Dec. 13 - 15, 2017.
- Seunghee Lee, **Jungmo Koo**, Hyungjin Kim, Kwangyik Jung, and Hyun Myung, "A Robust Estimation of 2D Human Upper-body Poses using Fully Convolutional Network," in *Proc. Int'l Conf. on Robot Intelligence Technology and Applications (RiTA)*, Daejeon, Korea, Dec. 13 - 15, 2017.
- **Jungmo Koo**, Seunghee Lee, Hyungjin Kim, Kwangyik Jung, Taekjun Oh, and Hyun Myung, "Human Upper-Body Pose Estimation using Fully Convolutional Network and Joint Heatmap," in *Proc. of IEEE/RSJ Int'l Conf. on Intelligent Robots and Systems (IROS)*, Vancouver, Canada, Sep. 24 - 28, 2017.
- **Jungmo Koo**, Sungwook Jung and Hyun Myung, "A Jellyfish Distribution Management System using an Unmanned Aerial Vehicle and Unmanned Surface Vehicles," in *Proc. of IEEE/OES Int'l Symposium on Underwater Technology (UT)*, Busan, Korea, Feb. 21 - 24, 2017.
- Hanguen Kim, Donghoon Kim, Sungwook Jung, **Jungmo Koo**, Jae-Uk Shin, and Hyun Myung, "Development of a UAV-type jellyfish monitoring system using deep learning," in *Proc. of Int'l Conf. on Ubiquitous Robots and Ambient Intelligence (URAI)*, pp.495-497, KINTEX, Goyang, Korea, Oct. 28-30, 2015.
- Donghoon Kim, Hangeun Kim, Sungwook Jung, **Jungmo Koo**, Jongheon Kim, Jae-Uk Shin, and Hyun Myung, "Development of a jellyfish reconnaissance and removal robot system using unmanned aerial and surface vehicles," in *Proc. of Int'l Conf. on Ubiquitous Robots and Ambient Intelligence (URAI)*, p.101, KINTEX, Goyang, Korea, Oct. 28-30, 2015.
- Donghoon Kim, Hangeun Kim, Sungwook Jung, **Jungmo Koo**, Jongheon Kim, and Hyun Myung, "A Vision-Based Detection Algorithm for Moving Jellyfish in Underwater Environment," in *Proc. of Int'l Conf. on Ubiquitous Robots and Ambient Intelligence (URAI)*, pp.144-145, KINTEX, Goyang, Korea, Oct. 28-30, 2015.
- **Jungmo Koo**, Hanguen Kim, Donghoon Kim, Sungwook Jung, and Hyun Myung, "A Deep Learning-based Jellyfish Distribution Monitoring System using an Unmanned Aerial Vehicle," in *Proc. IEEE/RSJ Int'l Conf. on Intelligent Robots and Systems (IROS)*, p.4787, Hamburg, Germany, Sep.28 - Oct.2, 2015.

Domestic Conference

- **구정모**, 박창규, 임형태, 성현승, 명현, "다중 표적 분류를 위한 신경망 네트워크 경량화 기법," *2019* 한국군사과학기술학회 종합학술대회, 제주 서귀포, June 13-14, 2019.
- 임형태, 박창규 ,**구정모**, 명현, 성현승, "무인 항공기의 정찰 및 감시를 위한 HOG-LBP 기반 소형 물체 분류 SVM 알고리즘," *2019* 한국군사과학기술학회 종합학술대회, 제주 서귀포, June 13-14, 2019.
- **구정모**, 임형태, 박창규, 성현승, 명현, "소형 물체 분류를 위한 특징 기반 심층 신경망 구조 개발," 제 *14*회 한국로봇종합학술대회 *(KRoC 2019)*, 평창 휘닉스파크, pp.501-502, Jan.20-23, 2019.
- **구정모**, 임형태, 윤필립, 백하은, 명현, "초해상도 복원 특징을 활용한 소형 물체 분류 딥 뉴럴 네트워크 알고리즘," 한국군사과학기술학회 종합학술대회, pp.507-508, 제주 컨벤션센터, Jun. 2018.
- 이승희, 김한근, 오택준, **구정모**, 강상승, 지수영, 명현, "운동 자세 인식을 위한 SVM 기반의 관절 추정 알고리즘," 제 *12*회 한국로봇종합학술대회 *(KRoC 2017)*, 평창 휘닉스파크, pp.220-221, Feb. 5 - 8, 2017.
- **구정모**, 김한근, 김동훈, 정성욱, 명현, "경량화된 딥 뉴럴 네트워크 기반의 실시간 해파리 분포 인식 시스템," 제 *11*회 한국로봇종합학술대회*(KRoC 2016)*, 평창 휘닉스파크, Jan. 2016.
- 김한근, 김동훈, 정성욱, 신재욱, **구정모**, 명현, "기계학습을 이용한 영상기반 해파리 분포 인식 알고리즘 설계," 제*30*회 제어로봇시스템학회 *(ICROS)* 학술대회, 대전 DCC, May 2015. **(Best Paper Award)**

Research projects

Development of a location recognition algorithm that is robust against spatial changes (AI One Team) — *KT*

Team Leader — *Apr. 2021 - Present*

- Korean: 공간 변화에 강인한 위치 식별 알고리즘 개발
- **Keywords: Panoptic segmentation / Object tracking / Deep learning / SLAM**

Video target classification and training data processing module development — *ADD & Pixoneer*
[Video]

Team Leader — *Jan. 2018 - Nov. 2019*

- Korean: 동영상 표적분류 및 학습 데이터 처리 모듈 개발
- **Keywords: Object detection / Multiple object tracking / Classification / Super-resolution**

Next-generation Intelligent Assistant and element technology development — *Samsung electronics*

Team Member — *June 2017 - June 2018*

- Korean: 차세대 Intelligent Assistant 및 요소기술 개발
- **Keywords: Object detection / Lightweight neural network / SLAM**

Development of robot task intelligence technology that can perform more than 80% of a given task in an inexperienced situation through autonomous knowledge acquisition and situation adaptive knowledge application — *KETI*
[Video1] [Video2]

Team Member — *June 2015 - May 2018*

- Korean: 자율적 지식습득과 상황 적응적 지식응용을 통하여 무경험 상황에서 주어진 작업을 80% 이상 수행할 수 있는 로봇작업지능기술 개발
- **Keywords: Keypoint detection / Human pose estimation / segmentation**

JEROS (Jellyfish Elimination RObotic Swarm) project — *NRF & Rastech*
[Video1] [Video2] [Video3]

Team Leader & Member — *June 2015 - Oct. 2017*

- Project name 01: Jellyfish reconnaissance and extermination system to prevent harmful jellyfish damage(유해 해파리 피해 방지를 위한 해파리 정찰 및 퇴치 시스템), NRF
- Project name 02: Unmanned robot system for reconnaissance/extermination/rescue to prevent casualties at the beach(해수욕장 인명 피해 방지를 위한 정찰/퇴치/구조용 무인 로봇 시스템), NRF
- Project name 03: Development of formation control of jellyfish extermination robot and UAV type image-based jellyfish distribution recognition system(해파리 퇴치로봇의 군집제어 및 무인기 타입 영상기반 해파리 분포인식 시스템 개발), Rastech
- **Keywords: Lightweight neural network / Classification / Embedded system**

HSI user interface and database prototype development — *ETRI*

Team Member — *Aug. 2015 - Nov. 2015*

- Korean: HSI 사용자 인터페이스 및 데이터베이스 시작품 제작
- **Keywords: Machine learning**

Awards

ICROS Best paper — *ICROS(Institute of Control, Robotics and Systems, Korea)*

Paper title: "Design of Image-based Jellyfish Distribution Recognition Algorithm Using Machine Learning" — *May 2015*

Best graduation work prize (최우수상) — *Kyung Hee University*

Best graduation work in embedded system division. — *Sep. 2014*

Freescale special prize (Freescale 특별상) — *Hanyang university*

Smart cruise control competition using a model car. — *July 2013*

Excellence award (우수상) — *KROS (Korea Robotics Society)*

Robot demo award for undergraduate student. — *May 2013*

Prime minister prize (국무총리상) — *Government of the Republic of Korea*

Explorer robot competition in International robot contest. — *Oct. 2012*

Patents

Jellyfish Distribution Recognition Method and Systems for Operating Effectively Jellyfish Removal Type of Robot Systems (해파리 퇴치용 군집 로봇 시스템을 효율적으로 운용하기 위한 해파리 분포 인식 방법 및 시스템) [Link] *Granted*

KR 10201501156667 *2015. 08. 17*