BK21 FOUR IT-Bio융합시스템농업교육연구단 제 2회 국제학술대회

"International Conference on IT-Bio Convergence"

27 AUGUST 2021 | VIRTUAL CONFERENCE

Organizing Committee

General Cahir	Prof. Nak Yong Ko Chosun University, Korea
General Co-Chairs	Prof. Kang Mo Ku Chonnam National University, Korea
	Prof. Ho Kyung Ha Sunchon National University, Korea
Steering Committee	Prof. Jangho Kim Chonnam National University, Korea
	Prof. Chul Ju Yang Sunchon National University, Korea
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	Prof. Kang Mo Ku Chonnam National University, Korea
	Prof. Suk Seung Hwang Chosun University, Korea

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KRISO, Korea

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Chonnam National University, Korea

Prof. Jae Il Cho
Chonnam National University, Korea

Prof. Bo Keun Ha
Chonnam National University, Korea

Prof. Tae Ho Han
Chonnam National University, Korea

Prof. Il Sup Nou
Sunchon National University, Korea

Prof. Woo Hoon Seon
Sunchon National University, Korea

	Prof. Chun Bo Sim Sunchon National University, Korea
	Prof. Ju Sik Cho Sunchon National University, Korea
	Prof. Young Yoon Cho Sunchon National University, Korea
	Prof. Sung Bum Pan Chosun University, Korea
	Prof. Jin Yi Lee Chosun University, Korea
Conference Secretariats	Ms. Pu Reum Mun Chonnam National University, Korea Ms. Hye Won Yang Chonnam National University, Korea Dr. Hong Seok Mun Sunchon National University, Korea Ms. Ji Hyeon Kim Chosun University, Korea

Organizer & Sponsor

Center for IT-Bio Convergence System Agriculture - Chosun University | Chonnam National University | Sunchon National University

National Research Foundation of Korea

Institute of Control, Robotics, and Systems, Gwangju-Jeonnam Branch

Welcome Message

On behalf of the organizing committee, I welcome you to the International Conference on IT-Bio Convergence. We're grateful to the invited speakers worldwide, and the attendees especially the professors and students. Today we have 20 invited speakers and 5 student speakers. They devoted their time for the preparation of the presentation and are waiting for the presentation. They are willing to endure the inconvenience due to the time difference. The invited speakers are experts on IT, AI, Robotics, and agriculture. A variety of research results will be shared for convergence.

The conference is hosted by the Center for IT-Bio Convergence System Agriculture which is supported by National Research Foundation of Korea, as a BK21 Four project. The center works to promote convergence of IT and Bio technologies for sustainable development of agriculture, especially for the smart farm. For this purpose, three universities converged: Chosun University, Chonnam National University, and Sunchon National University. We're proud of the fused construction of the consortium, which perfectly conforms to the purpose of IT-Bio convergence.

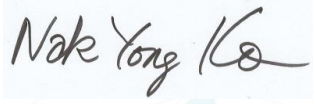
The purpose of the conference is not defined. The purpose depends on yourself. We wish the participants make the best use of the conference to understand the field which they were not used to be, and take the chance to initiate collaboration for generation of invaluable ideas.

We again appreciate for your participation, and wish you enjoy the conference.

August 27, 2021

Nak Yong Ko, Professor, Chosun University

General Chair of the International Conference on IT-Bio Convergence



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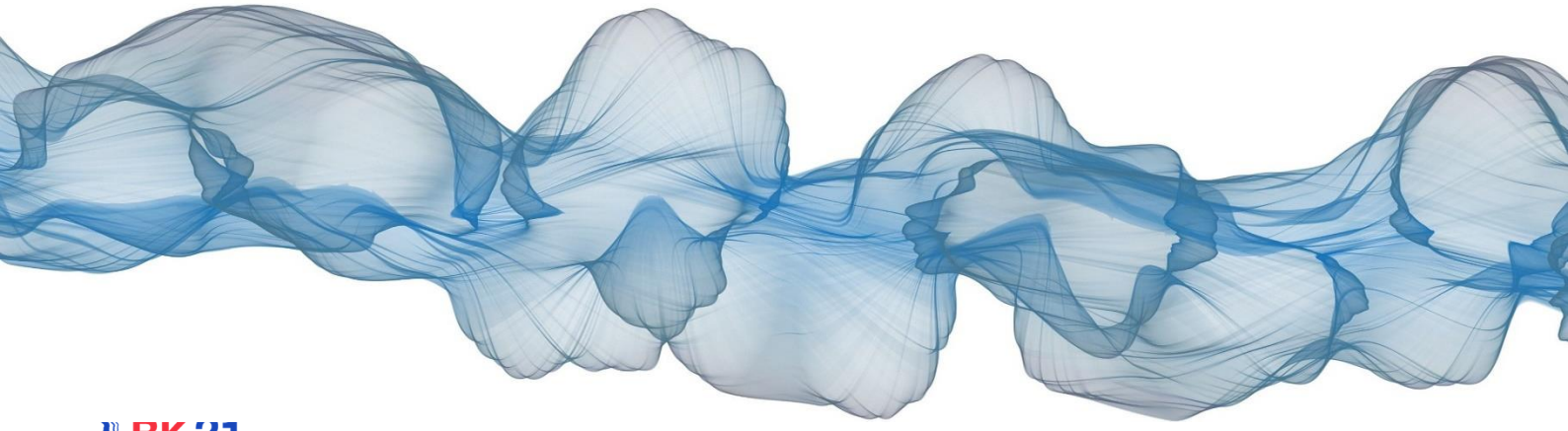

Congratulatory Address

Distinguished scholars, professors, and students, I feel greatly honored and privileged to welcome you to the 2-nd International Conference on IT-Bio Convergence. I would like to congratulate you holding the conference, and give respect to the organizing committee of the three universities: Chosun University, Chonnam National University and Sunchon National University. Especially, I appreciate for the efforts by Prof. Nak Yong Ko at Chosun University, Prof. Kang-Mo Ku at Chonnam National University, and Prof. Ho Kyung Ha, at Sunchon National University, and the supports by Prof. Jangho Kim at Chonnam National University.

This conference is to promote the convergence of IT technologies and Bio technologies for smart farm agriculture, which is one of the promising fields that will contribute to achieve sustainable development for humanity. It is well known that there is few expert who knows everything for convergence while the convergence is attributed to the collaboration of experts in specific fields. I expect that the conference will be the forum for discussions on how various fields of technologies combine together to accomplish synergetic results seamlessly.

This conference is invaluable in many respects. Experts worldwide in various fields get together to introduce their research and suggest how the results can be utilized for other fields. I strongly recommend the students take this opportunity to get insights from the lectures.

I thank and welcome again all the participants and wish you to enjoy the conference.

August 27, 2021

M.D. & Ph. D. Min, Young-Don

President of Chosun University

Congratulatory Address

Welcome to the 2-nd International Conference on IT-Bio Convergence. I appreciate all the distinguished scholars and participants for attending the conference. This conference is hosted by Center for IT-Bio Convergence System Agriculture which is a consortium of Chosun University, Chonnam National University, and Sunchon National University. The center is one of the BK 21 Four team supported by National Research Foundation of Korea to promote research of professors and students and enhance cooperation of academia and industries.

The conference aims to encourage the participants to integrate their expertise with others to achieve what they cannot attain without collaboration. As science and technologies develop, almost no creative idea is generated without cooperation. I wish this conference contribute to generate new idea and ignite interaction between researchers.

I′d like to give special thanks to the organizing committee members who have put an enormous amount of efforts for the success of the conference. Also, I appreciate the invited speakers worldwide for their devotion and strong support for the conference. The active participation of the audience is expected and will be awarded by excellent research results inspired by the lectures.

Thank you all, and have great time at the conference.

August 27, 2021

Lee, Goung Jin, Ph.D.

Dean of the Graduate School, Chosun University

Welcome Address

We sincerely welcome your participation in the 2st International Conference of the Brain Korea 21 FOUR Interdisciplinary Program in IT-Bio Convergence System. I'm Professor Jangho Kim of Chonnam National University, the head of the BK21 FOUR Interdisciplinary Program in IT-Bio Convergence System Agriculture.

Our BK21 FOUR Interdisciplinary Program in IT-Bio Convergence System Agriculture consists of researchers, students, and administrative staffs, including 24 excellent professors from Chonnam National University, Suncheon University, and Chosun University. In particular, as the nation's first National and Private University associated BK Research and Education Group in the field of "Smart Farm", is committed to fostering high-quality human resources to lead the future agriculture and bio industry.

I am very happy and honored that our Education Research Group has invited Professor Nak Yong Ko of Chosun University as the general chair of the organizing committee to hold the 2st International Conference of the Brain Korea 21 FOUR Interdisciplinary Program in IT-Bio Convergence System.

I appreciate, Youngdon Min, the president of Chosun University and Goungjin Lee, the Dean of Graduate School at Chosun University, for delivering congratulatory speeches for this international academic conference. Please continue to give great encouragement and attention. Also, I would like to thank everyone at home and abroad for participating in this conference.

In particular, I sincerely glad that this conference will be a great opportunity for students by participating various experts in IT, AI, Robotics, and agriculture fields. Once again, I would like to thank and welcome everyone who are with us today.
Thank you.

August 27, 2021

Head of Center for IT-Bio Convergence System Agriculture

Jangho Kim

2021 2nd International Conference of the Brain Korea21 FOUR Interdisciplinary Program in IT-Bio Convergence System

Virtual Presentation

International Conference on IT-Bio Convergence

August. 27, 2021

7:50a.m. ~ 6:00p.m.

@Center for IT-Bio Convergence System Agriculture

■ Welcome Remark

Korean time	Chair: Prof. Nak Yong Ko
7:50~8:00	**Congratulatory address** President of Chosun University, Young Don Min
	Congratulatory address Dean of Graduate School at Chosun University, Goung Jin Lee
	Welcome address Dean of IT-Bio Convergence System Agriculture, Chonnam National University, Jangho Kim
	Welcome message General Chair, Chosun University, Nak Yong Ko

■ Track Abba : Invited Lectures

Korean time/ Speaker's time	Chair: Prof. Nak Yong Ko
8:00~8:30 19:00~19:30	**"Robot Design, Planning, and Control for Environmental Applications"** Dr. Byung Cheol Min (Purdue University, USA)
8:30~9:00 19:30~20:00	**"Design, Control and Test of an Autonomous Unmanned Vehicle System & Intelligent Robot (AUVSIR)"** Dr. Dong Bin Lee (Oregon Institute of Technology, USA)
9:00~9:30 20:00~20:30	**"Graph Neural Networks for Decentralized Multi-Robot Submodular Action Selection"** Dr. Lifeng Zhou (Pennsylvania University, USA)
9:30~10:00 20:30~21:00	**"Advanced V2V Authentication for Roadside Infrastructure-less Vehicular Network"** Dr. KiHo Lim (William Paterson University, USA)
10:00~10:25 21:00~21:25	**"ARC - Actor Residual Critic for Adversarial Imitation Learning"** Ankur Deka (Carnegie Mellon University, USA)
10:25~10:30	**Coffee break**

	Chair: Prof. Kang Mo Ku
10:30~11:00 9:30~10:00	**"Bio-Syncretic Robotics by Integrating Living Materials and Nonliving Systems"** Dr. Wenxue Wang (Shenyang Institute of Automation, China)
11:00~11:30 8:00~8:30	**"Application of Modern Technology on Smart Swine Farming"** Dr. Shad Mahfuz (Sylhet Agricultural University, Bangladesh)
11:30~11:50	**"Map Merging Algorithms and Systems for Multi-Robot SLAM"** Dr. Heon Cheol Lee (Kumoh National Institute of Technology, Korea)
11:50~12:10	**"Future Mobility Lab's Entry to the 2020 University Student Autonomous Driving Contest"** Dr. Woo Suk Sung (Chosun University, Korea)
12:10~12:30	**"3D Point Cloud Mapping with Only Static Environments Using Convolutional Neural Networks for Classification"** Dr. Se Jin Lee (Kongju National University, Korea)
12:30~13:30	**Lunch**
	Chair: Prof. Suk Seung Hwang
13:30~14:00	**"3D Visualization of Cultural Heritage"** Dr. Liang Li (Ritsumeikan University, Japan)
14:00~14:30 13:00~13:30	**Object detection based on Mobilenet for Visually Impaired People in a Raspberry Pi Environment"** Dr. Jae Neung Lee (City University of Hong kong , Honkong)
14:30:15:00	**"Anomaly Detection for Smart Manufacturing"** Dr. Hye Jin Kim (Electronics Telecommunications Research Institute, Korea)
15:00~15:30 14:00~14:30	**"Next Generation Multiple Access for Integrated Terrestrial and Aerial Network"** Dr. Chee Yen(Bruce) Leow (University Technology Malaysia, Malaysia)
15:30~15:50	**"Wireless Localization and Sensing in B4G/6G"** Dr. Sun Woo Kim (Hanyang University, Korea)
15:50~16:00	**Coffee break**
	Chair: Dr. Hyun Taek Choi
16:00~16:30 9:00~9:30	**"Underwater Robot Vision"** Dr. Rafael Garcia (University of Girona, Spain)
16:30~17:00 9:30~10:00	**"Acoustic-based tracking and navigation"** Dr. Riccardo Costanzi (University of Pisa, Italy)
17:00~17:30	**"Introduction to Situational Awareness System for Autonomous ships"** Dr. Hyun Taek Choi (Korea Research Institute of Ships and Ocean Engineering, Korea)
17:30~18:00 9:30~10:00	**"Understanding Equilibrium Properties of Multi-Agent Systems"** Dr. Michael Wooldridge (University of Oxford, UK)

■ Track Beatles : Student Short Talks & Invited Lectures

Korean time/ Speaker's time	Chair: Prof. Keun Chang Kwak
14:00~14:25	**"Three-dimensional Photogrammetric Mapping of Apples in Orchard based on Point Cloud Instance Segmentation"** Xuhua Dong (Chonnam National University, Korea)
	"Two-Dimensional Mapping And Localization of a Mobile Robot for Indoor Environment" Henok Tegegn Warku (Chosun University, Korea)
	"Heat and pressure-assisted soft lithography for agricultural applications" Woo Chan Kim (Chonnam National University, Korea)
	"Efficient Angle-of-Arrival Estimation Algorithm for Massive Antenna Array" Tae Yun Kim (Chosun University, Korea)
	"Ensemble Three-Stream RGB-S Deep Neural Network for Human Behavior Recognition Under Intelligent Home Service Robot Environments" YeongHyeon Byeon (Chosun University, Korea)
14:30~15:00	**" AUV for Biointeraction and Biodiversity Monitoring"** Hayato Kondo (Tokyo University, Japan)

학회 프로그램

■ Welcome Remark

시간	Chair: 고낙용 교수
7:50~8:00	**환영사 1:** President of Chosun University, Young Don Min
	환영사 2: Dean of Graduate School at Chosun University, Goung Jin Lee
	환영사 3: Dean of IT-Bio Convergence System Agriculture, Chonnam National University, Jangho Kim
	환영사 4: General Chair, General Chair, Chosun University, Nak Yong Ko

■ Track Abba : Invited Lectures

시간	좌장: 고낙용 교수
8:00~8:30	**초청강연 1: "Robot Design, Planning, and Control for Environmental Applications"** Dr. Byung Cheol Min (Purdue University, USA)
8:30~9:00	**초청강연 2: "Design, Control and Test of an Autonomous Unmanned Vehicle System & Intelligent Robot (AUVSIR)"** Dr. Dong Bin Lee (Oregon Institute of Technology, USA)
9:00~9:30	**초청강연 3: "Graph Neural Networks for Decentralized Multi-Robot Submodular Action Selection"** Dr. Lifeng Zhou (Pennsylvania University, USA)
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10: 25~10:30	Coffee break
	좌장: 구강모 교수
10:30~11:00	**초청강연 6: "Bio-Syncretic Robotics by Integrating Living Materials and Nonliving Systems"** Dr. Wenxue Wang (Shenyang Institute of Automation, China)
11:00~11:30	**초청강연 7: "Application of Modern Technology on Smart Swine Farming"** Dr. Shad Mahfuz (Sylhet Agricultural University, Bangladesh)
11:30~11:50	**초청강연 8: "Map Merging Algorithms and Systems for Multi-Robot SLAM"** Dr. Heon Cheol Lee (Kumoh National Institute of Technology, Korea)
11:50~12:10	**초청강연 9: "Future Mobility Lab's Entry to the 2020 University Student Autonomous Driving Contest"** Dr. Woo Suk Sung (Chosun University, Korea)
12:10~12:30	**초청강연 10: "3D Point Cloud Mapping with Only Static Environments Using Convolutional Neural Networks for Classification"** Dr. Se Jin Lee (Kongju National University, Korea)
12:30~13:30	Lunch

	좌장: 황석승 교수
13:30~14:00	초청강연 11: "3D Visualization of Cultural Heritage" Dr. Liang Li (Ritsumeikan University, Japan)
14:00~14:30	초청강연 12: " Object detection based on Mobilenet for Visually Impaired People in a Raspberry Pi Environment" Dr. Jae Neung Lee (City University of Hong kong , Honkong)
14:30~15:00	초청강연 13: "Anomaly Detection for Smart Manufacturing" Dr. Hye Jin Kim (Electronics Telecommunications Research Institute, Korea)
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	좌장: 최현택 박사
16:00~16:30	초청강연 16: "Underwater Robot Vision" Dr. Rafael Garcia (University of Girona, Spain)
16:30~17:00	초청강연 17: "Acoustic-based tracking and navigation" Dr. Riccardo Costanzi (University of Pisa, Italy)
17:00~17:30	초청강연 18: "Introduction to Situational Awareness System for Autonomous ships" Dr. Hyun Taek Choi (Korea Research Institute of Ships and Ocean Engineering, Korea)
17:30~18:00	초청강연 19: "Understanding Equilibrium Properties of Multi-Agent Systems" Dr. Michael Wooldridge (University of Oxford, UK)

■ Track Beatles : Student Short Talks & Invited Lectures

시간	좌장: 곽근창 교수
14:00~14:25	학생발표 1~5 1. Xuhua Dong (Chonnam National University, Korea) "Three-dimensional Photogrammetric Mapping of Apples in Orchard based on Point Cloud Instance Segmentation" 2. Henok Tegegn Warku (Chosun University, Korea) "Two-Dimensional Mapping And Localization of a Mobile Robot for Indoor Environment" 3. Woo Chan Kim (Chonnam National University, Korea) "Heat and pressure-assisted soft lithography for agricultural applications" 4. Tae Yun Kim (Chosun University, Korea) "Efficient Angle-of-Arrival Estimation Algorithm for Massive Antenna Array" 5. YeongHyeon Byeon (Chosun University, Korea) "Ensemble Three-Stream RGB-S Deep Neural Network for Human Behavior Recognition Under Intelligent Home Service Robot Environments"
14:30~15:00	초청강연 20: " AUV for Biointeraction and Biodiversity Monitoring" Dr. Hayato Kondo (Tokyo University, Japan)

BK21 FOUR
IT-Bio융합시스템농업교육연구단
제 2회 국제학술대회
(초청연사)

Zoom Meeting (Track Abba)

2021-08-27 (Fri) 07:50~18:00

https://zoom.us/j/91780632324?pwd=V0M5TU9wNEJacURqVVpLVFQwZDhoUT09

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BK21 FOUR
IT-Bio융합시스템농업교육연구단
제 2회 국제학술대회
(대학원생&초청연사)

Zoom Meeting (Track Beatles)

2021-08-27 (Fri) 14:00~15:00

https://jnu-ac-kr.zoom.us/j/98379219492?pwd=SkRNd3ZxUjFNZ2F1eDZTREFZRWdYQT09

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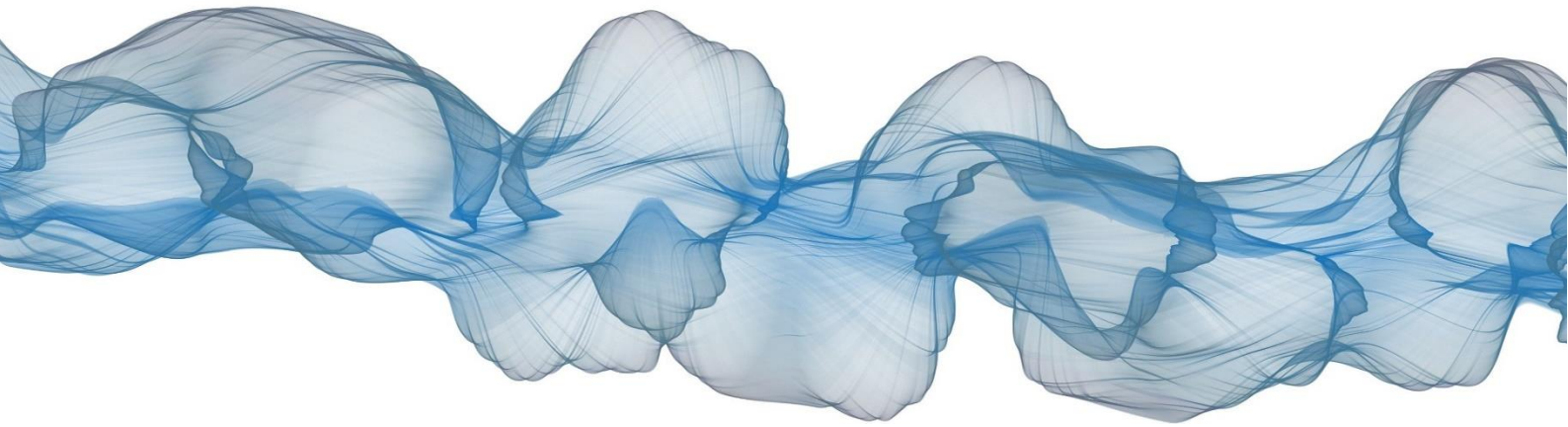
ABSTRACT

Track Abba : INVITED LECTURES



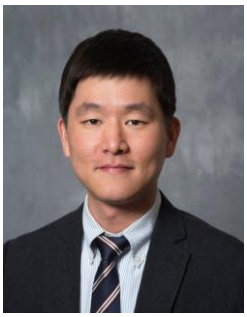
Robot Design, Planning, and Control for Environmental Applications

Byung-Cheol Min

Department of Computer and Information Technology, Purdue University, West Lafayette, IN 47907, USA

With the continuous interest in and advancement of robotics-related technology, robots have been proven useful and effective in environmental applications, including monitoring and cleaning tasks that have generally been carried out manually. In this talk, I introduce research in environmental robotics that the SMART Lab of Purdue University has done or is currently doing. The talk is largely divided into two parts. In the first part, I introduce various robots we developed for water quality monitoring, sediment sampling, and algae removal. These robots were specifically developed to suit low-cost, small-scale, and fully open-source use cases to enable their easy building and use by the public. In the second part, I will introduce algorithms and control methods we designed for environmental monitoring and cleaning operations involving one or multiple robots. In particular, I will present details on how we utilized distributed and cooperative control techniques to enable robots to perform their assigned tasks more effectively as a team.

Funding: This work was supported in part by the National Science Foundation (NSF) Center for Robots and Sensors for the Human Well-Being (RoSe-HuB) under CNS-1439717, by NSF CAREER Award under IIS-1846221, by the Purdue Research Foundation (PRF) Research Grant, and by the Arequipa Nexus Institute.



Curriculum Vitae – Dr. Byung Cheol Min

Department of Computer and Information Technology, Purdue University, West Lafayette, IN 47907, USA

Email: minb@purdue.edu

Education

Ph.D. in Technology, Purdue University (2014)
M.S. in Electronics and Radio Engineering , Kyung Hee University (2010)
B.S. in Electronics Engineering, Kyung Hee University (2008)

Research and Teaching Positions

- University Faculty Scholar, Purdue University (2021-present)
- Associate Professor, Department of Computer and Information Technology, Purdue University (2020-present)
- Assistant Professor, Department of Computer and Information Technology, Purdue University (2015-2020)
- Postdoctoral Fellow, Field Robotics Center, The Robotics Institute, Carnegie Mellon University (2014-2015)

Selected Refereed Journal Articles (last 5 years)

1. Bae, J. H., Jo, W., Park, J. H., Voyles, R. M., McMillan, S. K., & Min, B. C. (2021). Evaluation of sampling methods for robotic sediment sampling systems. IEEE Journal of Oceanic Engineering, 46(2), 542-554.

2. Penmetcha, M., & Min, B. C. (2021). A deep reinforcement learning-based dynamic computational offloading method for cloud robotics. IEEE Access, 9, 60265-60279.

3. Luo, S., Kim, J., & Min, B. C. (2020). Asymptotic boundary shrink control with multirobot systems. IEEE Transactions on Systems, Man, and Cybernetics: Systems, Early Access.

4. Parasuraman, R., Kim, J., Luo, S., & Min, B. C. (2020). Multipoint rendezvous in multirobot systems. IEEE transactions on cybernetics, 50(1), 310-323.

5. Mina, T., Singh, Y., & Min, B. C. (2020). Maneuvering ability-based weighted potential field framework for multi-usv navigation, guidance, and control. Marine Technology Society Journal, 54(4), 40-58.

6. Kitjacharoenchai, P., Min, B. C., & Lee, S. (2020). Two echelon vehicle routing problem with drones in last mile delivery. International Journal of Production Economics, 225, 107598.

7. Jo, W., Hoashi, Y., Aguilar, L. L. P., Postigo-Malaga, M., Garcia-Bravo, J. M., & Min, B. C. (2019). A low-cost and small USV platform for water quality monitoring. HardwareX, 6, e00076.

ABSTRACT

Design, Control and Test of an Autonomous Unmanned Vehicle System & Intelligent Robot (AUVSIR)

Dongbin “don” Lee, Ph.D.

M.Cobian[1], T. Giles[1], J. Leonard[1], S. Harrison[1], C. Robles[1], M. HuntoonRoche[1], D. Lee[2]
1. Students at Oregon Institute of Technology (OIT or Oregon Tech), Klamath Falls, OR 97603, USA
2. Associate Professor/Grad program-,Robotics Lab directors, MMET Dept, OIT, Klamath Falls, OR, 97603, USA

The goals of this project at Oregon Tech (OIT) are to obtain learning objectives and experience hands-on knowledge throughout the opportunity to build an autonomous robotic submarine given by UTEAP and AFRIP awards sponsored by Oregon NASA Consortium while strengthening theoretical aspects together at the 2021 RoboSub competition, even in restricted situations (online this year). The purpose of our project is to design and manufacture a functional autonomous robotic submarine capable of completing a couple of tasks underwater including passing through a mandatory gate. From last year we have been fortunate to work at home remotely even in the spring term, July and also came to school labs in the early August even in the Pandemic so that we were able to build the vehicle through utilizing OIT machine shops and robotics lab while testing in a limited capacity, though, for essential propulsion test under autonomous mode. To continue and complete the project this year, students have designed four candidates for the 2021 RoboSub competition. With thorough design matrix and thorough discussion, we selected the final version of hull and frame for the Competition that enables our strengths to focus on navigation to complete as many tasks as possible such as dropping magnetic markers (like bombs) into 2 bins while shooting a torpedo either a target (Bootlegger or G-man) after opening via a robotic arm. Thanks to the participation of computer/embedded/software teams from robotics club, we were able to develop upon last year’s system with a hardware package consisting of a new Raspberry Pi 4 (SBC) with Raspbian OS, Arduino Mega, and a new AHRS IMU device (WT61). Python and C++ are our main languages, Python being for the main application, and C++ is used both for compiling in the visual studio, GUIs that generates the state machine for mission control to develop competition strategies, and OpenCV/TensorFlow to incorporate image and vision system and also certain libraries to communicate with the IMU related to propulsion system. We have built a virtual simulation with 3D models using Unity to make scenarios as shown in Sec. 4. After fixing water leak, buoyance, and balance of the robotic submarine, we tested basic motions such as heading and depth and attitude control while practicing roll, pitch, and yaw motion with IMU sensors and then, applied navigations using vision and image processing based on previous competition tasks – gate and buoys. We demonstrated the vehicle motion with a borrowed Deep Learning neural network model for detection targets under OpenCV applying to captured videos taken videos at the competition venue and improved the system performance.

Acknowledgement: This project is partially sponsored by under the contract, NASA 80NSSC20M0035. We’d like to thank OIT MMET senior project team & Robotics Club members, MMET Dept chairperson, Dean of COEM, and Dean of Student Affairs.

Curriculum Vitae – Dongbin "don" Lee, Ph.D.

Mechanical, Manufacturing Engineering and Technology,
Oregon Institute of Technology, 3201 Campus Dr, Klamath Falls, OR 97603, USA
Graduate Program Director/Robotics Lab Director at OIT
NASA OSGC Affiliate Professor/OMIC Affiliate Professor
Email: don.lee@oit.edu

Education

PhD in EE, Robotics and Intelligent program, Clemson University, SC, USA (2009)
PhD coursework, Robotics in the school of Robotics (formerly, CIE), Kwangwoon University,
MS in Control and Instrumentation Engineering (CIE), Kwangwoon University,
BS in ECE, Kwangwoon University

Research and Teaching Positions

• Robotics, Mechatronics, and Smart Sensing Tech for Production Lines
• Robot Modeling with Statics/Kinematics/Dynamics,
• Robotic Unmanned Vehicle Systems and Applications from Air to Underwater
• Robotic System Design, Analysis, Estimation, GN&C (Guidance, Navigation and Control)
• Aerospace Autonomy for UAS, Satellite, Rocketry and CubeSats
• Robotic System Controls with Non-/Linear Solutions
• Adaptive, Robust, Output/State Feedback, Nonlinear Controls w/State-space method
• Digitally transformed Skills for Industry 4.0 Manufacturing, Precision Ag, and Cleantech Technologies
• Machine-/Deep Learning/Artificial Intelligence/Computational Intelligence
Computer Programming Skills: MATLAB/Simulink, C/C++, Python, Visual BASIC, Minitab, HIL, ROS, Gazebo, Unity, Linux, Quanser Real-time OS, LabVIEW, SignalExpress, AutoCAD, SketchUp, etc.,
Hardware: Arduino/Raspberry Pi, Measurement and instrumentation systems, and basic manufacturing tools.

Selected Refereed Journal Articles (last 5 years)

1. Sajina Pradhan, Suk-seung Hwang*, Dongbin Lee, Mathematical Analysis of Line Intersection and Shortest Distance Algorithms, Vol.14, Issue 5, Journal of Energies, {DOI: 10.3390/en14051492}

2. Tae-Yun Kim, Dongbin Lee, and Suk-Seung Hwang, "Performance Analysis of AOA Estimation for Concentric Ring Array Antenna in Beamforming Satellite System", Journal of KIECS Vol.15, No. 4, pp.643-650, Aug. 2020, {DOI: 10.13067/JKIECS.2020.15.4.643}

3. Dongbin Lee and Eklas Hossain, Guest Editor of a book, Modeling, Optimization, and Control of Electric Power and Energy Systems, Energies (IF:2.702, CiteScore: 3.8), MDPI, Nov. 2020 – Present

4. Bandar Alghamdi, Dongbin Lee, Patrick Schaeffer, and Joe Stuart, "An Integrated Robotic System:2D-Vision based Inspection Robot with Automated PLC Conveyor System," Control, Dynamic Systems, and Robotics (CDSR) 2017, Toronto, {DOI: 10.11159/cdsr17.136}, Aug. 2017

5. Dongbin Lee (Editor), Nonlinear Systems: Design, Analysis, Estimation and Control, Intechopen Publishing, co-editor with Timothy C. Burg, and Christopher Volos, Oct. 2016

6. Dongbin Lee and Timothy C. Burg, "Lyapunov-based Control of Unmanned Aerial Vehicle Designed via Stability Analysis," Chapter 12 in Control Theory: Perspectives, Applications and Developments, Nova Science Publishers, ISBN: 978-1-63482-730-0, Oct. 2015

ABSTRACT

Graph Neural Networks for Decentralized Multi-Robot Submodular Action Selection

Lifeng Zhou, Ph.D.

GRASP lab, University of Pennsylvania, Philadelphia, USA

We develop a learning-based approach for decentralized submodular maximization. We focus on applications where robots are required to jointly select actions, e.g., motion primitives, to maximize team submodular objectives with local communications only. Such applications are essential for large-scale multi-robot coordination such as multi-robot motion planning for area coverage, environment exploration, and target tracking. To this end, we propose a general-purpose learning architecture towards submodular maximization at scale, with decentralized communications. Particularly, our learning architecture leverages a graph neural network (GNN) to capture local interactions of the robots and learns decentralized decision-making for the robots. We train the learning model by imitating an expert solution and implement the resulting model for decentralized action selection involving local observations and communications only. We demonstrate the near-expert coverage performance, fast running time, and transferability of the proposed approach in a scenario of active target coverage with large networks of robots.

Curriculum Vitae – Dr. Lifeng Zhou

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Education

- August 2016 - May 2020 : Virginia Tech, Blacksburg, USA
  Ph.D. in Electrical & Computer Engineering / Advisor: Pratap Tokekar
- September 2013 - March 2016 : Shanghai Jiao Tong University, Shanghai, China
  M.S. in Control Science & Engineering / Advisor: Shaoyuan Li
- September 2009 - June 2013 : Huazhong University of Science & Technology, Wuhan, China / B.S. in Automation

Research and Teaching Positions

- Postdoctoral Researcher, GRASP lab, University of Pennsylvania, Philadelphia, USA (10/2020-present)
- Research Associate, Dept. of Electrical & Computer Engineering, Virginia Tech, Blacksburg, USA (5/2020-9/2020)
- Visiting Scholar, Dept. of Computer Science, University of Maryland, College Park, USA (9/2019-4/2020)
- Research Assistant, Dept. of Electrical & Computer Engineering, Virginia Tech, Blacksburg, USA (8/2016-8/2019)
- Research Assistant, Key Laboratory of Distributed System Optimization, Shanghai, China (9/2013-3/2016)
- Industry Internship, GE China Power Conversion, Shanghai, China (1/2015-3/2015)
- Research Assistant, Key Laboratory of Industrial Automation, Wuhan, China (7/2012-9/2012)
- Guest Lecturer, Resilient and Risk-Aware Submodular Maximization (9/2019)
- Teaching Assistant, ECE 4405: Control Systems (Fall 2016)

Selected Refereed Journal Articles (last 5 years)

[J12] J. Liu, L. Zhou, P. Tokekar, R. K. Williams, "Distributed Resilient Submodular Action Selection in Adversarial Environments," IEEE Robotics and Automation Letters. Note: submitted.
[J11] L. Zhou and P. Tokekar, "Multi-Robot Coordination and Planning in Uncertain and Adversarial Environments," Current Robotics Reports. Note: submitted.
[J10] L. Zhou, V. Tzoumas, G. J. Pappas, and P. Tokekar, "Distributed Resilient Submodular Maximization for Multi-Robot Planning," IEEE Transactions on Robotics (T-RO). Note: submitted.
[J9] L. Zhou and P. Tokekar, "Risk-Aware Submodular Optimization for Multi-Robot Coordination," IEEE Transactions on Robotics (T-RO). Note: submitted.
[J8] Z. Zhang, L. Zhou, and P. Tokekar, "Strategies to Inject Spoofed Measurement Data," Robotics and Autonomous Systems. Note: submitted.

[J7] Z. Zhang, J. Lee, J. M. Smereka, L. Zhou, Y. Sung, and P. Tokekar, "Tree Search Techniques for Minimizing Detectability and Maximizing Visibility," Autonomous Robots. Note: accepted.
[J6] L. Zhou and P. Tokekar, "Sensor Assignment Algorithms to Improve Observability while Tracking Targets," IEEE Transactions on Robotics (T-RO), 35(5), pp. 1206-1219, 2019. Note: also accepted and presented at ICRA 2020.
[J5] L. Zhou, V. Tzoumas, G. J. Pappas, and P. Tokekar, "Resilient Active Target Tracking with Multiple Robots," IEEE Robotics and Automation Letters, 4(1): pp. 129-136, 2019. Note: also accepted and presented at ICRA 2019.
[J4] L. Zhou and P. Tokekar, "Active Target Tracking with Self-Triggered Communications in MultiRobot Teams," IEEE Transactions on Automation Science and Engineering (T-ASE), 16(3): pp. 1085- 1096, 2019.
[J3] L. Zhou and S. Li, "Distributed Model Predictive Control for Multi-Agent Flocking via Neighbor Screening Optimization," International Journal of Robust and Nonlinear Control, 27(9): pp. 1690-705, 2017.

ABSTRACT

Advanced V2V Authentication for Roadside Infrastructure-less Vehicular Network

Kiho Lim

William Paterson University of New Jersey, USA

Advancement of autonomous driving and vehicular ad-hoc networks (VANETs) have demanded many applications requiring vehicle-to-vehicle (V2V) communications as vehicles cooperatively share their traffic information (collected by sensors) with each other to improve driving safety, traffic efficiency and convenience. In order to secure V2V communications, authentication has been carried out in the presence of the central trusted authority and infrastructures. However, the scenarios where the infrastructures are not available have not been addressed well. In this presentation, we introduce an advanced V2V Authentication scheme for roadside infrastructure-less vehicular networks to authenticate vehicles locally without involvement of a trusted authority and infrastructures. Our protocol utilizes the sensors installed in vehicles to verify the shared surrounding objects. The proposed scheme is robust against possible security threats (e.g., location spoofing attack and man-in-the-middle attack). An extensive simulation was also conducted in an autonomous driving environment to evaluate our scheme.

Curriculum Vitae – Dr. Kiho Lim

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Education

• Doctor of Philosophy in Computer Science, University of Kentucky (08/2016)
  - Thesis: Secure and authenticated message dissemination in Vehicular Networks and an incentive-based architecture for Vehicular Cloud / Advisor: Dr. D. Manivannan
• Master of Science in Computer Science, University of Kentucky (05/2012)
  - Thesis: A Protocol Suite for Vehicular Ad-hoc Networks / Advisor: Dr. D. Manivannan
• Bachelor of Engineering in Computer Engineering, Chosun University, South Korea (08/2007)

Research and Teaching Positions

• Assistant Professor, Director of Cybersecurity Lab, Department of Computer Science, William Paterson University of New Jersey (08/2019-Present)
• Assistant Professor, Department of Computer Science, University of South Dakota (08/2016-07/2019)
• Graduate Research Assistant, Computer Science, University of Kentucky (08/2013-05/2016)
  - Designing secure routing protocols and architecture for vehicular networks
  - Modeling a secure incentive-based architecture for vehicular cloud
• Graduate Teaching Assistant, Computer Science, University of Kentucky (08/2008-12/2015).
  - Lecturer and lab instructor
  - Courses: Intro to Computing I, Intro to Program Design, Abstraction and Problem Solving (C++)
• Graduate Research Assistant, Library Science, University of Kentucky (05/2013-08/2013, 11/2010- 02/2011)
  - Lecturer and lab instructor
  - Courses: Intro to Computing I, Intro to Program Design, Abstraction and Problem Solving (C++)

Selected Refereed Journal Articles (last 5 years)

1. G.H. Choi, K. Lim*, and S. B. Pan. "Driver Identification System Using Normalized Electrocardiogram Based on Adaptive Threshold Filter for Intelligent Vehicles." Sensors, 21(1), 202. 2021.
2. T. Hong, J. A. Choi, K. Lim*, and P. Kim. "Enhancing Personalized Ads Using Interest Category Classification of SNS Users Based on Deep Neural Networks." Sensors, 21(1), 199. 2021.
3. J. A. Choi and K. Lim*. Identifying machine learning techniques for classification of target advertising. Information & Communications Technology Express, Artificial Intelligence and Data Science, 6(3), 175- 180. Elsevier. September 2020.
4. H. Kim, J. Ben-Othman, L. Mokdad, and K. Lim. CONTVERB: Continuous Virtual Emotion Recognition Using Replaceable Barriers for Intelligent Emotion-Based IoT Services and Applications. IEEE Network, 34(5), 269-275. 2020.
5. X. Wang, M. Nguyen, J. Carr, L. Cui and K. Lim. A group preference-based privacy-preserving POI recommender system. Information & Communications Technology Express, Artificial Intelligence and Data Science. 6(3), 204-208. Elsevier. September 2020.
6. K. Lim, W. Liu, X. Wang, and J. Joung. "SSKM: Scalable and Secure Key Management Scheme for Group Signature Based Authentication and CRL in VANET." Electronics, 8(11), 1330. November 2019. 7. K. Lim and D. Manivannan. "An efficient protocol for authenticated and secure message delivery in vehicular ad hoc networks." Vehicular Communications, 4, 30-37. Elsevier. April 2016.
(Note: * indicates the corresponding author of publications resulted from joint research with students or postdocs under my direct advising.)

ARC - Actor Residual Critic for Adversarial Imitation Learning

Ankur Deka

Carnegie Mellon University (CMU)

Adversarial Imitation Learning (AIL) is a class of popular state-of-the-art Imitation Learning algorithms where an artificial adversary's misclassification is used as a reward signal and is optimized by any standard Reinforcement Learning (RL) algorithm. Unlike most RL settings, the reward in AIL is differentiable but model-free RL algorithms do not make use of this property to train a policy. In contrast, we leverage the differentiability property of the AIL reward function and formulate a class of Actor Residual Critic (ARC) RL algorithms that draw a parallel to the standard Actor-Critic (AC) algorithms in RL literature and uses a residual critic, C function (instead of the standard Q function) to approximate only the discounted future return (excluding the immediate reward). ARC algorithms have similar convergence properties as the standard AC algorithms with the additional advantage that the gradient through the immediate reward is exact. For the discrete (tabular) case with finite states, actions, and known dynamics, we prove that policy iteration with C function converges to an optimal policy. In the continuous case with function approximation and unknown dynamics, we experimentally show that ARC aided AIL outperforms standard AIL in simulated continuous-control and real robotic manipulation tasks. ARC algorithms are simple to implement and can be incorporated into any existing AIL implementation with an AC algorithm.

Curriculum Vitae – Dr. Ankur Deka

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Education

Robotics Institute, Carnegie Mellon University (CMU) (4.0/4.0, Current)
MS in Robotics (2019–2021 expected)
Indian Institute of Technology (IIT) Guwahati (9.16/10)
BTech in Electronics and Communication Engineering, Minor Computer Science (2015–2019)

Research and Teaching Positions

- Research Intern, ATR Intelligent Robotics and Communication Labs, Japan (May 2018–July 2018)
  Supervisors: Vishnu K. Narayanan, Takahiro Miyashita
  Improved Social Attention, Vemula et al. which uses spatio-temporal graph to predict pedestrian trajectory. Contributions were the use of local coordinate system, incorporating local obstacle map and formulating an improved attention model. Proposed approach performs better than state-of-the art methods Social LSTM and Social Attention on two publicly available datasets. Also worked on joint prediction-planning pipeline for human-aware robot path planning.
- Research Intern, Iwahori Computer Vision Lab, Chubu University, Japan (May 2017–July 2017)
  Supervisor: Yuji Iwahori
  Formulated a Dense SLAM pipeline to recover 3D shape from 2D images of endoscopic polyp. The shape of polyp can provide information for cancer detection to a medical practitioner or a machine learning classifier.
- Conducting Robotics and Electronics Workshop, India (Dec 2016 - Jul 2019)
  Started an initiative named IgnoTech to inculcate the passion for technical skills in college and school students due to the lack of opportunities in my hometown. We have taught topics like basic C# programming, micro-controllers, sensors and actuators to more than 200 students so far.

Selected Refereed Journal Articles (last 5 years)

1. Ankur Deka, Katia Sycara, "Natural Emergence of Heterogeneous Strategies in Artificially Intelligent Competitive Teams", Spotlight talk in RSS 2020 workshop "Heterogeneous Multi-Robot Task Allocation and Coordination".
2. Ankur Deka, Vishnu K. Narayanan, Takahiro Miyashita, Norihiro Hagita, "Adaptive Attention-Aware Pedestrian Trajectory Prediction for Robot Planning in Human Environments", in IEEE/RSJ IROS 2018 workshop "From Freezing to Jostling Robots: Current Challenges and New Paradigms for Safe Robot Navigation in Dense Crowds".
3. Ankur Deka, Yuji Iwahori, M. K. Bhuyan, Pradipta Sasmal, Kunio Kasugai, "Dense 3D Reconstruction of Endoscopic Polyp", in Bioimaging 2018. (BEST POSTER AWARD in Bioimaging 2018, Portugal)
4. Sushmita Das, Ankur Deka, Yuji Iwahori, M. K. Bhuyan, Takashi Iwamoto, Jun Ueda, "Contour-Aware Residual W-Net for Nuclei Segmentation", accepted to KES 2019 special session on Computational Intelligence System and Applications.

Bio-Syncretic Robotics by Integrating Living Materials and Nonliving Systems

Wenxue Wang

Shenyang Institute of Automation, Chinese Academy of Sciences

Advances of science and technology enables the human-robot interaction closer and closer. In this talk, the speaker will present a new generation of robots with the physical and information integration of living systems and electromechanical systems at the levels of cells and tissues, leading to the biohybrid/bio-syncretic robots. The speaker will review the current research status of bio-syncretic robotics, discuss the challenges in the research of bio-syncretic robotics, and then present his recent research achievements in bio-syncretic robotics.

Funding : The research is funded by the National Natural Science Foundation of China and the National Key R&D Program of China.

Curriculum Vitae – Dr. Wenxue Wang

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Education

- PhD in Systems Science and Mathematics, Department of Electrical and Systems Eng., Washington University in Saint Louis, USA (2006)
- M. Sc. in Operation Research and Control Theory, Institute of Systems Science, Chinese Academy of Sciences, China (1999)
- B. Sc. in Automatic Control, Beijing Institute of Technology, China (1996)

Research and Teaching Positions

- Professor, Shenyang Institute of Automation, Chineses, Academy of Sciences, China(Oct 2012-July Current)
- Post-Doctoral Research Associate, Department of Chemical Engineering, Institute for Collaborative Biotechnologies, University of California Santa Barbara, USA (Sept 2008-Aug 2012)
- Post-Doctoral Research Associate, Dept of Mathematics and Statistics, Texas Tech University, USA (Sept 2006-Aug 2008)
- Research Assistant, Dept of System Science and Mathmatics, Washington University in Saint Louis, USA (Sept 1999-Jun 2006)

Selected Refereed Journal Articles (last 5 years)

1. Yang J, Li G, Wang W, Shi J, Li M, Xi N, Zhang M, Liu L (2021) A Bio-syncretic Phototransistor Based on Optogenetically Engineered Living Cells. Biosensors and Bioelectronics 178, 113050.
2. Li N, Yang T, Yang Y, Yu P, Xue X, Zhao X, Song G, Elhajj IH, Wang W, Xi N, Liu L (2020) Bioinspired Musculoskeletal Model-based Soft Wrist Exoskeleton for Stroke Rehabilitation. Journal of Bionic Engineering , 17, 1163.
3. Hu Y, Wang W, Liu H, Liu L (2019) Reinforcement Learning Tracking Control for Robotic Manipulator with Kernel-based Dynamic Model. IEEE Transactions on Neural Networks and Learning Systems, 31(9), 3570.
4. Li G, Wang F, Yang W, Wang W, Li G, Wang Y, Liu L (2019) Imaging with Optogenetically Engineered Living Cells as a Photodetector. Advanced Biosystems, 3(8), 1800319.
5. Liu L, Zhang C, Wang W, Xi N, Wang Y (2018) Regulation of C2C12 Differentiation and Control of Beating Dynamics of Contractile Cells for Muscle-driven Bio-syncretic Crawler by Electric Stimulation. Soft Robotics, 5(6), 748.
6. Zhang C, Shi J, Wang W, Xi N, Wang Y, Liu L (2018) Dynamic model for characterizing contractile behaviors and mechanical properties of a cardiomyocyte. Biophysical Journal, 114(1), 188.
7. Li G, Yang J, Wang W, Wang F, Wang Y, Wang W, Liu L (2018) Label-free multidimensional information acquisition from optogenetically engineered cells using a graphene transistor. Nanoscale, 10(5), 2285.
8. Li G, Yang J, Yang W, Wang Y, Wang W, Liu L (2017) 2D Normalized Iterative Hard Thresholding Algorithm for Fast Compressive Radar Imaging. Remote Sensing, 9(6), 619.
9. Wang B, Wang W, Wang Y, Liu B, Liu L (2017) Dynamical Modeling and Analysis of Viscoelastic Properties of Single Cells. Micromachines, 8(6), 171.
10. Zhang C, Shi J, Wang W, Xi N, Wang Y, Liu L (2017) Simultaneous Measurement of Multiple Mechanical Properties of Single Cells Using AFM by Indentation and Vibration. IEEE Transactions on Biomedica l Engineering, 64(12), 2771.

ABSTRACT

Application of Modern Technology on Smart Swine Farming

Shad Mahfuz[1] and C-J Yang[2]

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In recent years, the world has seen rapid changes in the dynamics and efficiency of pig production. Modern pig production should therefore be based not only on a modern infrastructure and a precisely designed feeding program, but also on the use of modern technologies for monitoring, health, welfare and production of the entire herd. Smart farming refers to the application of Information and Communication Technology (ICT) in farming system. ICT-based smart livestock farming system as a development strategy for the animal industry, is the time demanding issue. Modern technology applications in smart farming and precision farming through IoT, ICT, Bigdata, Robotics will enable the industry to increase operational efficiency, lower costs, reduce waste, and improve the product quality. The Internet of Things (IoT) technology, based on the wireless sensor network, is developing rapidly and permeating into agriculture including livestock farming. Through this smart farming system, all the farming parameters can be monitor or handle or control by a software application or PIC (Programmable intelligent computers). Now, IoT technology has the potential to significantly influence smart swine farming by using real-time sensing, data analysis, information technology, and decision-making to improve animal health, welfare and production efficiency. The application of IoT technology in swine farming can provide accurate data on fed intake, water intake, body weight, illness data, movement, behavior, excretion of feces, vaccination, and medical treatment etc. which ultimate can ensure the better production. Besides, the technological advances in feeding and rearing, modern farmers impose high requirements on the swine shed environment. Sensor bases monitoring technologies can provide a scientific management and help to raise management efficiency. Thus the application of ICT knowledge in swine industry would be beneficial for the next generation.

Curriculum Vitae – Dr. Shad Mahfuz

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Education

- Post Doctorate in Animal Nutrition, China Agricultural University (2021)
- PhD in Animal Nutrition and Fed Science, Jilin Agricultural University (2018)
- MS in Animal Nutrition, Sylhet Agricultural University (2012)
- Doctor of Veterinary Medicine (DVM), Sylhet Agricultural University (2009)

Research and Teaching Positions

- Associate Professor, Department of Animal Nutrition, Sylhet Agricultural University, Bangladesh (7-2018-continue)
- Post Doc Fellow, State key laboratory of Animal Nutrition, China Agricultural University, Beijing, China (4/2019-1/2021)
- Assistant Professor, Department of Animal Nutrition, Sylhet Agricultural University, Bangladesh (8/2012-6/2018)
- Lecturer, Department of Animal Nutrition, Sylhet Agricultural University, Bangladesh (8/2010-7-2012)

Selected Refereed Journal Articles (last 5 years)

1. Shad Mahfuz, Qinghui Shang and Xiangshu Piao (2021) Phenolic compounds as natural feed additives in poultry and swine diets-review. Journal of Animal Science and Biotechnology 12:48.

2. Shad Mahfuz, Tengfei He, Jiayu Ma, Hansuo Liu, Shenfei Long, Qinghui Shang, Lianhua Zhang, Jingdong Yin, and Xiangshu Piao (2020) Mushroom (Flammulina velutipes) stem residue on growth performance, meat quality, antioxidant status and lipid metabolism of broilers. Italian Journal of Animal Science19 (1):803-812.

3. Shad Mahfuz and Xiang Shu Piao (2019) Application of moringa (Moringa oleifera) as natural feed supplement in poultry diets- A Review. Animals, 9, 431.

4. Shad Mahfuz, Hui Song, Yue Miao, and Zhongjun Liu (2018) Dietary inclusion of mushroom (Flammulina velutipes) stem waste on growth performance, and immune response in growing layer hens. Journal of the Science of Food and Agriculture, 99(2):703-710.

5. Shad Mahfuz, Hui Song, Zhongjun Liu, Xinyu Liu, Zipeng Diao, Guihong Ren, Zhixin Guo, and Yan Cui (2018) Effect of golden needle mushroom (Flammulina velutipes) stem waste on laying performance, calcium utilization, immune response and serum immunity at early phase of production. Asian-Australasian Journal of Animal Science, 31 (5), 705-711.

ABSTRACT

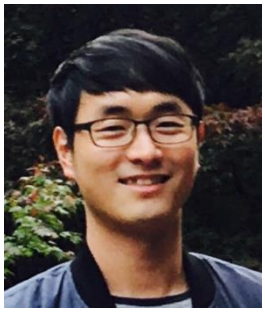
Map Merging Algorithms and Systems for Multi-Robot SLAM

Heoncheol Lee

Department of IT Convergence Engineering, School of Electronic Engineering,
Kumoh National Institute of Technology

Simultaneous localization and mapping (SLAM) is one of the important techniques to implement autonomous robot navigation systems in unknown or partially known environments. By SLAM, a robot can estimate its pose with the equipped sensor system while building a map of surrounding environments. Multi-robot SLAM is to conduct SLAM using multiple robots to improve the efficiency of multi-robot systems. The key technique for multi-robot SLAM is *map merging* which is to acquire an accurate collective map from individual maps built by different multiple robots exploring given environments. Map merging can be easily implemented if the relative position and orientation between robots are given from a global positioning system or a motion capture system at the start or during operation. However, if they are not given, robots have to find a map transformation between them to build a collective map. If relative initial poses are known, the map transformation can be easily obtained since the robot poses can be represented in a common coordinate system at the start. However, even if they are unknown, a collective map should be obtained by map merging methods which can be divided into direct map merging methods and indirect map merging methods. Direct map merging methods is to find a map transformation by using observation measurements from an internal onboard sensor system or an external structural sensor system. Indirect map merging methods is to find a map transformation by autonomously finding and matching the overlapping areas between individual grid maps. In this talk, various direct and indirect map merging algorithms and systems will be presented with experimental results. Several remaining issues in map merging for multi-robot SLAM will be also addressed for future works.

Funding: This work was supported in part by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. 2019R1G1A1100597), and in part by the Grand Information Technology Research Center Program through the Institute of Information & Communications Technology and Planning & Evaluation (IITP) funded by the Ministry of Science and ICT (MSIT), Korea (IITP-2020-2020-0-01612).



Curriculum Vitae – Prof./Dr. Heoncheol Lee

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Education

- Ph.D. in Electrical Engineering and Computer Sciences, Seoul National University (2013)
- M.S. in Electrical Engineering and Computer Sciences, Seoul National University (2008)
- B.S. in Electronic-Electrical Engineering & Computer Sciences, Kyungpook National University (2006)

Research and Teaching Positions

- Assistant Professor, School of Electronic Engineering, Kumoh Nat'l Inst. of Technology (2019-cur.)
- Senior Researcher, Agency for Defense Development (ADD) (2013-2019)
- Lecturer, Dept. of Computer and Communication Engineering, Seoul Cyber University (2012-2013)
- Researcher, Automation and Systems Research Institute (2011-2013)

Selected Refereed Journal Articles (last 5 years)

1. Heoncheol Lee and Seunghwan Lee, "Extended Spectra-based Grid Map Merging with UnilateralObservations for Multi-Robot SLAM," IEEE Access, vol. 9, pp. 79651-79662, May 2021.
2. Heoncheol Lee, "Selective Spectral Correlation for Efficient Map Merging in Multi-Robot Systems," Electronics Letters, vol. 57, no. 9, pp. 351-353, Mar. 2021.
3. Heoncheol Lee and Seunghwan Lee, "Grid Map Merging with Insufficient Overlapping Areas for Efficient Multi-Robot Systems with Unknown Initial Correspondences," IEEE International Conference on Systems, Man, and Cybernetics (SMC), Oct. 2020.
4. Heoncheol Lee, "One-Way Observation-based Cooperative Robot Mapping," IEEE International Conference on Automation Science and Engineering (CASE), Aug. 2020.
5. Heoncheol Lee and Kipyo Kim, "Real-Time Monte Carlo Optimization on FPGA for the Efficient and Reliable Message Chain Structure," Electronics, vol. 8, no. 8, pp. 866(1-18), Aug. 2019.

Team - Future Mobility Lab's Entry to the 2020 University Student Autonomous Driving Contest

Sung, Woosuk

School of Mechanical System & Automotive Engineering, Chosun University

The main mission given in the contest we entered, the 2020 University Student Autonomous Driving Contest (ADC), can be simply described as robo-taxi services on public roads. As a robo-taxi will serve in the future, vehicles in the contest are expected to convey passengers between locations of their choice. During the contest, actual passengers do not hail from the street, though. Instead, their ride-hailing is simulated by tens of virtual calls for a ride that are broadcast over a vehicular communication system, which is often called V2X. The vehicles in the contest are evaluated in the following manner. The vehicles earn points if they pick up passengers and safely drop them off at their destination. Their earned points are deducted if the vehicles violate traffic rules. The same is applied to the vehicles if they issue take-over requests (TOR) to an attendant so as to avoid possible system failures in the presence of component faults. The vehicles will be finally ranked by the cumulative points gained during the contest. We won the 5th place and in this talk, we briefly introduce key functions we designed and implemented to our vehicle.

Funding : This research was funded by the Ministry of Trade, Industry & Energy, Korea.

Curriculum Vitae – Dr. Sung, Woosuk

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Education

- Ph.D. in Chemical Engineering, Ajou University (2016)
- M.S. in Electrical Engineering, Louisiana State University (2006)
- B.S. in Mechanical and Electrical Engineering (double major), Sungkyunkwan University (2003)

Professional Activities and Services

- Assistant Professor, Chosun University (Mar 2017-current)
- Senior Research Engineer, Hyundai Motor Group (Jan 2014-Dec 2016)
- Research Engineer, Hyundai Motor Group (Sep 2006-Dec 2013)

Selected Refereed Journal Articles (last 5 years)

1. Sung W, Lee J (2019) Implementation of SOH Estimator in Automotive BMSs Using Recursive Least-Squares. Electronics 8 (11), 1237.
2. Sung W, Lee J (2018) Improved Capacity Estimation Technique for the Battery Management Systems of Electric Vehicles Using the Fixed-Point Iteration Method. Computers and Chemical Engineering 117 (2), 283.
3. Sung W, Choi J-H, Lee J (2016) Robust and Efficient Capacity Estimation Using Data-Driven Metamodel Applicable to Battery Management System of Electric Vehicles. Journal of Electrochemical Society 163 (6), A981.
4. Sung W, Hwang DS, Jeong B-J, Lee J and Kwon T (2016) Electrochemical Battery Model and Its Parameter Estimator for Use in a Battery Management System of Plug-In Hybrid Electric Vehicles. International Journal of Automotive Technology 17 (3), 493.

ABSTRACT

3D Point Cloud Mapping with Only Static Environments Using Convolutional Neural Networks for Classification

Chul Hee Bae and Sejin Lee

Kongju National University

Three-dimensional Lidar sensors are used primarily throughout robotics such as environmental mapping, localization, obstacle avoidance, and autonomous driving. Classifying dynamic and static objects, especially in recognizing the environment, is a major skill in many applications. In previous studies, it was common to identify and analyze the rate of change for motion in the time domain in order to understand these dynamic characteristics. However, if we can semantically classify moving and non-moving objects from a long-term perspective, the static environment can be built.

In this work, we used a convolutional neural network model, one of the deep learning models, to classify the kinds of objects attributed to each point measured with a Lidar sensor. What is important here is the information value put into the network input. The three-layer spherical feature image, represented by the feature values of each point proposed in this paper, is an image representation method that captures the spatial distribution tendency of neighboring points based on the point. Any point can produce an image among points that forms a three-dimensional group of points. The proposed method was verified from several experiments.

Funding : This work was supported by Institute of Information & communications Technology Planning & Evaluation (IITP) grant funded by the Ministry of Science and ICT (No.2018-0-00205, Development of Core Technology of Robot Task-Intelligence for Improvement of Labor Condition)

Curriculum Vitae – Dr Lee Sejin

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Education

PhD in Mechanical Engineering, Pohang University of Science and Technology (POSTECH) (2009) MS in Mechanical Engineering, Pohang University of Science and Technology (POSTECH) (2005) BS in Mechanical Engineering, Hanyang University (2003)

Research and Teaching Positions

- Director, Applied Intelligence & Robotics (AIR) Lab, Kongju Natl. Univ. (9/2013-current)
- Associate Professor, Division of Mechanical and Automotive Engineering, Kongju National University (9/2017-current)
- Assistant Professor, Division of Mechanical and Automotive Engineering, Kongju National University (9/2013-8/2017)
- Assistant Professor, Department of Applied Robotics, Kyungil University (3/2011-8/2013)
- Teaching Professor, Department of Mechanical Engineering, Seoul National University of Science and Technology (3/2010-4/2011)
- Research Professor, Department of Mechanical Engineering, Korea University (8/2009-4/2010)
- PhD candidate, Mechanical Engineering, POSTECH (3/2005-8/2009)
- MS candidate, Mechanical Engineering, POSTECH (3/2003-2/2005)
- BS candidate, Mechanical Engineering, Hanyang University (3/1996-2/2003)

Selected Refereed Journal Articles (last 5 years)

1. Sun-Woong Paik and Sejin Lee (2020) Development of Binarization Method of Sonar Image Based on Gabor Filter for Underwater Obstacle Detection. J. Korean Soc. Mech. Technol. 22(5), 839-844.
2. Eon-ho Lee, Yeongjun Lee, Jinwoo Choi and Sejin Lee (2020) Study on Underwater Object Tracking Based on Real-Time Recurrent Regression Networks Using Multi-beam Sonar Images. Journal of Korea Robotics Society 15(1), 8-15.
3. Huu Thu Nguyen, Eon-Ho Lee, Chul Hee Bae and Sejin Lee (2020) Multiple Object Detection Based on Clustering and Deep Learning Methods. MDPI Sensors 2020 20, 4424.
4. Byungjae Park and Sejin Lee (2019) Robust range-only beacon mapping in multipath environments. ETRI Journal, DOI: 10.4218/etrij.2018-0614.
5. Eon-Ho Lee, Yeongjun Lee, Jinwoo Choi and Sejin Lee (2019) Study of Marker Detection Performance on Deep Learning via Distortion and Rotation Augmentation of Training Data on Underwater Sonar Image. Journal of Korea Robotics Society 14(1), 14-21.
6. Chul Hee Bae and Sejin Lee (2019) A Study of 3D Point Cloud Classification of Urban Structures Based on Spherical Signature Descriptor Using LiDAR Sensor Data. Trans. Korean Soc. Mech. Eng. A 43(2), 85-91.
7. Huu-Thu Nguyen, Eon-Ho Lee and Sejin Lee (2019) Study on the Classification Performance of Underwater Sonar Image Classification Based on Convolutional Neural Networks for Detecting a Submerged Human Body. MDPI Sensors 2019 20, 94.
8. Byungjae Park, Beom-Su Seo and Sejin Lee (2018) LiDAR Image Segmentation using Convolutional Neural Network Model with Refinement Modules. Journal of Korea Robotics Society 13(1), 8-15.
9. Eon-Ho Lee and Se-Jin Lee (2018) Development of Modified Spherical Signature Descriptor Using 3D Point Cloud Data and Application to Convolutional Neural Network for Urban Structure Classification. J. Korean Soc. Mech. Technol. 20(1), 18-25.

3D Visualization of Cultural Heritage

Liang Li

College of Information Science and Engineering

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This presentation introduces research activities that are part of our international collaboration project to create digital archives of the Borobudur temple (Yogyakarta, Indonesia, UNESCO World Cultural Heritage). The purpose of the project is to perform 3D scanning and create high-quality visual content of the temple. The visual contents help researchers analyze the temple and are available for digitally publicizing the temple to the public. The visual contents include visualization of the main temple building, the reliefs on the stone walls, and the underground foundation construction. One of the most challenging tasks was reconstructing the 3D models of the Karmawibhangga reliefs, which were hidden behind the stone walls and became not visible following the reinforcements during the Dutch era. We introduce our deep-learning-based approach to reconstruct the hidden relief panels into 3D point clouds from old photos. Fused 3D see-through visualization of Borobudur Temple was achieved by combining photogrammetry point cloud data and 3D reconstructed models based on our transparent visualization method.

Acknowledgment:

This work is partially supported by JSPS KAKENHI Grant Number 19KK0256 and the Program for Asia-Japan Research Development (Ritsumeikan University, Japan). Images of the Borobudur temple are presented with the permission of the Borobudur Conservation Office and Research Center for Area Studies (P2W) of the Indonesian Institute of Sciences (LIPI), Indonesia. Photogrammetry scanning point cloud data was provided by the Nara National Research Institute for Cultural Properties, Japan.

Curriculum Vitae – Dr. Liang Li

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Education

- Doctor of Engineering in Information Engineering, Hiroshima University (2011)
- Master of Engineering, Hiroshima University (2008)
- Bachelor of Engineering, Taiyuan University of Technology (2005)

Research and Teaching Positions

- Associate Professor, College of Information Science and Engineering, Ritsumeikan University (Apr. 2018 – current)
- Lecturer, College of Information Science and Engineering, Ritsumeikan University (Apr. 2014 – Mar. 2018)
- Senior Researcher, Ritsumeikan Global Innovation Research Organization, Ritsumeikan University (Apr. 2013 – Mar. 2014)
- Postdoctoral Fellow, Ritsumeikan Global Innovation Research Organization, Ritsumeikan University (Apr. 2011 – Mar. 2013)

Selected Refereed Journal Articles (last 5 years)

1. Xu, R., Liu, T., Ye, X., Liu, F., Lin, L., Li, L., Tanaka, S., Chen, Y. (2021) Joint Extraction of Retinal Vessels and Centerlines Based on Deep Semantics and Multi-Scaled Cross-Task Aggregation. IEEE Journal of Biomedical and Health Informatics, 25 (7), pp. 2722-2732.
2. Li, W., Hasegawa, K., Li, L., Tsukamoto, A., Tanaka, S. (2021) Deep Learning-Based Point Upsampling for Edge Enhancement of 3D-Scanned Data and Its Application to Transparent Visualization. Remote Sensing, 13 (13), 2526.
3. Choi, W., Yanagihara, N., Li, L., Kim, J., Lee, J. (2021) Visuomotor control of intermittent circular tracking movements with visually guided orbits in 3D VR environment. PLoS ONE 16(5), e0251371.
4. Li, L., Hasegawa, K., Tanaka, S. (2020) Recording, Preservation, and Exhibition of Objects and Events: An Approach to Digital Museums of Cultural Heritage, Journal of the Asia-Japan Research Institute of Ritsumeikan University, vol. 2, pp. 166-178.
5. Li, L., Yamada, T., Choi, W. (2020) The Effect of Depth Information on Visual Complexity Perception in Three-Dimensional Textures. Applied Sciences, 10 (15), 5347.
6. Uchida, T., Hasegawa, K., Li, L., Adachi, M., Yamaguchi, H., Thufail, F. I., Riyanto, S., Okamoto, A., Tanaka, S. (2020) Noise-robust transparent visualization of large-scale point clouds acquired by laser scanning. ISPRS Journal of Photogrammetry and Remote Sensing, vol. 161, pp. 124-134.

Object detection based on Mobiletnet for Visually Impaired People in a Raspberry Pi Environment

Jae-Neung Lee

City University of Hong kong

Our proposed device is a smart technology that uses computer vision algorithms combining wearable platforms to help people with visual problems. Our main goal is to improve individual independence to accomplish daily task and ensure safety of the users. Users can avoid obstacle and access information in the surroundings using our proposed system. The design is simple, portable, efficient and could be worn as a headset. Our design includes a sensing module, a controller, and a feedback module. The sensing module includes the camera, an ultrasonic sensor to collect environment data. The controller handles acquired signals from the sensing module (signal processing, distance calculation, sends command to feedback module and perform other functions). The feedback module, including 2 vibration motors and a speaker, handles command signals from host controller and display corresponding outputs (i.e. audio or haptic).

Curriculum Vitae – Dr. Jae-Neung Lee

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Education

• Chosun University South Korea, Bachelor of Science, major in Machine learning (2006.03 - 2013.02)
• Chosun University South Korea, Master of Science, major in deep learning, motion analysis, ECG biometrics (2013.03 - 2015.02)
• Chosun University, South Korea PhD Degree, major in Machine learning, motion analysis, ECG biometrics, face recognition (2015.03 - 2019.08)
• CITY University of Hong kong, Hong Kong Pstdoctoral fellowship (2019.11 - 2021.06)

Research and Teaching Positions

• Research assistant of chosun university in 2015
• Teaching university student for electronic engineering circuit design from 2015 to 2018
• CITY University of Hong Kong from Nov 2020 to June 2021

Selected Refereed Journal Articles (last 5 years)

1. Jae-Neung Lee, Keun-Chang Kwak, "Personal identification using a robust EigenECG network based on time-frequency representations of ECG signals", IEEE Access, vol. 7, pp. 48392–48404, March 2019. DOI: 10.1109/ACCESS.2019.2904095
2. Jae-Neung Lee, Yeong-Hyeon Byeon, Sum Bum Pan, and Keun-Chang Kwak, An EigenECG network approach based on PCANet for personal identification from ECG signal", Sensors. vol. 18, no. 11, pp. 1–25, Nov 2018. DOI: 10.3390/s18114024
3. Yeong-Hyeon Byeon, Myung-Won Lee, Jae-Neung Lee, Keun-Chang Kwak, "Multilinear EigenECGs and FisherECGs for Individual Identification from Information Obtained by an Electrocardiogram Sensor", Symmetry. vol. 10, no. 10, pp. 1–21, Oct 2018.DOI: 10.3390/sym10100487 2
4. Jae-Neung Lee, Yeong-Hyeon Byeon and Keun-Chang Kwak, "Design of Ensemble Stacked AutoEncoder for Classification of Horse Gaits with MEMS Inertial Sensor Technology", Micromachines, vol. 9, no. 8, pp. 1-17, Aug 2018. DOI: 10.3390/mi9080411
5. Yeong-Hyeon Byeon, Myung-Won Lee, Jae-Neung Lee, Keun-Chang Kwak, "Prediction of dinghy boom direction using intelligent predictor", International Journal of Control Automation and Systems, vol. 16, No.1, pp. 368-376, Jan 2018. DOI: 10.1007/s12555-017-0079-1
6. Jae-Neung Lee, Keun-Chang Kwak, " ECG-based Biometrics Using Deep Network Based on Independent Component Analysis", IEEE ACCESS(Submitting), 2019
7. Jae-Neung Lee, Keun-Chang Kwak, "Classification of Horse Gaits Based on Wavelet Packet and Auto-Encoder for Self-Coaching System", JKIIT, vol. 15. No.5, DOI: 10.14801/jkiit.2017.15.5.1

Anomaly Detection for Smart Manufacturing

Hye-Jin Kim

Electronics Telecommunications Research Institute (ETRI)

Owing to advances in artificial intelligence, smart manufacturing is widely employed, and productivity has rapidly increased. For smart manufacturing, a major application based on machine learning is product quality enhancement by surface and dimension defect detection. Various types of surface defects have been detected using images. However, monocular dimension measurements have not been deeply studied. Instead, stereoscopic sensors, 2D or 3D laser sensors, structured light sensors, etc., are often used to obtain precise thickness measurements. For medium and small producers in industries such as the ceramic industry, these sensors are prohibitively expensive given their mass production and may lead to discontinuity during manufacture. Alternatively, a single monocular image can be used to identify surface and dimension defects. Thus, the high cost and fragility to environmental changes (e.g., temperature and humidity) of most high-precision measurement equipment can be avoided. We introduce a method for 3D measurements of ceramic manufacturing products based on a single image by leveraging depth estimation. As conventional depth estimation is sensitive to two-sided biased data, we propose a magnifier network to amplify parts with critical dimensions in various ranges of the given input dimensions. As deep neural networks may fail to suitably learn partial ranges, we propose a magnifier loss to focus on the data range of interest. The proposed method enables the use of a single image for 3D estimation of ceramic product dimensions and quantitatively outperforms structured light sensing, which is used in this study to obtain the ground-truth reference.

Curriculum Vitae – Dr. Hye-Jin Kim

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Education

• Pursuing Ph.D degree in Korea Advanced Institute of Science and Technology(KAIST)
M.S. in Computer Science and Engineering (GPA 3·94/4·3)
Pohang University of Science and Technology (POSTECH), Republic of Korea, 2003
- Thesis: Analysis of Interaction in Multiple Genes Using Independent Feature Subspace Analysis
- Advisors: Prof. Sung-Yang Bang and Seungjin Choi

• B.S. in Chemical Engineering (Magna cum laude, GPA 3·54/4·3)
Pohang University of Science and Technology (POSTECH), Republic of Korea, 2001
- Thesis: The Protein secondary structure by Neural Network in Bioinformatics
- Advisors: Prof. Byung Jun, Yoon

Research and Teaching Positions

• Learning and Intelligence
- Computer Vision, Machine Learning
- Learning based Depth Extraction, Machine Vision
- Data-Driven Understanding, Anomaly Detection / Classification / Prediction

• Positions Held
- Principal Researcher, Electronics and Telecommunications Research Institute(ETRI), Republic of Korea (May 2004 – Present)
- Researcher, SNU Biomedical Informatics, Seoul National University, Republic of Korea (Jan. 2004 – Apr. 2004)
- Researcher, Intelligent Multimedia Lab, POSTECH, Republic of Korea (Aug. 2003 – Dec. 2003)

Next Generation Multiple Access for Integrated Terrestrial and Aerial Network

Chee Yen (Bruce) LEOW

Wireless Communication Center, University Technology Malaysia

To enable ubiquitous connectivity for emerging applications with extreme requirements in terms of data rate, reliability, latency, energy efficiency and connection density, integrated terrestrial and aerial communication systems have been proposed for the future 6th Generation networks. The use of low altitude platform such as unmanned aerial vehicle (UAV) is able to provide 3-dimensional coverage to complement the existing terrestrial network, while the terrestrial network shall simultaneously serve both the terrestrial users and aerial users. The integrated terrestrial and aerial network poses a new challenge to the multiple access system due to the distinctive aerial and terrestrial channels, diverse service requirements and unique constraints of the aerial and terrestrial users. Non-orthogonal multiple access (NOMA) is a candidate for next generation multiple access technique to address the shortcomings of the existing orthogonal multiple access schemes currently used in existing 5G and legacy networks. NOMA enables sharing of common spectrum resource to simultaneously support both the aerial and terrestrial communication. This presentation starts with the introduction of the basic principle of NOMA and its merits. The first part of the presentation discusses the proposed NOMA scheme for UAV base station which optimizes the spectral efficiency, energy efficiency and coverage. The second part of the presentation elaborates the proposed NOMA scheme for terrestrial base stations which simultaneously meet the coverage and rate requirements of both the aerial and terrestrial users. The presentation concludes with the on-going challenges and future works of NOMA for integrated terrestrial and aerial networks.

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Education

• PhD in Electrical and Electronic Engineering, Imperial College London (2011)

• B. Eng in Computer Engineering, University Technology Malaysia (UTM) (2007)

Research and Teaching Positions

• Associate Professor, School of Electrical Engineering, UTM (Oct 2018 - Current)

• Senior Lecturer, Faculty of Electrical Engineering, UTM (Sep 2011- Sep 2018)

• Research Fellow, Wireless Communication Centre, UTM (Sep 2011- Current)

Selected Refereed Journal Articles (last 5 years)

1. W. K. New, C. Y. Leow, K. Navaie, Y. Sun and Z. Ding. "Interference-Aware NOMA for Cellular-Connected UAVs: Stochastic Geometry Analysis." IEEE Journal on Selected Areas in Communications. (Accepted for Publication, In Press).

2. W. K. New, C. Y. Leow, K. Navaie, and Z. Ding, "Robust Non-Orthogonal Multiple Access for Aerial and Ground Users." IEEE Transactions on Wireless Communications, vol. 19, no. 7, July 2020.

3. M. F. Sohail, C. Y. Leow, and S. Won, "Energy Efficient Non-Orthogonal Multiple Access for UAV Communication System," IEEE Transactions on Vehicular Technology, vol. 68, no. 11, pp. 10834-10845, Nov. 2019.

4. M. F. Sohail, C. Y. Leow and S. Won, "Non-Orthogonal Multiple Access for Unmanned Aerial Vehicle Assisted Communication," in IEEE Access, Vol. 6, pp. 22716-22727, 2018.

5. A. A. Badrudeen, C. Y. Leow, and S. Won, "Performance Analysis of Hybrid Beamforming Precoders for Multiuser Millimeter Wave NOMA Systems,"IEEE Transactions on Vehicular Technology, vol. 69, no. 8, Aug 2020.

6. A. A. Badrudeen, C. Y. Leow and S. Won, "Sub-Connected Structure Hybrid Precoding for Millimeter-Wave NOMA Communications," in IEEE Wireless Communications Letters, vol. 10, no. 6, pp. 1334-1338, June 2021.

Wireless Localization and Sensing in B4G/6G

Sunwoo Kim

Hanyang University

As the beyond 5G and 6G is now coming to our attention, wireless localization is attracting special attentions from academia and industry. Wireless localization is expected to provide unprecedented accuracy due to the increased signal bandwidth, the use of large number antennas, high directivity of the signal, and device-to-device communications. Furthermore, the development of localization leads to the new forms of sensing capability of wireless signal. In this talk, the recent development of wireless localization and the possibility of wireless sensing in B5G and 6G communications will be presented.

Curriculum Vitae – Prof. Sunwoo Kim

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Education

• PhD in Electrical and Computer Engineering, The University of California, Santa Barbara (2005)
• MS in Electrical and Computer Engineering, The University of California, Santa Barbara (2002)
• BS in Electronic Engineering, Hanyang University (1999)

Research and Teaching Positions

• Professor, Elecronic Engineerig, Hanyang University (2005 - Current)
• Director, 5G/Unmanned Vehicle Research Center (2017 - Current)

Selected Refereed Journal Articles (last 5 years)

1. J. Kang, N. Garcia, H. Wymeersch, C. Fischione, G. Seco-Granados, and S. Kim, "Optimizing the mmWave Channel Estimation Duration by Rate Prediction," *IEEE Commun. Lett.*, vol. 25, no. 2, Feb. 2021.

2. S. H. Lim, S. Kim, B. Shim, and J. W. Choi, "Efficient Beam Training and Sparse Channel Estimation for Millimeter Wave Communications Under Mobility," *IEEE Trans. Commun.*, vol. 68, no. 10, pp. 6583-6596, Oct. 2020.

3. H. Kim, K. Granström, L. Gao, G. Battistelli, S. Kim and H. Wymeersch, "5G mmWave Cooperative Positioning and Mapping using Multi-Model PHD Filter and Map Fusion," *IEEE Trans. Wireless Commun.*, vol. 19, no. 6, pp. 3782-3795, Jun. 2020.

4. J. A. del Peral-Rosado, G. Seco-Granados, S. Kim, and J. A. Lopez-Salcedo, "Network Design for Accurate Vehicle Localization," *IEEE Trans. Veh. Technol.*, vol. 68, no. 5, pp. 4316-4327, May 2019.

5. H. Kim, S. W. Choi, and S. Kim, "Connectivity Information-Aided Belief Propagation for Cooperative Localization," *IEEE Wireless Commun. Lett.*, vol. 7, no. 6, pp. 1010-1013, Dec. 2018..

Underwater Robot Vision

Rafael Garcia

University of Girona

Despite the undeniable importance of the marine ecosystem, vast areas of the seabed remain largely unexplored. However, the last decade has seen amazing advances in the ability of robots to process visual data from their environment. Underwater vision requires the robot to get very close to the seabed to acquire images, due to the challenging underwater medium. Light suffers absorption and scattering, and these effects are wavelength dependent to make it even harder. For these reasons, most of the underwater mapping has relied in the past in expensive sonar systems. In this talk we will overview the most recent advances in underwater robot vision, enabling the robots to explore the seabed with high resolution using low-cost optical cameras. Accurate and detailed 3D models of the environment will be presented, with the advantage that such results convey immense information easily interpretable by humans.

Curriculum Vitae – Rafael Garcia, Ph.D

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Education

• PhD in Computer Engineering, Univ. of Girona, Spain (2001)

• Computer Engineering, Univ. Autónoma of Barcelona, Spain (1994)

Research and Teaching Positions

• 2019-today: Full professor (Catedrático de Universidad), Univ. of Girona.

• 2003-today: Director of the Underwater Vision Lab, Univ. of Girona.

• 2007-2017: General Manager of the spin-off company Coronis Computing SL.

• 2011-2016. Director of the Institute of Education Sciences, Univ. of Girona.

• 2009-2015. Director of the Computer Vision and Robotics Group, Univ. of Girona.

• 2003-2011: Vice-dean of the Polytechnic School, Univ. of Girona.

• 2005: visiting professor (3.5 months), Electrical and Computer Engineering Department, Univ. of Miami, USA.

• 2002-2003: Member of the committee for the evaluation of the Computer Engineering studies.

• 2002-2004: Associate director of the Dept. of Electronics, Informatics and Automation.

• 2003-2019: Tenured University Professor, Department of Electronics, Informatics and Automation, Univ. of Girona.

Selected Refereed Journal Articles (last 5 years)

1. R. Campos, J. Quintana, R. Garcia, T. Schmitt, G. Spoelstra, D. Schaap (2020). Modern 3D simplification methods and large scale terrain tiling. Remote Sensing, 12(3), 437. DOI: 10.3390/rs12030437

2. K. Istenič, N. Gracias, A. Arnaubec, J. Escartin, R. Garcia (2020). Automatic scale estimation of structure from motion based 3D models using laser scalers in underwater scenarios. ISPRS Journal of Photogrammetry and Remote Sensing 159, pp. 13-25. DOI: 10.1016/j.isprsjprs.2019.10.007

3. K. Istenič, N. Gracias, A. Arnaubec, J. Escartin, R. Garcia (2019). Scale Accuracy Evaluation of image Based 3D Reconstruction Strategies using Laser Photogrammetry. Remote Sensing. 11(18), 2093. DOI: 10.3390/rs11182093

4. J. Bosch, K. Istenič, N. Gracias, R. Garcia, P. Ridao (2019). Omnidirectional Multi-Camera Video Stitching using Depth Maps. IEEE Journal of Oceanic Engineering. DOI: 10.1109/JOE.2019.2924276

5. R. Garcia, R. Prados, J. Quintana, A. Tempelaar, N. Gracias, S. Rosen, H. Vågstøl and K. Løvall (2019). Automatic Segmentation of Fish using Deep Learning with Application to Fish Size Measurement. ICES Journal of Marine Science. DOI: 10.1093/icesjms/fsz186.

6. R. Campos and R. Garcia (2018). Surface Meshing of Underwater Maps from Highly Defective Point Sets. Journal of Field Robotics, 35 (4), pp. 491-515. DOI: 10.1002/rob.21758

7. K. Korotkov, J. Quintana, R. Campos, M.A.J. Silva, P. Iglesias, S. Puig, J. Malvehy, R. Garcia (2018). An Improved Skin Lesion Matching Scheme in Total Body Photography. IEEE Journal of Biomedical and Health Informatics. DOI: 10.1109/JBHI.2018.2855409

8. O. A. Codruta, C. Ancuti, C. De Vleeschouwer, R. Garcia. A semi-global color correction for underwater image restoration. In ACM SIGGRAPH 2017 (SIGGRAPH '17), New York, NY, USA. DOI: https://doi.org/10.1145/3102163.3102237.

Acoustic-based tracking and navigation

Riccardo Costanzi

Dipartimento di Ingegneria dell'Informazione e
Centro di Ricerca "E. Piaggio"
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ISME – Interuniversity Center of Integrated Systems for the Marine Environment

Electro-magnetic waves, on which several ground and aerial technologies are based, are absorbed by few centimeters of water. Systems commonly used above the surface for navigation and/or tracking purposes (e.g., GNSS or radar) are not a solution in the underwater environment. Acoustics, thus, plays a fundamental role in this domain as acoustic waves effectively propagate at considerable distances below the surface. Part of the recent research carried out at the ISME (https://isme.unige.it/) node of Università di Pisa has its focus on employing various acoustic-based solutions to the problems of navigation and tracking. About the tracking, various applications will be presented corresponding to different purposes ranging from cooperative tracking for dynamic parameters identification for Unmanned Underwater Systems to passive non-cooperative tracking of acoustic sources. About the navigation, on the other hand, a possible solution for the estimation of the trajectory followed by a "sensorised" diver will be presented. Moreover, the first steps carried out towards cooperative navigation among a dyad of heterogeneous unmanned vehicles (AUV and ASV) will be presented and discussed. The various scenarios, apparently different one from the other ones, share common features that are: acoustic measures as indirect observations of quantities of interest and Kalman filtering implementations exploiting these measures to estimate the state of the various systems.

The most of the results presented within the talk have been achieved in the framework of the SEALab (https://isme.unige.it/research/sealab), the joint laboratory among ISME and the Naval Support and Experimentation Center of Italian Navy (CSSN) in La Spezia (Italy).

Curriculum Vitae – Riccardo Costanzi, PhD

Assistant Professor Università di Pisa
Dipartimento di Ingegneria dell'Informazione (DII)
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Education

PhD in Industrial Engineering - Thesis: "Navigation Systems for Unmanned Underwater Vehicles" (2015)

Research and Teaching Positions

- Assistant Professor, Systems Theory and Automatic Control, Università di Pisa
  Responsible for courses: Underwater Systems and System Identification for the Master Course of Robotics and Automation Engineering
- Interuniversity Center of Integrated Systems for the Marine Environment (ISME - https://isme.unige.it/) – Member of the Scientific Board
- Laboratory on heterogeneous autonomous systems, joint between ISME and Italian Navy (SEALab - https://isme.unige.it/research/sealab) – Member of the Techincal-Scientific board
- IEEE OES Italy Chapter – Vice-president

Selected Refereed Journal Articles (last 5 years)

1. F. Ruscio, G. Peralta, L. Pollini, and R. Costanzi. ICT Tools for Preservation of Underwater Environment: A Vision-Based Posidonia Oceanica Monitoring. Marine Technology Society (MTS), accepted for the publication in the July/August 2021 issue.

2. R. Costanzi, D. Fenucci, V. Manzari, M. Micheli, L. Morlando, D. Terracciano, A. Caiti, M. Stifani, and A. Tesei. Interoperability among unmanned maritime vehicles: Review and first in-field experimentation. Frontiers in Robotics and AI, 7, 2020.

3. D. S. Terracciano, L. Bazzarello, A. Caiti, R. Costanzi, and V. Manzari. Marine Robots for Underwater Surveillance. Curr Robot Rep 1:159–167, 2020.

4. R. Costanzi, F. Fanelli, E. Meli, A. Ridolfi, A. Caiti, and B. Allotta. Ukf-based navigation system for auvs: Online experimental validation. IEEE Journal of Oceanic Engineering, 44(3):633–641, 2019.

5. R. Costanzi, D. Fenucci, V. Manzari, A. Caiti, and R. Petroccia. Towards an autonomous underwater vehicles test range: At-sea experimentation of bearing-only tracking algorithms. Annual Reviews in Control, 46:304–314, 2018.

Introduction to Situational Awareness System for Autonomous ships

Hyun Taek Choi

Korea Research Institute of Ships and Ocean Engineering

With recent advancements in artificial intelligence technologies, the academia and industry have heightened performance expectations for autonomous vehicles that have been operated only in structured environments so far, and in some sense it is not appropriate to call them autonomous vehicles. We can image various types of autonomous vehicles, but today, let's think about an autonomous ship and in particular, a situational awareness system which plays an important role to make autonomy of autonomous ship.

In this short talk, I'd like to briefly introduce a novel design concept and key features of our situational awareness system named iSAS(Intelligent Situational Awareness System) with its preliminary results. The iSAS consists of deep-learning algorithms for detecting marine objects by using camera, radar, and LIDAR, a probability based data association algorithm and Bayesian filtering based multi-target tracking algorithms, and an semantic information based collision risk evaluation algorithm. Because the iSAS estimates motions of all and each marine objects along with their semantic information, it could not be said as a simple replacement of what the captain does.

The iSAS has been developing as part of the Korea Autonomous Surface Ships (KASS) project launched in April 2020.

Curriculum Vitae – Dr. Hyun Taek Choi

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Education

- Ph.D. Electrical Engineering, Hanyang University, Korea (2000)
- M.S. Electrical Engineering, Hanyang University, Korea (1993)
- B.S. Electrical Engineering, Hanyang University, Korea (1991)

Research and Teaching Positions

- Principle Researcher, Korea Research Institute Ships and Ocean Engineering (KRISO), Korea (2003.11-present)
- Post-doc & Researcher, Department of Mechanical Engineering, University of Hawaii at Manoa, USA (2000.11-2003.10)
- Researcher, KT (Korea Telecom) Research & Development Center, Korea (1993.3-1995.8)

Selected Refereed Journal Articles (last 5 years)

1. Jongdae Jung, Jeonghong Park, Jinwoo Choi, and Hyun-Taek Choi, Navigation of Unmanned Surface Vehicles Using Underwater Geophysical Sensing, IEEE Access, vol. 8, pp. 208707-208717, 2020, doi: 10.1109/ACCESS.2020.3038816.
2. Jinwoo Choi, Jeonghong Park, Jongdae Jung, Yoongeon Lee, and Hyun-Taek Choi, Development of an Autonomous Surface Vehicle and Perfor- mance Evaluation of Autonomous Navigation Technologies, International Journal of Control, Automation and Systems 18(3) (2020) 535-545
3. Jeonghong Park, Jinwoo Choi and H. Choi, COLREGS-compliant path planning considering time-varying trajectory uncertainty of autonomous surface vehicle, Electronics Letters Vol. 55 No. 4 pp. 222–224, Feb. 2019
4. Jongdae Jung, Jeonghong Park, Jinwoo Choi, and Hyun-Taek Choi, Autonomous Mapping of Underwater Magnetic Fields Using a Surface Vehicle, IEEE Access, vol. 6, pp. 62552-62563, 2018, doi: 10.1109/ACCESS.2018.2872672.|
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Understanding Equilibrium Properties of Multi-Agent Systems

Michael Wooldridge

University of Oxford

Over a twenty minute period on the afternoon 6 May 2010, the Dow Jones industrial average collapsed, at one point wiping a trillion dollars off the value of the US markets. Remarkably, the market recovered in a similarly short period of time, to nearly its position before the collapse. While the precise causes of the so-called "Flash Crash" are complex and controversial, the Flash Crash was only possible because modern international markets are multi-agent systems, in which high frequency trading agents autonomously buy and sell on timescales that are so small that they are far beyond human comprehension or control. There is no reason to believe that the 2010 Flash Crash was an isolated event: and the next one could be even bigger, with protentially devastating global consequences. The 2010 Flash Crash provides a stark illustration of something we have long known: that systems composed of large numbers of multiple interacting components can be subject to rapid, unpredictable swings in behaviour. We urgently need to develop the theory and tools to understand such multi-agent system dynamics.

In this talk, I will present two very different approaches to this problem.

The first views a multi-agent system as a game, in the sense of game theory, with decision-makers interacting strategically in pursuit of their goals. I describe a model we have developed in which players in such a game act in pursuit of temporal logic goals. In such a setting, the key decision problems relate to the properties of a system that hold under the assumption that players choose strategies in (Nash) equilibrium. I conclude by describing a tool, developed by DPhil student Muhammed Najib, through which we can automatically analyse the properties of such equilibria.The second approach takes a very different approach, in which we use agent-based financial models, involving very large numbers of agents, to understand specifically the factors that can contribute to Flash Crash events, and in particular the phenomenon of "contagion", where stress on one asset leads to other assets being stressed.

This talk will report joint work with Ani Calinescu, Julian Gutierrez, Paul Harrenstein, Muhammed Najib, James Paulin, and Giuseppe Perelli.

Michael Wooldridge is a Professor of Computer Science and Head of Department of Computer Science at the University of Oxford, and a programme director for AI at the Alan Turing Institute. He has been an AI researcher for more than 30 years, and has published more than 400 scientific articles on the subject, including nine books. He is a Fellow of the Association for Computing Machinery (ACM), the Association for the Advancement of AI (AAAI), and the European Association for AI (EurAI). From 2014-16, he was President of the European Association for AI, and from 2015-17 he was President of the International Joint Conference on AI (IJCAI).

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Education

- MA (by resolution); University of Oxford (2014)
- PhD in Computation; University of Manchester Institute of Science and Technology (UMIST) (1992)
- First Class BSc (Hons) Computer Science (CNAA); awarded Addison-Wesley prize for best performance on the course. (1989)

Research and Teaching Positions

- Department of Computer Science, University of Oxford, Computational Game Theory. (2015)
- Department of Computer Science, University of Liverpool, Robotics & Autonomous Systems. (2011–2012) Multiagent Systems (1999–2012)
- Department of Electronic Engineering, Queen Mary & Westfield College, University of London, Systems analysis and software engineering, Java Programming, Knowledge-based Systems (1997–1999)
- Department of Computing, Manchester Metropolitan University, Introduction to Programming, Program and Data Structures, Formal Methods (1992–1996)
- Department of Computing, Manchester Polytechnic, Commercial Information Systems, Commercial Programming (1990–92)

Selected Refereed Journal Articles (last 5 years)

1. J. Gutierrez, A. Murano, G. Perelli, S. Rubin, T. Steeples, and M. Wooldridge. Equilibria for Games with Combined Qualitative and Quantitative Objectives. In Acta Informatica, (2020)
2. J. Gutierrez, G. Perelli, and M. Wooldridge. Multi-player games with LDL goals over finite traces. In Information and Computation, (2020)
3. D. Han, P. Harrenstein, S. Nugent, J. Philpott, M. Wooldridge. Behavioural strategies in weighted Boolean games. In Information and Computation, (2020)
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5. O. Skibski, T. P. Michalak, Y. Sakurai, M. Wooldridge, and M. Yokoo. Partition decision trees: representation for efficient computation of the Shapley value extended to games with externalities. In Autonomous Agents and Multi-Agent Systems, 34(1), (2020)
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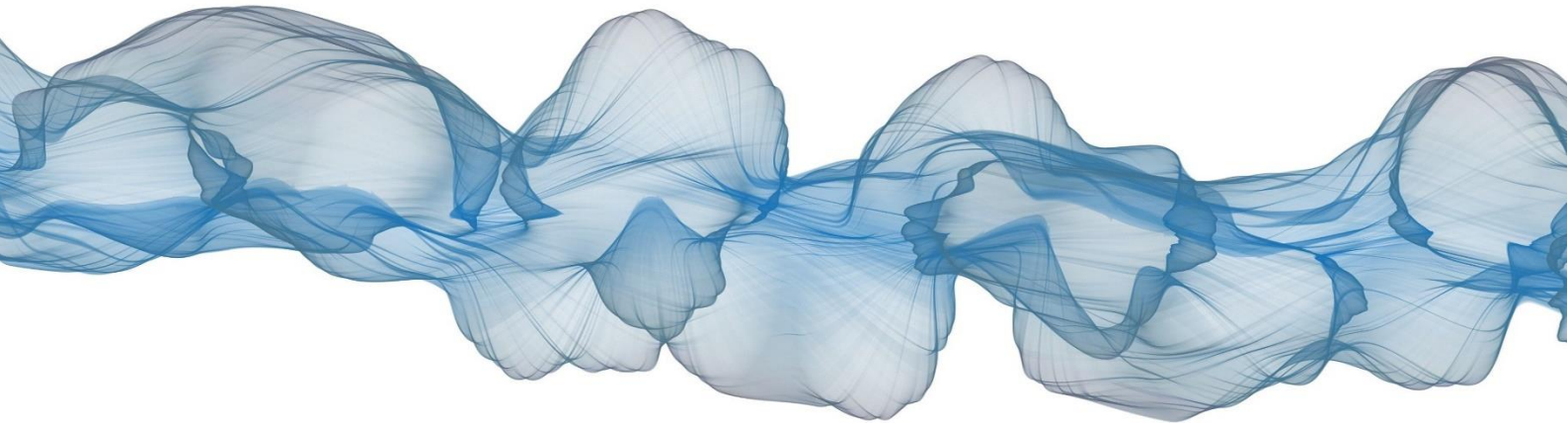
10. O. Skibski, T. Rahwan, T. P. Michalak, M. Wooldridge. Enumerating Connected Subgraphs and Computing the Myerson and Shapley Values in Graph-Restricted Games. In ACM Transactions on Intelligent Systems & Technologies. 10(2), (2019)

ABSTRACT

Track Beatles :

STUDENT SHORT TOLK

& INVITED LECTURES



ABSTRACT

Three-dimensional Photogrammetric Mapping of Apples in Orchard based on Point Cloud Instance Segmentation

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The assessment of 3D fruit phenotyping traits of apple trees can provide management strategies for growers of apple orchards. The estimation of quantitative distribution of apples in orchard is an important parameter for yield estimation. Since it is hard to quantify them manually, resolving apple phenotyping efficiently is critical for monitoring apple yield and promoting a better management system. Thus in current study, we have developed a novel technology for 3D mapping of three types of apple training system fields. The 3D point cloud of apples was reconstructed using high spatial and temporal multi-viewing images collected by unmanned aerial vehicles (UAVs) based multi-camera system. The extraction of information about individual apple in 3D point cloud was executed using 3D instance segmentation algorithm which includes generalized sparse convolutional neural networks, discriminative loss function, and varying density-based 3D clustering method. The developed apple traits extraction algorithm could measure the 3D position of an individual apple by sphere fitting. The accuracy of the technique was evaluated by comparing its results with manual estimates of number of apples. The results obtained from our method are in good agreement with manual estimates. The average accuracy of apple counting in three types of the fields were ~92 % followed by the linear regression (R^2) of 0.92 with root-mean-square error (RSME) value of 13.93. Thus, 3D spatial distribution of apples were achieved and analyzed by above technique. This research proposes a method that combines 3D photography with 3D instance segmentation to accurately extract individual apples from various types of apple training systems in orchards and can also be used to segment and analyze other fruits.

Keywords: Oblique photogrammetry; 3D reconstruction; 3D segmentation; Fruit-level phenotyping; 3D spatial distribution.

Funding:
This work was supported by the Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry (IPET) the Advanced Production Technology Development Program, funded by the ministry of Agriculture, Food and Rural Affairs (MAFRA)(No. 32003003).

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Education

B.S. College of Mechanical and Electrical Engineering, Wenzhou University (2017)

Research and Teaching Positions

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Research Interests

- Deep Learning
- Image Processing and 3D Vision
- Digital Agriculture

Research and Projects

- ICT-based future apple orchard smart precision management technology research (2017-2019)
  - UAV-based multi-view 3D reconstruction of apple orchard
  - 3D point cloud-based apple tree phenotype extraction
  - Robot map generation for assisting robot apple orchard autonomous driving

- Development of an artificial-intelligence sensing platform for intelligent driving of agricultural vehicle using wired aerial robot (2017-2019)
  - Vision algorithms development of wired aerial robot (object detection, road information extraction)

- Apple growth management (pruning, flower thinning, and fruit thinning) robot development (2020-2022)
  - Database establishment (biomass, flower distribution, fruit distribution) of apple tree based on multi sensors and 3D reconstruction technology
  - AI pruning strategy development for robot

Two-Dimensional Mapping And Localization of a Mobile Robot for Indoor Environment

Henok Tegegn Warku, Nak Yong Ko+

Chosun University, Gwangju, Korea

Abstract contents~~ This article uses a two-wheel differential robot and Velodyne with 16-channel lidar sensor to generate a map of the actual indoor environment, and locate the robot on the created map. To accomplish navigation of a mobile robot to move the robot from initial position to a goal position, good map of the environment and localizing itself inside the environment is necessary. From diverse Simultaneous Localization and Mapping (SLAM) algorithms, slam_gmapping is used to create a 2D occupancy grid map from the laser scan data and the odometry from the encoder of the robot. Initially, when the robot starts the SLAM process, all cells of the map of are marked as unknown, then the robot starts using its laser scanner feedback to start the marking process to occupy the environment. The robot will perform laser scans and, in every scan, it will check the distance to obstacles and mark every cell in the map corresponding to an obstacle location as occupied (black color) and other cells as free (white color). When the robot moves around the map, it needs to know the pose (position and orientation) on the map using its sensor readings. This is implemented through Adaptive Monte Carlo Localization (AMCL), which uses a particle filter to filter out noisy sensor measurement outputs and tracks the mobile robot's position and orientation relative to the known map. AMCL takes a laser-based map and laser scans, transforms messages and generate a probabilistic pose. The implementation of both the simulation and the hardware is using the standard and open source platform known as the Robot Operating System (ROS) with Gazebo and Rviz to visualize the robot operation in real dimensions and the internal visualization of the sensors, respectively. The robot model is described using Unified Robot Description Format (URDF) to interface it with the laser sensor and to visualize the transformation among distinct frames of the mobile robot and the frame of the laser scan. Several experiments are carried out to assess performance. The result of the experiment shows that the robot can map its real indoor environment and localize itself as the robot moves around the environment by generating a new sample that predict the robot's position after the motion command and sensor readings are incorporated by re-weighting these samples and normalizing the weights. The mapping and localization of a mobile robot can be used for autonomous navigation in a known constructed map.

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Education

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Research and Teaching Positions

- Masters Student in Intelligent Robotics Lab (IRL), Chosun University (Sep 2020-current)
- Teaching Assistant, Hawassa University, Ethiopia (Sep 2018-Jul 2019)
- Internship, Sigma Engineering and Products PLC, Ethiopia (Feb 2017-May 2017)

Selected Refereed Journal Articles (last 5 years)

1. Henok Tegegn Warku, Nak Yong Ko, Gyeongsub Song, Da Bin Jeong (2021) Pose Estimation of a Mobile Robot in a Small Indoor Workspace Using Ultrasonic Beacons. Korea Robotics Society (KROS).
2. Henok Tegegn Warku, Nak Yong Ko, Hong Gi Yeom, Sung Hyun You (2021) Indoor Environment Mapping Based on ROS Using GMapping Algorithm and Lidar Sensor. 2021 36th Conference of Control, Robot, and Systems (ICROS2021).
3. Milkisa Yebasse, Birhanu Shimelis, Henok Warku, Jaepil Ko, Kyung Joo Cheoi (2021) Coffee Disease Visualization and Classification. Plants 2021, 10(6), 1257

ABSTRACT

Heat and pressure-assisted soft lithography for agricultural applications.

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Soft lithography is a versatile, convenient, and high-throughput process in which a multiscale micro/nanotopography is transferred onto the various biopolymeric materials from an elastomeric mold. Polydimethylsiloxane (PDMS) has been widely used as a mold material to fabricate multiscale patterns, owing to its cost-effectiveness, flexibility, and optical transparency. However, it is important to analyze and understand the deformation of nanoscale patterns due to mechanical and thermal inputs during the replication step. Here, we present an analysis of nanoscale deformation of PDMS molds in response to heat and pressure during the repetitive molding process of thermoplastic polymers. The width and height of the nano-sized ridges of PDMS molds decreased as the number of replications of thermoplastic polymers increased. The decoupling experiments showed that the heat and pressure induced considerable deformation of the width and height of nano-sized ridges of PDMS molds. Using the precisely controlled deformation of nanostructures in PDMS molds, we demonstrated that nanostructures of different sizes can be fabricated on representative thermoplastic and UV-curable polymers consistently. Using the precisely tunable methodologies of nanoscale structures, we also propose the applications to newly processed agricultural by-products as functional platforms and to develop the food packaging systems.

Funding: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (NRF-2016M3A9B4919353, NRF-2019R1I1A3A0106345, and NRF-2019M3A9H1103737). This work was also supported by a grant (714002-7) from the Agricultural Robotics and Automation Research Center through the Agriculture, Food and Rural Affairs Research Center Support Program, Ministry of Agriculture, Food and Rural Affairs.

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Education

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  Advisor: Prof. Jangho Kim
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  Advisor: Prof. Jangho Kim

Selected Refereed Journal Articles (last 5 years)

1. W. Kim, Y. Gwon, Y. K. Kim, S. Park, S. J. Kang, H. K. Park, M. S. Kim, J. Kim (2021) Plasma-assisted multiscale topographic scaffolds for soft and hard tissue regeneration. npj Regenerative Medicine.

2. W. Kim, S. Park, Y. Gwon, H. N. Kim, J. Kim. (2021) Heat and pressure-assisted soft lithography for size-tunable nanoscale structures. Materials Letters.

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4. W. Kim, D. Kim, S. Park, D. Lee, H. Hyun, J. Kim. (2018) Engineering lotus leaf-inspired micro-and nanostructures for the manipulation of functional engineering platforms. Journal of Industrial and Engineering Chemistry.

Efficient Angle-of-Arrival Estimation Algorithm for Massive Antenna Array

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Abstract: The Angle-of-Arrival (AOA) has a variety of applications in civilian and military wireless communication fields. As the location based service (LBS) industry is rapidly developed, the importance of AOA estimation technique is increased. Although we need to employ the large size of antenna array for estimating the accurate AOA information of many signals, the computational complexity of the conventional AOA estimation algorithm such as Multiple Signal Classification (MUSIC) is dramatically increased in this case. To solved this problem, we propose a cascade AOA estimation algorithm employing CAPON and Beamspace MUSIC, based on the flexible (on/off) antenna array. First, it roughly finds AOA groups including several signal AOAs using CAPON, by applying some of the antenna element. Then, it estimates each signal AOA in the estimated AOA groups using Beamspace MUSIC, by applying full size of antenna array. The proposed algorithm does not only have extremely low computational complexity, but it also has similar estimation performance to MUSIC. Especially, the proposed cascade AOA estimation algorithm is greatly efficient for employing the massive antenna array. Representative computer simulation examples are provided to illustrate the AOA estimation performance of the proposed technique.

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Education

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Research and Teaching Positions

• Teaching assistant, Chosun University (Mar 2014 – Dec 2017)
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Selected Refereed Journal Articles (last 5 years)

1. Kim T, Hwang S (2021). Angle-of-Arrival Estimation Algorithm Based on Combined Array Antenna. Journal of Positioning, Navigation, and Timing, 10(2), 131-137.
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3. Kim T, Hwang S (2020). Performance Analysis of Cascade AOA Estimator with Concentric Ring Array Antenna. The Journal of the Korea institute of electronic communication sciences, 15(5), 849-856.
4. Kim T, Lee D, Hwang S (2020). Performance Analysis of AOA Estimation for Concentric Ring Array Antenna in Beamforming Satellite System. The Journal of the Korea institute of electronic communication sciences, 15(4), 643-650.
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7. Kim T, Hwang S (2019). Performance Evaluation of Cascade AOA Estimation Algorithm Based on Square Array Antenna. The Journal of the Korea institute of electronic communication sciences, 14(6), 1053-1060.
8. Kim T, Hwang S (2019). Performance Analysis of Beamforming Satellite System Applying Circular Array Antenna. The Journal of the Korea institute of electronic communication sciences, 14(5), 845-852.

ABSTRACT

Ensemble Three-Stream RGB-S Deep Neural Network for Human Behavior Recognition Under Intelligent Home Service Robot Environments

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and Keun-Chang Kwak[1]

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This presentation introduces a method for recognizing behaviors in videos based on the ensemble RGB-S deep neural network, which combines RGB images and skeleton features from an action recognition database built in intelligent home service robot environments. The ensemble model is designed using the three-stream approach. This approach not only reflects the spatial and temporal features of the behaviors in videos, but also includes all characteristics of the 2D sequence images, 3D videos, and skeleton sequences. Finally, a large-scale database for behavior recognition in videos, known as ETRI-Activity3D, is used in this study to verify the performance of the proposed deep neural network.

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Education

PhD in Control and Instrumentation Engineering, Chosun University, KOR (2021)

Research and Teaching Positions

- Post-doc, IT Research Institute, Chosun University, KOREA (Mar 2021-Current)
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Selected Refereed Journal Articles (last 5 years)

1. Yeong-Hyeon Byeon, Do-Hyung Kim, Jae-Yeon Lee and Keun-Chang Kwak (2021) Ensemble three-stream rgb-s deep neural network for human behavior recognition under intelligent home service robot environments. *IEEE Access*, 9, 73240-73250.
2. Yeong-Hyeon Byeon, Do-Hyung Kim, Jae-Yeon Lee and Keun-Chang Kwak (2021) Body and hand-object roi-based behavior recognition using deep learning. *Sensors*, 21(5), 838.
3. Yeong-Hyeon Byeon, Jae-Yeon Lee, Do-Hyung Kim, and Keun-Chang Kwak (2020) Posture recognition using ensemble deep models under various home environments. *Applied Sciences*, 10(4), 1287.
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5. Yeong-Hyeon Byeon, Sung-Bum Pan and Keun-Chang Kwak (2019) Intelligent deep models based on scalograms of electrocardiogram signals for biometrics. *Sensors*, 19(4), 935.

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Education

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- B.Eng. and M.Eng., Mechanical Engineering, Waseda University, 1994 and 1997.

Research and Teaching Positions

- 2018 - present, Professor, Tokyo University of Marine Science and Technology.
- 2017 - present, Co-Chair, IEEE OES, Tech Cmte on Autonomous Maritime Systems.
- 2011 - 2012, Guest Investigator, Woods Hole Oceanographic Institution, USA.
- 2008 - 2010, Co-Chair, IEEE RAS, Tech Cmte on Marine Robotics.
- 2005 - 2016, Vice Chair, IEEE OES, Tech Cmte on Unmanned Maritime Vehicles and Submersibles.
- 2003 - 2018, Associate Professor, Tokyo University of Marine Science and Technology, with merger of Tokyo University of Mercantile Marine and Tokyo University of Fisheries in 2003.
- 2002 - 2003, PD (Postdocs), JSPS Research Fellowships for Young Scientists.
- 2002 - 2003, Postdoctoral Fellow (Additional Post), Institute of Industrial Science, The University of Tokyo.

Selected Refereed Journal Articles

1. H. Yamazaki, E. Masunaga, S. Gallager, M. Tanaka, M. Takeuchi, K. Amakasu, H. Kondo, "Coastal observation systems to monitor physical, chemical, and biological parameters," The Journal of the Acoustical Society of America 140, 3241, 2016.
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3. T. Maki, H. Kondo, T. Ura, T. Sakamaki, H. Mizushima, M. Yanagisawa, "3D photo mosaicing of Tagiri shallow vent field by an autonomous underwater vehicle (2nd report) -Wide area visual mapping through multiple dives-," Journal of the Japan Society for Marine Surveys and Technology, 21 (1), pp.13-25, 2009.
4. H. Kondo, T. Ura, "Navigation of an AUV for investigation of underwater structures," Control Engineering Practice, A Journal of IFAC, 12(12), pp.1551-1559, 2004.
5. H. Kondo, T. Ura, Y. Nose, "Development of an Autonomous Underwater Vehicle "Tri-Dog" toward Practical Use in Shallow Water," Journal of Robotics and Mechatronics, 13(2), pp.205-211, 2001.

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Guide for Zoom Meeting Attendance

Zoom 설치 및 회의 참가 가이드

"International Conference on IT-Bio Convergence"
August. 27, 2021 (7:50a.m. ~ 6:00p.m)

[Zoom meeting - Track Abba]

Meeting link:
https://zoom.us/j/91780632324?pwd=V0M5TU9wNEJacURqVVpLVFQwZDhoUT09
Meeting ID: 917 8063 2324
Password: 829784

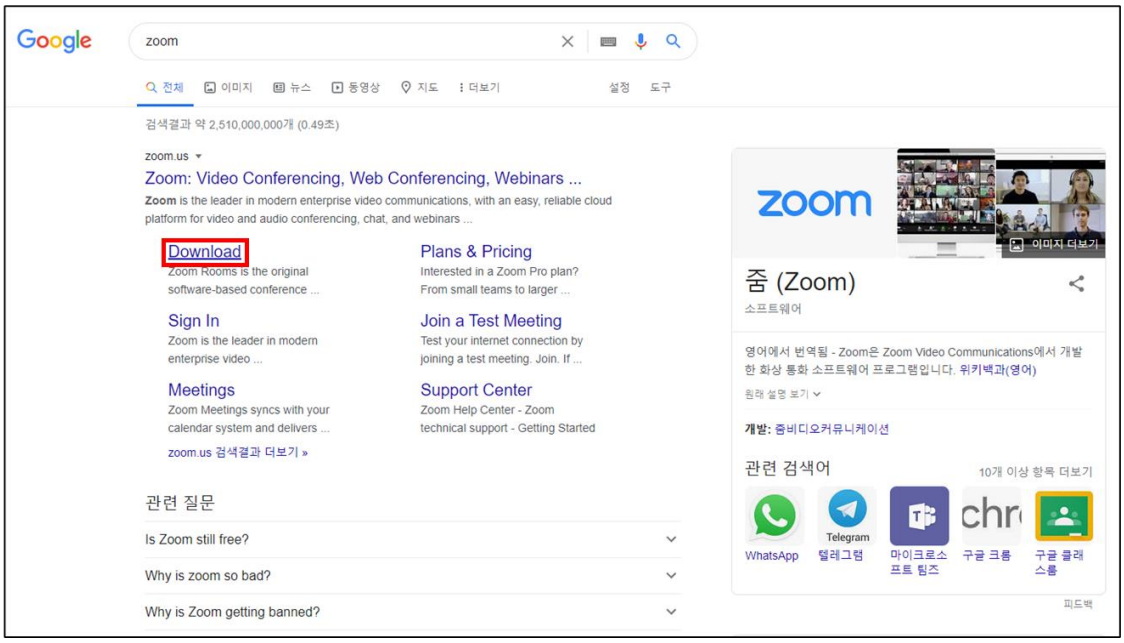
[Zoom meeting - Track Beatles]

Meeting link:
https://jnu-ac-kr.zoom.us/j/98379219492?pwd=SkRNd3ZxUjFNZ2F1eDZTREFZRWdYQT09
Meeting ID: 983 7921 9492
Password: 381331

- 이미 zoom 프로그램이 설치되어 있다면, zoom meeting link (URL)를 클릭해주시면 바로 zoom meeting에 참여할 수 있습니다.
  If you already have the zoom program installed, you can join the zoom meeting right away by clicking the zoom meeting link (URL).
- Zoom 프로그램이 설치가 되어있지 않다면, 설치 및 회의 접속 가이드를 따라 진행 해주시면 됩니다.
  If the Zoom program is not installed, please follow the installation and meeting attendance guide.

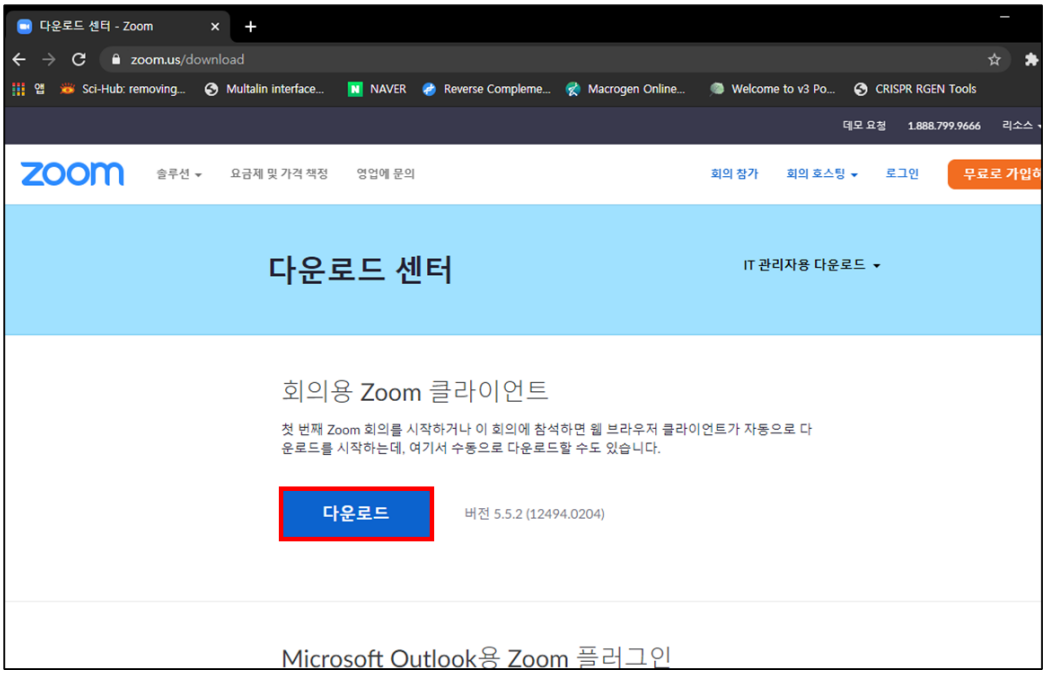
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

1. Google 검색창에서 "zoom" 검색 후 > "Download" 클릭
   Search “zoom” in Google > Click the Download button



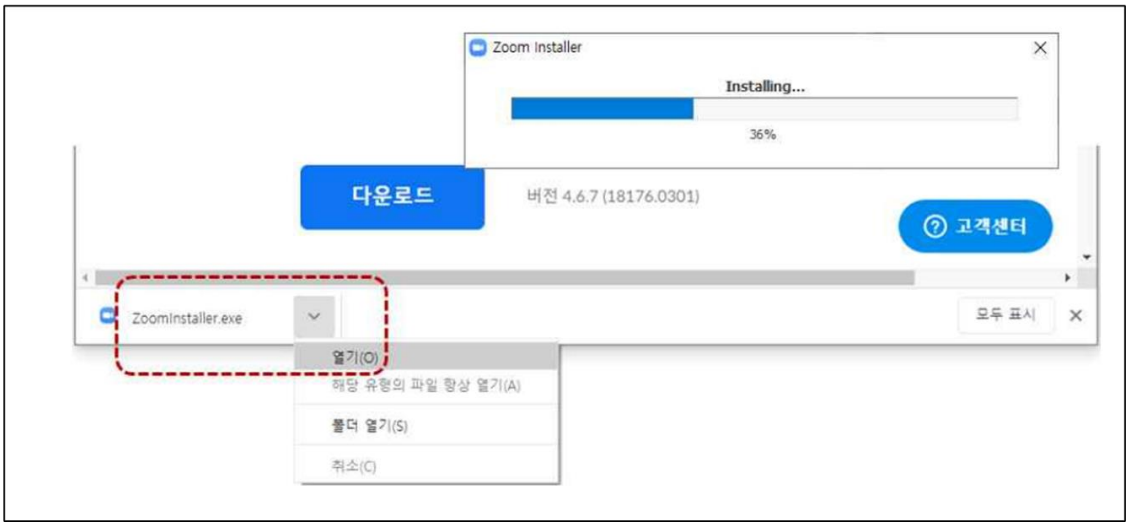
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

2. "다운로드" 클릭
   Click the download button



- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

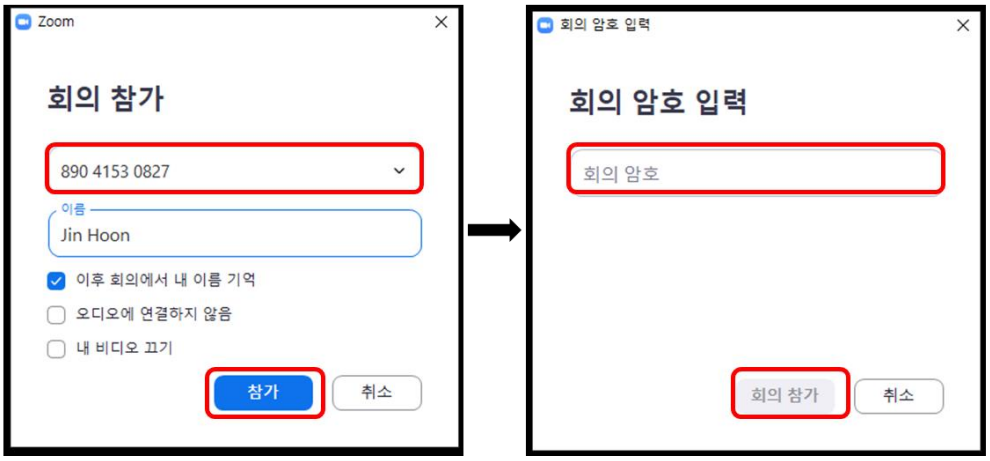
3. Zoom 설치파일 실행 후 설치
   Open the zoom installation file > Install the zoom program



4. Zoom 프로그램 실행 후 '회의참가' 버튼 클릭
   After running zoom program, click the 'participation in meeting' button

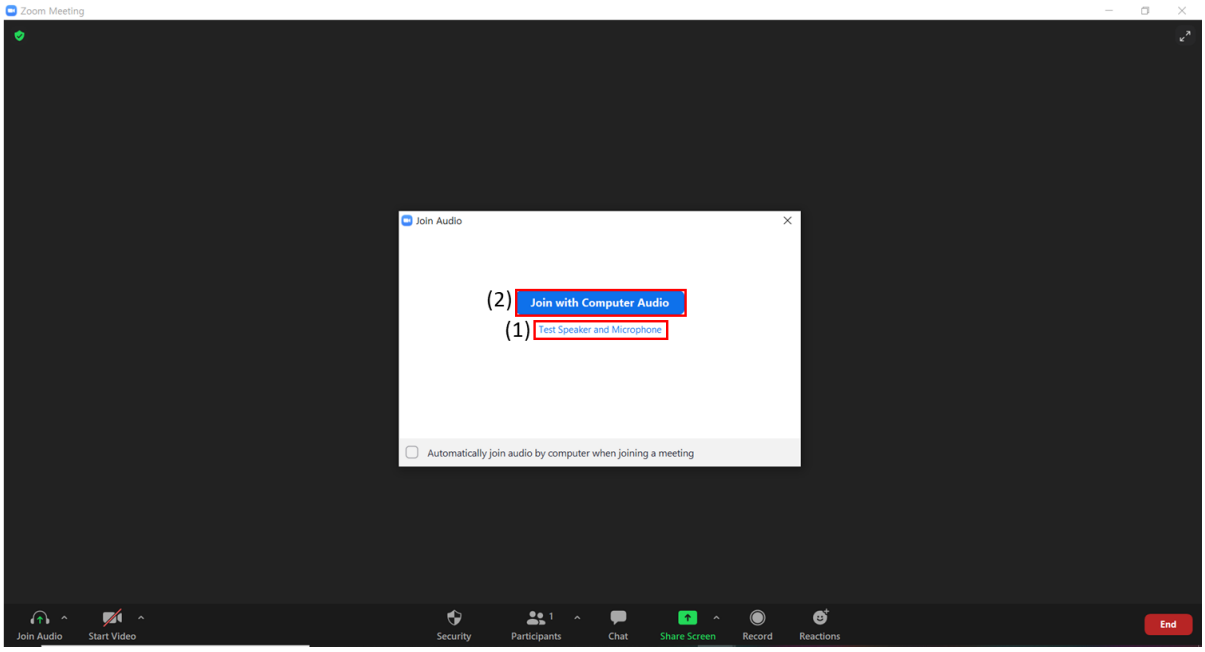
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

5. Meeting ID를 입력하고 '참가' 버튼을 클릭 > 회의 암호 입력 후 '회의 참가' 클릭
   Enter the Meeting ID and click the'Join' button
   > Enter the meeting password and click'Join the Meeting'



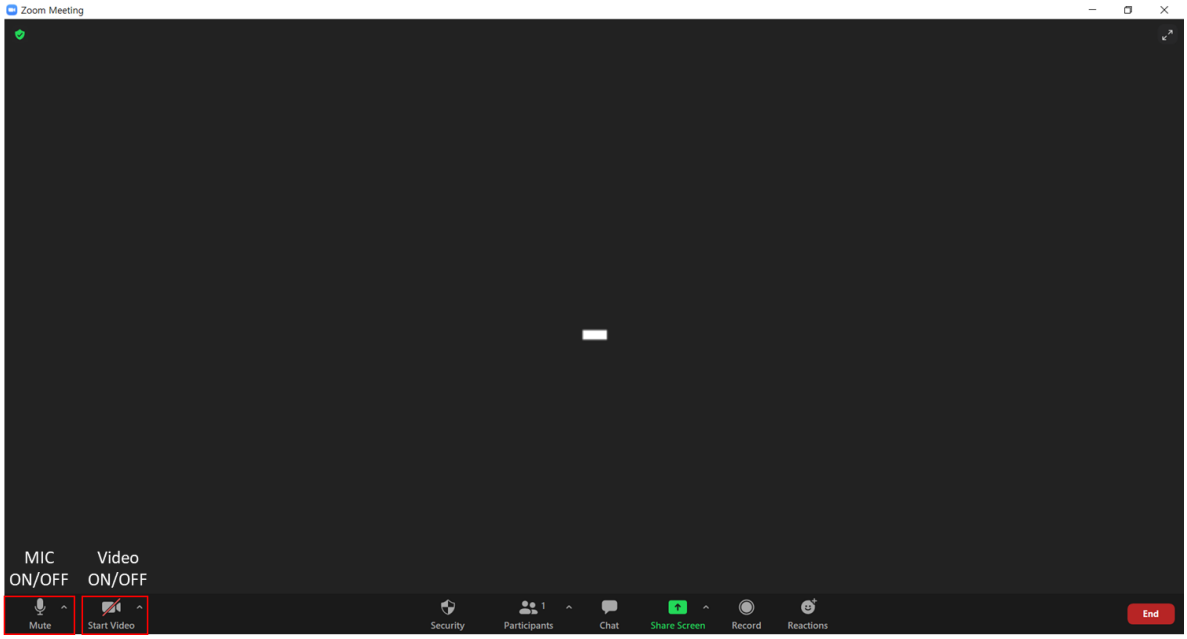
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

6. (1) 스피커, 마이크 테스트 버튼을 눌러서 작동 유무를 확인한다
   Before join the meeting, Please check the speaker and microphone (click the **'Test Speaker and Microphone'** button
   (2) 컴퓨터 오디오로 참가 버튼을 누르면 회의 화면을 볼 수 있다.
   Click the 'Join with computer audio' button > You can see the meeting



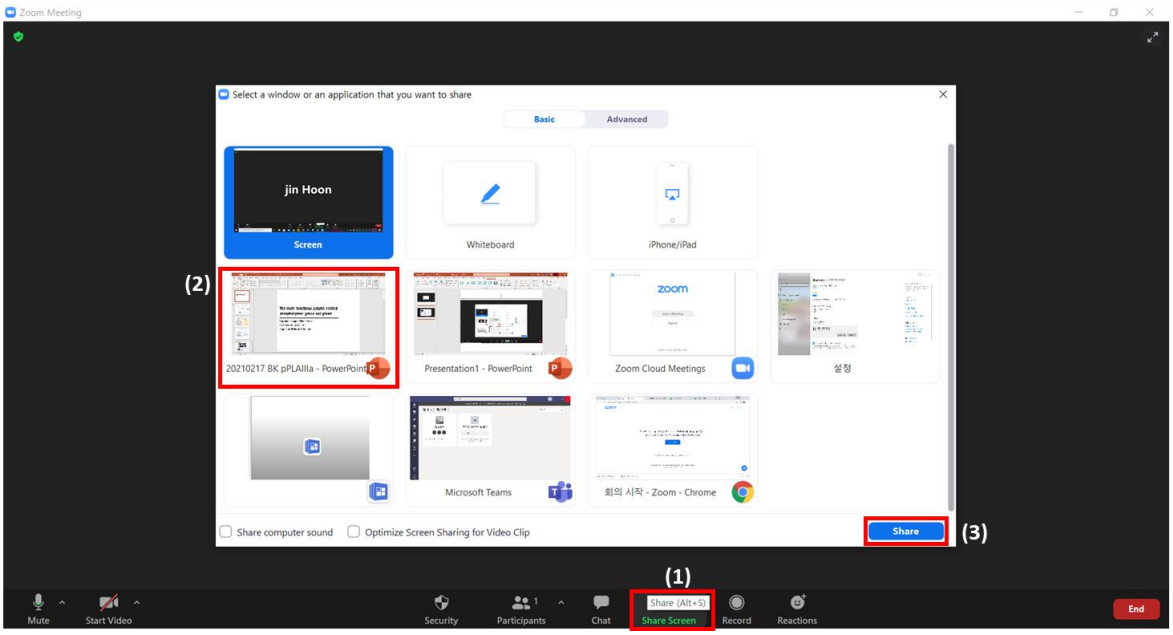
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup

7. (1) 미팅에 참여한 뒤, 음소거 버튼으로 마이크를 ON/OFF 할 수 있다. **(필요시에만 마이크를 켜 주시길 바랍니다.)**
   After joining the meeting, you can turn the microphone ON/OFF with the mute button. **(Please turn on the microphone only when necessary.)**
   (2) 비디오 시작 버튼을 클릭하면 웹캠 (얼굴 화면)을 보여줄 수 있습니다. **(가급적 비디오를 켜 주시길 바랍니다.)**
   Click the **'start video button'**, you can show your webcam (face screen) **(We recommend turning on the video.)**



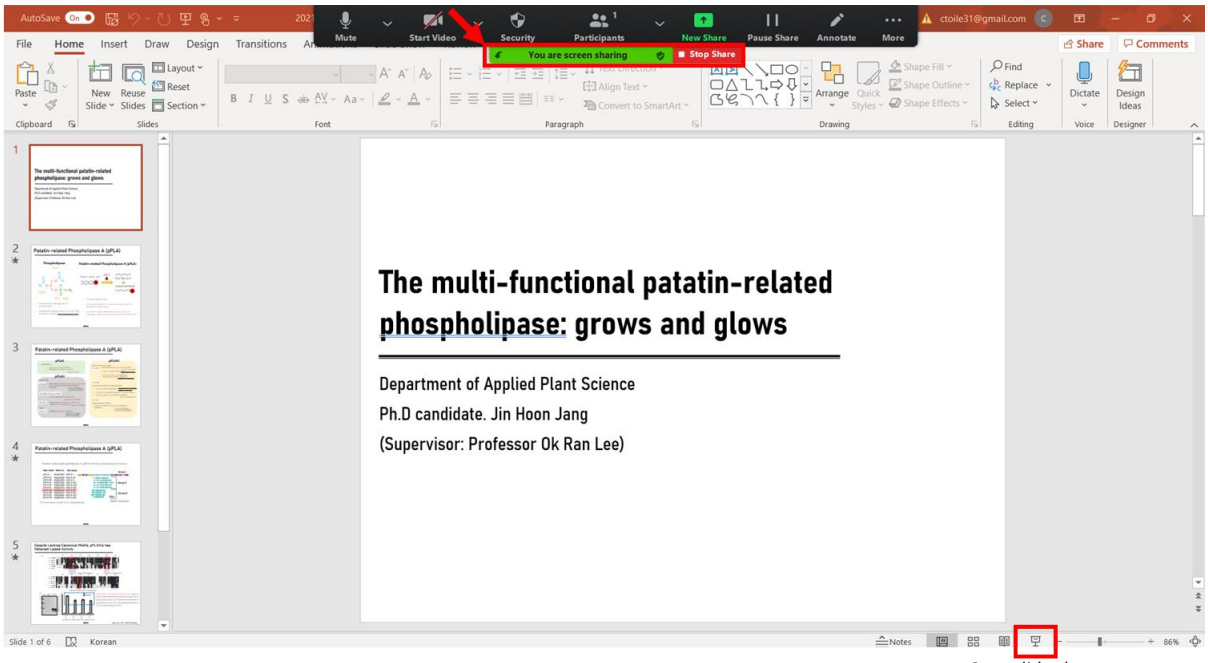
- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup
  발표자 화면공유 (Speaker's screen sharing)

8. (1) 화면 공유 버튼을 클릭 > (2) 공유할 창 (ex, ppt 파일)을 클릭 > (3) '공유' 버튼을 클릭
   (1) Click the **'Share Screen'** button > (2) Click the screen you want to share. > (3) Click the **'Share'** button



- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup
  발표자 화면공유 (Speaker's screen sharing)

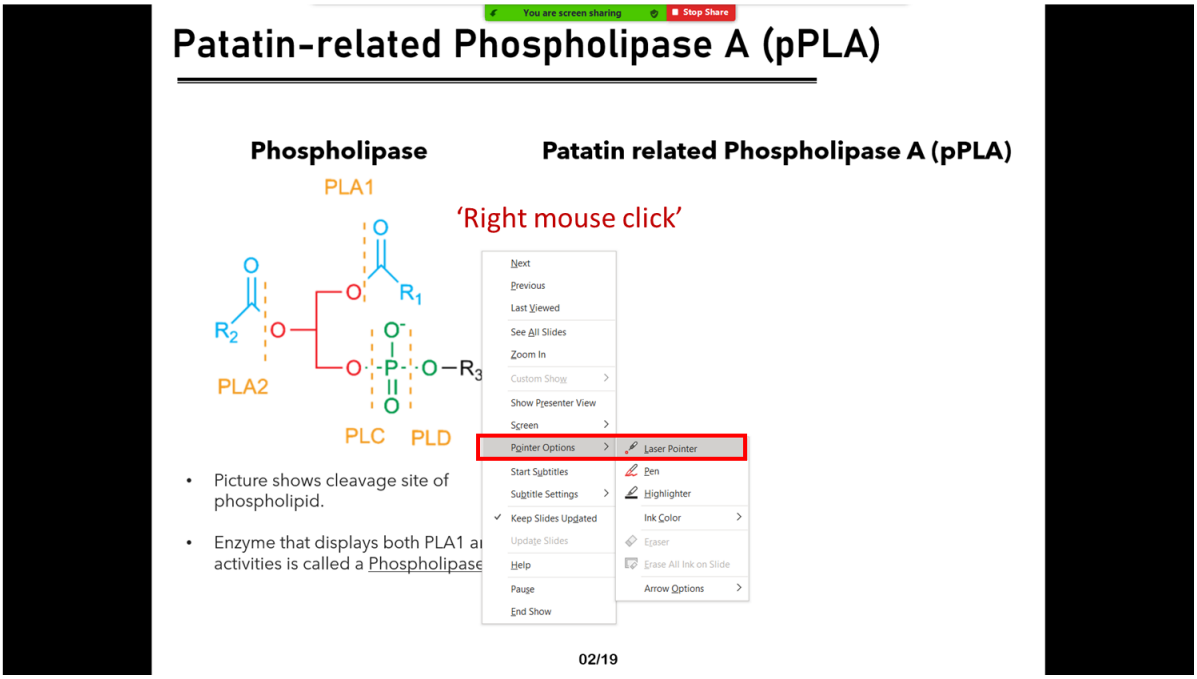
9. 화면공유가 되었다면, **화면공유중 이라는 안내문구**를 확인할 수 있다. > 슬라이드 쇼 버튼을 누르고 발표 시작
   If the screen is shared, you can check the message that **'You are screen sharing'** > Start to presentation

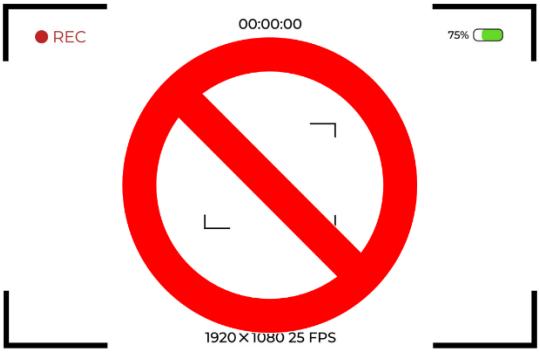


Start slide show

- **Zoom 설치 및 회의 참가 가이드**
  Guide of Zoom program setup
  발표자 화면공유 (Speaker's screen sharing)

10. 파워포인트 발표 (슬라이드쇼) 중 마우스 우클릭 > 포인터 기능 사용가능
    Right mouse click on ppt slide > You can use the pointer



 *'https://kor.pngtree.com/so/음소거'*	 *'https://kor.pngtree.com/so/카메라*
발표자를 제외한 모든 참가자들 **음소거 해주세요.** **Please press the mute button.**	**실시간 온라인 강의(ZOOM) 시, 별도의** **기기를 이용하여 녹화하는 행위 금지** **(저작권 및 초상권 침해 가능성)** **Do not recording**

BK21 FOUR IT-Bio융합시스템농업교육연구단 제 2회 국제학술대회

"International Conference on IT-Bio Convergence"

27 AUGUST 2021 | VIRTUAL CONFERENCE