Dr. Taeyeong Choi *Curriculum vitae*

CONTACT INFORMATION

Lincoln Agri-Robotics Centre
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INTERESTS

Novel learning algorithms for real applications with limited resources — agricultural AI, robotics, deep neural networks, anomaly detection, data/controller synthesis, Bayesian learning, active planning/navigation, information-theoretic decision-making, decentralised systems, and reinforcement learning

CURRENT ACADEMIC APPOINTMENTS

University of Lincoln (UoL), Lincoln, UK
Postdoctoral Research Associate **Oct 2020 – Present**

- Superviser: Dr. Grzegorz Cielniak
- Affiliations:
  - Lincoln Agri-Robotics (LAR)
  - Lincoln Institute for Agri-food Technology (LIAT)
  - Lincoln Centre for Autonomous Systems (L-CAS)

EDUCATION

Arizona State University (ASU), Tempe, AZ, USA
M.S. & Ph.D., Computer Science **Dec 2020**

- Advisor: Dr. Theodore (Ted) P. Pavlic
- Ph.D. Dissertation: "Deep Learning Approaches for Inferring Collective Macrostates from Individual Observations in Natural and Artificial Multi-Agent Systems Under Realistic Constraints". ISBN: 9798557031004

Soongsil University (SSU), Seoul, South Korea
B.S.E., Computer Science and Engineering **Aug 2015**

WORK EXPERIENCE

Atlassian, Mountain View, CA

Data Scientist Intern **May 2018 – Aug 2018**

- Jira Duplicate Ticket Detection
  - Designed a deep learning pipeline for human natural language to classify semantically similar tickets from customers.
  - Gathered >124K examples to implement, train, fine-tune, and validate specialized LSTM models.
  - Demonstrated 1) significantly higher accuracy than traditional machine learning models, 2) generalizability to the data from different sources of ticket, and 3) feasibility of similarity-based ranking scenarios.

PUBLICATIONS

(Accepted / Preprinted)

[1] **Choi T.**, O. Would, A. Salazar-Gomez, and G. Cielniak. Self-supervised Representation Learning for Reliable Robotic Monitoring of Fruit Anomalies. In: *2022 IEEE International Conference on Robotics and Automation (ICRA 2022)*. arXiv:2109.10135.

[2] **Choi T.** and G. Cielniak. Channel Randomisation with Domain Control for Effective Representation Learning of Visual Anomalies in Strawberries. In: *AAAI-22 Workshop on AI for Agriculture and Food Systems (AIAFS 2022)*. OpenReview.net.

(Published)

[3] **Choi T.**, Benjamin Pyenson, Juergen Liebig, and T. P. Pavlic. Beyond Tracking: Using Deep Learning to Discover Novel Interactions in Biological Swarms. *Journal of Artificial Life and Robotics (AROB)*, Mar 2022. doi:10.1007/s10015-022-00753-y

— Extension of the *Best Paper Award* winner at *the 4th International Symposium on Swarm Behavior and Bio-Inspired Robotics 2021 (SWARM 2021)*, Jun 1–4, 2021. Kyoto, Japan. Virtual event.

[4] **Choi T.** and G. Cielniak. Adaptive Selection of Informative Path Planning Strategies via Reinforcement Learning. In: *Proceedings of the 10th European Conference on Mobile Robots (ECMR 2021)*, Aug 31–Sep 3, 2021. Bonn, Germany. Virtual event. doi:10.1109/ECMR50962.2021.9568796

[5] **Choi T.**, Benjamin Pyenson, Juergen Liebig, and T. P. Pavlic. Identification of Abnormal States in Videos of Ants Undergoing Social Phase Change. In: *Proceedings of the 35th AAAI Conference on Artificial Intelligence (AAAI-21)*, Feb 2–9, 2021. Virtual event.

[6] **Choi T.** and T. P. Pavlic. Automatic Discovery of Motion Patterns that Improve Learning Rate in Communication-Limited Multi-Robot Systems. In: *Proceedings of the IEEE 2020 International Conference on Multisensor Fusion and Integration (MFI 2020)*, Sep 14–16, 2020. Karlsruhe, Germany. Virtual event. doi:10.1109/MFI49285.2020.9235218

[7] Kang, S., **T. Choi** and T. P. Pavlic. How Far Should I Watch? Quantifying the Effect of Various Observational Capabilities on Long-range Situational Awareness in Multi-robot Teams. In: *Proceedings of the 1st IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS 2020)*, Aug 17–21, 2020. Washington, DC, USA. Virtual event. doi:10.1109/ACSOS49614.2020.00036

[8] **Choi, T.**, S. Kang, and T. P. Pavlic. Learning Local Behavioral Sequences to Better Infer Non-local Properties in Real Multi-robot Systems. In: *Proceedings of the 2020 IEEE International Conference on Robotics and Automation (ICRA 2020)*, May 31–June 4, 2020. Paris, France. Virtual event. doi:10.1109/ICRA40945.2020.9196728

[9] **Choi, T.**, T. P. Pavlic, and A. W. Richa. Automated Synthesis of Scalable Algorithms for Inferring Non-Local Properties to Assist in Multi-Robot Teaming. In: *Proceedings of the 2017 IEEE International Conference on Automation Science and Engineering (CASE 2017)*, Aug 20–23, 2017. Xi'an, China. doi:10.1109/COASE.2017.8256320

[10] **Choi, T.** and H. Na. Stealthy Behavior Simulations based on Cognitive Data. *Journal of Korea Game Society (JKGS)*, 16(2):27–40, Apr 2016. doi:10.7583/JKGS.2016.16.2.27

[11] **Choi, T.** and H. Na. Making Levels More Challenging with a Cooperative Strategy of Ghosts in Pac-Man. *Journal of Korea Game Society (JKGS)*, 15(5):89–98, Oct 2015. doi:10.7583/JKGS.2015.15.5.89

[12] **Choi, T.** and H. Na. Stealthy Behavior Simulations based on Cognitive Data. In: *Proceedings of the 2015 IEEE International Conference on Machine Learning and Cybernetics (ICMLC 2015)*, 16(2):27–40, Jul 12–15 2015. Guangzhou, China. doi:10.1109/ICMLC.2015.7340900

Poster Presentations

[13] **Choi, T.**, T. P. Pavlic, and A. W. Richa. Automated Synthesis of Scalable Algorithms for Inferring Non-local Properties to Assist in Multi-Robot Teaming. In: Poster Session at *Southwest Robotics Symposium*, Jan 2018. Tempe, AZ, USA.

[14] **Choi, T.**, T. P. Pavlic, and A. W. Richa. Automated Synthesis of Scalable Algorithms for Inferring Non-local Properties to Assist in Multi-Robot Teaming. In: Poster Session at *TEDxASU: Innovators Symposium*, Mar 2017. Tempe, AZ, USA.

[15] **Choi, T.**, J. Lee, C. Soh, and J. Lee. Social Alarm: Smart mobile application helping people to get up together. In: Poster Session at *Seoul Accord ITem SHOW*, Dec 2012. Seoul, South Korea.

Invited Talks

[16] Self-supervised Learning of Visual Anomalies in Strawberries. In: *International Conference on Digital Technologies for Sustainable Crop Production (DIGICROP)*, Mar 2022. Virtual event.

[17] AI Research in Agriculture and Beyond – Successful Machine Learning under Limited Resources. In: *Hankyong National University, School of Computer Engineering & Applied Mathematics Seminar*, Dec 2021. Anseong, South Korea.

[18] Identifying Anomalies for Better Decision-Making. In: *University of Lincoln, CMP9766M: Frontiers of Robotics Research Seminar*, May 2021. Lincoln, UK. Virtual event.

[19] Local Behavior Learning for Social Temperature Prediction without Individual Ant Tracking. In: Oral Session at *Collective Information Processing*, Mar 2020. Berlin, Germany.

[20] Machine Learning Applications for Video Game Development. In: *Hankyong National University, School of Computer Engineering & Applied Mathematics Seminar*, Jul 2015. Anseong, South Korea.

Research Projects

ASU, Tempe, AZ

- NSF: "CRISP: Type 2/Collaborative Research: Design and Control of Coordinated Green and Gray Water Infrastructure to Improve Resiliency in Chemical and Agricultural Sectors" **Aug 2018 – Dec 2019**
  - PI: Dr. John Sabo
  - Combinatorial optimization for the placement of green infrastructures (wetlands) along with gray infrastructures (reservoirs) to minimize risks of natural disasters in an area of interest.
- DARPA I20: "BioSwarm: Bio-Inspired Swarming" **Aug 2017 – Jul 2018**
  - Supervisor (co-PI): Dr. Theodore (Ted) P. Pavlic
  - PI: Dr. Stephen C. Pratt
  - Designed deep neural networks to identify informative behaviors of *Harpegnathos* ants for classification of colonial states.

SSU, Seoul, South Korea

- Reinforcement Learning for Video Game Design **Oct 2014 – Aug 2015**
  - Supervisor: Dr. Hyeon-Suk Na
  - Designed a model-free reinforcement learning framework to predict the actions of human players at the stage of video game development.
  - Proposed team strategies of enemies using A* algorithm to highly increase the level in the games of Pac-Man.
- Development of a Cognitive Planning and Learning Model for Mobile Platforms **Dec 2012 – Sep 2014**
  - Supervisor: Dr. Young-Tack Park
  - Contributed to refining noisy GPS data from Android phones and creating modules on Android OS for reliable communication with a remote server computer.
  - Implemented ontology-based temporal reasoning models integrated with SPAQL.

Teaching Experience

ASU, Tempe, AZ

Teaching Assistant

- CSE 450/551: Design Analysis of Algorithms/Foundations of Algorithms: **Jan 2018 – May 2018**
  - Instructor: Dr. Andréa Richa
  - Graded exams, and held office hours (2 hours/week) for tutoring students.

- CSE 310: Data Structures and Algorithms: **Aug 2017 – Dec 2017**
  - Instructor: Dr. Andréa Richa
  - Taught recitation sessions (4 hours/week), graded exams, and provided instructions for C++ programming assignments.
- CSE 205: Object-Oriented Programming & Data Structures **Jan 2016 – May 2016**
  - Instructor: Dr. Xuerong Feng
  - Graded exams, and tutored students for Java programming (4 hours/week).
- CSE 100: Prin. of Programming with C ++ **Jan 2016 – May 2016**
  - Instructor: Dr. Phillip Miller
  - Supervised C++ programming laboratories (5 hours/week), and held tutoring hours (4 hours/week).
- CSE 424: Capstone Project II **Aug 2015 – Dec 2015**
  - Instructor: Dr. Debra Calliss
  - Supervised each project group with their short-term and long-term goals, and graded IT ethics essays.

MENTORING

UoL, Lincoln, UK

- Owen Would (MSc in Robotics & Autonomous Systems) **Mar 2021 – Sep 2021**
  - Studied on deep network-based visual anomaly detection of strawberry images, and validated GAN-based approaches on challenging conditions such as occlusion.

ASU, Tempe, AZ, USA

- Sehyeok Kang (MS in Computer Engineering) **Mar 2019 – May 2020**
  - Researched on Remote Teammate Localization on the physical robot platform *Thymio*, and also analysed the correlation between the prediction accuracy and the amount of observation samples.
- Ricardo Weir (BS in Computer Science) **Mar 2018 – Dec 2018**
  - Built a YOLO-based deep learning pipeline from data annotation to model validation to perform automatic tracking of individual *Harpegnathos* ants from video recordings.

GRANTS & AWARDS

SWARM 2021

- Best Paper Award Jun 2021

ASU Graduate College

- Completion Fellowship ($8,550 plus tuition for 1 credit hour) Aug 2020

ASU Ira A. Fulton Schools of Engineering

- Engineering Graduate Fellowship ($700) May 2020

ASU School of Computing, Informatics, and Decision Systems Engineering

- Doctoral Fellowship ($4,000) Mar 2020

ASU Social Insect Research Group

- Student Research Grants ($1,550) Nov 2018
  - Project: Deep features for generalizable insect behavior learning.

SSU College of Information Technology

- Bronze Award at Software Development Competition — Oct 2012
  - Social Alarm: Smart Android Alarm Application (Photos & Demo)

PROFESSIONAL SERVICE

TAROS 2021

- *Session Chair: "Oral Session 3"* — Sep 2021

ASU Graduate and Professional Student Association

- *Research Grants Reviewer* — Aug 2017 – May 2018
- *Travel Grants Reviewer* — Aug 2016 – Jul 2017

IEEE CASE 2017

- *Session Co-chair: "Big Data for Automation II"* — Aug 2017

HARDWARE AND SOFTWARE SKILLS

Data Science & Machine Learning:

- Tensorflow, PyTorch, Tensorboard, Weka, OpenCV, and Gephi.

Robotics:

- Thymio: A two-wheeled mobile robotic platform with a small diameter of about 12cm.
- Robotarium: Mobile multi-robot system simulator, designed by *GRITSLab* in *Georgia Institute of Technology*, enabling to remotely access the physical robotic resources.
- Webots: An open-sourced robot simulator to visualise operation of various commercialised platforms in 3D with Python scripts.

Programming Languages:

- Python, Java, C, C++, UNIX shell scripting, GNU make, MySQL, and others.

Operating Systems:

- Microsoft Windows family, Apple OS X, Linux, and other UNIX variants.

Others:

- Unity 3D, MATLAB, LaTeX, GitHub, Android, and TCP/IP programming.

SERVICE

ASU International Students Club
Student President — Aug 2016 – Dec 2017

Korea Food for the Hungry International (KFHI)
Math Tutor for Middle School Students — Apr 2014 – Aug 2014

Campus Crusade for Christ at Seoul South District
Student President — Mar 2011 – Aug 2012

Republic of Korea Army
Military Service — Feb 2009 – Dec 2010