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INTERESTS	<b>Novel learning methods for real-world applications with limited resources</b> —applied AI, robotics, AI for agriculture/biology, anomaly detection, active sensing, generative models, self-supervised learning, Bayesian learning, and reinforcement learning	
CURRENT ACADEMIC APPOINTMENTS	<b>University of California, Davis (UCD)</b> , Davis, CA, USA Postdoctoral Scholar, Computer Science	<b>Aug 2022 – Present</b>
	<ul style="list-style-type: none"> <li>• Supervisor: Dr. Xin Liu</li> <li>• Affiliations: <ul style="list-style-type: none"> <li>– Department of Computer Science</li> <li>– AI Institute for Food Systems (AIFS)</li> </ul> </li> </ul>	
PREVIOUS ACADEMIC APPOINTMENTS	<b>University of Lincoln (UoL)</b> , Lincoln, UK Postdoctoral Research Associate	<b>Oct 2020 – Jul 2022</b>
	<ul style="list-style-type: none"> <li>• Supervisor: Dr. Grzegorz Cielniak</li> <li>• Affiliations: <ul style="list-style-type: none"> <li>– Lincoln Agri-Robotics (LAR)</li> <li>– Lincoln Institute for Agri-food Technology (LIAT)</li> <li>– Lincoln Centre for Autonomous Systems (L-CAS)</li> </ul> </li> </ul>	
EDUCATION	<b>Arizona State University (ASU)</b> , Tempe, AZ, USA M.S. & Ph.D., Computer Science	<b>Dec 2020</b>
	<ul style="list-style-type: none"> <li>• Advisor: Dr. Theodore (Ted) P. Pavlic</li> <li>• 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</li> </ul>	
	<b>Soongsil University (SSU)</b> , Seoul, South Korea B.S.E., Computer Science and Engineering	<b>Aug 2015</b>
WORK EXPERIENCE	<b>Atlassian</b> , Mountain View, CA <i>Data Scientist Intern</i>	<b>May 2018 – Aug 2018</b>
	<ul style="list-style-type: none"> <li>• Jira Duplicate Ticket Detection <ul style="list-style-type: none"> <li>– Designed a deep learning pipeline for human natural language to classify semantically similar tickets from customers.</li> <li>– Gathered &gt;124K examples to implement, train, fine-tune, and validate specialized LSTM models.</li> <li>– 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.</li> </ul> </li> </ul>	
PUBLICATIONS	<b>(Preprinted/Accepted)</b> [1] <b>Choi T.</b> and X. Liu. Exploiting Unlabeled Data to Improve Detection of Visual Anomalies in Soft Fruits. In: <i>AAAI-23 Workshop on AI for Agriculture and Food Systems (AIAFS 2023)</i> .	

- [2] Liu Y., **T. Choi**, and X. Liu. Constrained Reinforcement Learning for Autonomous Farming: Challenges and Opportunities. In: *AAAI-23 Workshop on AI for Agriculture and Food Systems (AIAFS 2023)*.
- [3] **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)**

- [4] **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)*. May 23–27, 2022. Philadelphia, USA. doi:10.1109/ICRA46639.2022.9811954.
- [5] **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.
- [6] **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
- [7] **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.
- [8] **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
- [9] 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
- [10] **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
- [11] **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
- [12] **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
- [13] **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

- [14] **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
- [15] **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.
- [16] **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.
- [17] **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
- [18] Self-supervised Learning of Visual Anomalies in Strawberries. In: *International Conference on Digital Technologies for Sustainable Crop Production (DIGICROP)*, Mar 2022. Virtual event.
- [19] 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.
- [20] Local Behavior Learning for Social Temperature Prediction without Individual Ant Tracking. In: Oral Session at *Collective Information Processing*, Mar 2020. Berlin, Germany.
- [21] Machine Learning Applications for Video Game Development. In: *Hankyong National University, School of Computer Engineering & Applied Mathematics Seminar*, Jul 2015. Anseong, South Korea.
- TEACHING EXPERIENCE
- UCD**, Davis, CA, USA
- Guest Lecturer*
- ECS 293A: Research in Computer Science **Nov 2022**
    - Graduate-level course in computer science
    - Instructor: Dr. Xin Liu
    - Lecture: “How to Read Academic Papers for You Now”
- UoL**, Lincoln, UK
- Guest Lecturer*
- CMP 9766M: Frontiers of Robotics Research Seminar: **May 2021**
    - Graduate-level course in robotics and autonomous systems
    - Instructor: Dr. Grzegorz Cielniak
    - Lecture: “Identifying Anomalies for Better Decision-Making”
- ASU**, Tempe, AZ, USA
- 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

### UCD, Davis, CA, USA

- Avishai Halev (Ph.D. candidate in Applied Mathematics) **Sep 2022 – Present**
  - Collaborating with food scientists on efficient parameter search to build a realistic oxidation model based on empirical datasets.

### UoL, Lincoln, UK

- Owen Would (M.Sc. in Robotics & Autonomous Systems) **Mar 2021 – Sep 2021**
  - Studied on deep neural 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 (M.S. 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 (B.S. in Computer Science) **Mar 2018 – Dec 2018**
  - Developed a YOLO-based deep learning pipeline—from data annotation to model validation—to perform automatic tracking of individual *Harpegnathos* ants from video recordings.

## 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 placement of green infrastructures (wetlands) along with gray infrastructures (reservoirs) to minimize risks of natural disasters in areas 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 a deep neural network 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 novel team strategies of enemies in the video game of Pac-Man using A\* algorithm to significantly increase the overall level of difficulty.
- 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 for reliable communication with a remote server.
  - Implemented ontology-based temporal reasoning models integrated with SPAQL.

#### 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

##### **Workshop Organizer**

- (*Under Review in ICRA2023*) “Task-Informed Grasping IV: From Farm To Fork”
  - Full-day workshop on robotic innovations to improve food systems—from farming to postharvesting, consumption, and legislation

##### **Conference/Journal Reviewer**

- ICRA 2023, ICRA 2022, IROS 2022, RA-L, ICRA 2020

##### **Grant Reviewer**

- Research Grant at ASU GPSA Aug 2017 – May 2018
- Travel Grant at ASU GPSA Aug 2016 – Jul 2017

**Conference Session Chair**

- TAROS 2021 Sep 2021
- IEEE CASE 2017 Aug 2017

**HARDWARE AND  
SOFTWARE SKILLS**

**Data Science & Machine Learning:**

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

**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, L<sup>A</sup>T<sub>E</sub>X, 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

**Korea Campus Crusade for Christ**

*Student President for the Southern District of Seoul*

Mar 2011 – Aug 2012

**Republic of Korea Army**

*Military Service*

Feb 2009 – Dec 2010