Taeyeong Choi *Curriculum vitae*

CONTACT INFORMATION

University of Lincoln
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INTERESTS

Novel learning algorithms for robotic/biological agent systems under realistic constraints – deep neural networks, anomaly detection, data/controller synthesis, Bayesian learning, active planning, information-theoretic decision making, decentralised systems, reinforcement learning

CURRENT ACADEMIC APPOINTMENTS

University of Lincoln (UoL), Lincoln, UK
Postdoctoral Research Associate **Oct 2020 - present**

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

EDUCATION

Arizona State University (ASU), Tempe, AZ, USA
MS & 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**

- Advisor: Professor Jaeyoung Choi

CONFERENCE/ JOURNAL PUBLICATIONS

[1] **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).

[2] **Choi T.**, Benjamin Pyenson, Juergen Liebig, and T. P. Pavlic. Beyond Tracking: Using Deep Learning to Discover Novel Interactions in Biological Swarms. In: *Proceedings of the 4th International Symposium on Swarm Behavior and Bio-Inspired Robotics 2021 (SWARM 2021)*, Jun 1–4, 2021. Kyoto, Japan (Virtual).
– Best Paper Award

[3] **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 2021)*, Feb 2–9, 2021. Virtual conference.

[4] **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). doi:10.1109/MFI49285.2020.9235218

[5] 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). doi:10.1109/ACSOS49614.2020.00036

[6] **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). doi:10.1109/ICRA40945.2020.9196728

[7] **Choi, T.**, T. P. Pavlic, and A. 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

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

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

[10] **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

Workshop & Poster Presentation

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

[12] **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.

[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 *TEDxASU: Innovators Symposium*, Mar 2017, Tempe, AZ, USA.

[14] **Choi, T.**, J. Lee, C. Soh, and J. Lee. Social Alarm: Smart mobile application enabling a group of people to wake up each other. In: Poster Session at *Seoul Accord ITem SHOW*, Dec 2012, Seoul, 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 – present**
  - PI: Professor John Sabo
  - Solving combinatorial optimization problems to find the best locations of green infrastructure (wetlands) to minimize potential risks in operating gray infrastructure (reservoirs) in an area of interest.
- DARPA I20: "BioSwarm: Bio-Inspired Swarming" **Aug 2017 – Jul 2018**
  - Supervisor (co-PI): Professor Theodore (Ted) P. Pavlic
  - PI: Professor Stephen C. Pratt
  - Designed deep neural networks to detect the occurrences of social behaviors among *Harpegnathos* ants from large video data sets.
  - Automated to discover individual behaviors that highly correlate with the temporal changes of stability in ant colonies.

SSU, Seoul, South Korea

- Machine Learning for Video Game Design **Oct 2014 – Aug 2015**
  - Supervisor: Professor Hyeon-Suk Na
  - Showed the feasibility of a model-free reinforcement learning framework to predict actions of human players at the stage of video game development.
  - Proposed a better team strategy using A* algorithm to maximize the difficulty of a video game Pac-man.
- Development of a Cognitive Planning and Learning Model for Mobile Platforms **Dec 2012 – Sep 2014**
  - Supervisor: Professor Young-Tack Park
  - Contributed to implementing software modules of an android client application to refine collected raw GPS data and communicate with remote servers.
  - Demonstrated ontology-based temporal reasoning approaches with the queries of SPAQL.

WORK EXPERIENCE

Atlassian, Mountain View, CA

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

- Jira Duplicate Ticket Detection
  - Built a deep learning pipeline for NLP, which can classify semantically similar tickets from customers so that the writing customer can be notified with relevant tickets already answered before.
  - Collected >124K ticket examples to train, fine-tune, and validate a LSTM based model called BiMPM.
  - Demonstrated 1) better performance than baseline models previously implemented by traditional feature extraction, 2) generalizability with data from different ticket sources, and 3) feasibility in similarity-based ranking scenarios.

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
  - Responsible for grading exams and office hours (2 hours/week) to tutor students for assignments.
- CSE 310: Data Structures and Algorithms: **Aug 2017 – Dec 2017**
  - Instructor: Dr. Andréa Richa
  - Responsible for teaching recitation session (4 hours/week), grading exams, and providing C++ programming guides for assignments.
- CSE 205: Object-Oriented Programming & Data **Jan 2016 – Mar 2016**
  - Instructor: Dr. Xuerong Feng
  - Responsible for grading exams and Java programming tutoring (4 hours/week).
- CSE 100: Prin. of Programming with C ++ **Jan 2016 – Mar 2016**
  - Instructor: Dr. Phillip Miller
  - Responsible for supervision of C++ programming laboratory (5 hours/week) and programming tutoring hours (4 hours/week).
- CSE 424: Capstone Project II **Aug 2015 – Dec 2015**
  - Instructor: Dr. Debra Calliss
  - Responsible for supervising each project group's achievement toward their short-term and long-term goals as well as grading IT ethics essays.

MENTORING

ASU, Tempe, AZ

- Sehyeok Kang (Masters in Computer Engineering) **Mar 2019 – May 2020**
  - Implemented physical mobile robots *Thymio* to solve Remote Teammate Localization problem.
  - Collected trajectory data using color-based robot detection from recorded video frames.
- Ricardo Weir (Undergraduate in Computer Science) **Mar 2018 – Dec 2018**
  - Built a deep learning pipeline, from annotations to validations, to track individual *Harpegnathos* ants using YOLO algorithm.

PROFESSIONAL SERVICE

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

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.

Software Development Competition at SSU College of Information Technology

- Bronze Prize (Photos & Demo) Oct 2012
  - Social Alarm: Smart Anroid Alarm Application

HARDWARE AND SOFTWARE SKILLS

Data Science & Machine Learning:

- Tensorflow/PyTorch to implement various GPU-accelerated deep neural network algorithms, such as ANN, CNN, and RNN, for a huge amount of (possibly, temporal) data.
- Tensorboard: Visualization tool for machine learning models trained by Tensorflow/Pytorch.
- WEKA to easily try diverse preprocessing methods or (un)supervised machine learning algorithms.
- Open CV to (pre-)process video or image data.
- Gephi to visualize graph data.

Robotics:

- Thymio: A two-wheeled mobile robotic platform with a diameter of about 12cm, which can be easily programmed through a python interface.
- Robotarium: Mobile multi-robot system simulator, designed by *GRITSLab* in *Georgia Institute of Technology*, enabling to remotely access the physical robotic resources.

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 application development, TCP/IP networking.

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