Jiin Woo

Ph.D. Candidate at Carnegie Mellon University

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Education

Carnegie Mellon University (CMU)   *Pittsburgh, PA, USA*
Ph.D. in Electrical & Computer Engineering   *Aug. 2021 - Present*

- Advisors: Yuejie Chi and Gauri Joshi

Korea Advanced Institute of Science and Technology (KAIST)   *Daejeon, South Korea*
M.S. in Electrical Engineering   *Sep. 2016 - Aug. 2018*

- Advisor: Yung Yi

Korea Advanced Institute of Science and Technology (KAIST)   *Daejeon, South Korea*
B.S. in Mathematical Sciences   *Feb. 2011 - Aug. 2016*

Linköping University   *Linköping, Sweden*
Exchange Student   *Feb. 2014 - Aug. 2014*

Work Experience

NAVER Search   *Seongnam, South Korea*
Machine Learning Engineer   *Sep. 2018 - Aug. 2021*

- Developed a large-scale keyword representation model that identifies the intention of all queries using texts in search engine results pages (SERPs) and click logs, which covers long-tail keywords. Implemented a regularized BERT text classifier based on the co-click distance between keywords to extract fine-grained embeddings of SERPs. Reduced class spaces by clustering classes with non-negative matrix factorization.
- Developed a personalized keyword recommendation algorithm that considers real-time search trends and personal preferences depending on user features with contextual multi-armed bandit and Bradley-Terry model.
- Provided the embedding of user actions for various user analysis tasks, such as user satisfaction prediction and next action prediction. Contributed by developing an attention-based representation model, which encodes a sequence of search actions to a compact embedding.

Publications

Conference

[C3] Iterative Learning of Graph Connectivity from Partially-Observed Cascade Samples   *Online*
Jiin Woo, Jungseul Ok, Yung Yi
ACM MobiHoc, 2020

[C2] On the Asymptotic Content Routing Stretch in Network of Caches: Impact of Popularity Learning   *New York, USA*
Boram Jin, Jiin Woo, Yung Yi
NETGCOOP, 2019

[C1] Rumor Source Detection under Querying with Untruthful Answers   *Atlanta, USA*
Jaeyoung Choi, Sangwoo Moon, Jiin Woo, KyungHwan Son, Jinwoo Shin, Yung Yi
IEEE INFOCOM, 2017

Journal

[J2] Information Source Finding in Networks: Querying With Budgets
Jaeyoung Choi, Sangwoo Moon, Jiin Woo, KyungHwan Son, Jinwoo Shin, Yung Yi
IEEE/ACM Transactions on Networking, 2020

[J1] Estimating the Information Source under Decaying Diffusion Rates
Jiin Woo, Jaeyoung Choi
Electronics, 2019

Research Experience

Yuejie Chi Group and Optimization Probability and Learning (OPAL) Lab, CMU
Aug. 2021 - Present
Graduate Researcher (Advisors: Yuejie Chi and Gauri Joshi)

- Developed a federated Q-learning algorithm that balances heterogeneous training progress of local models via weighted averaging, which guarantees linear speedup with respect to the number of agents even in the presence of agents having insufficient coverage of the state-action space.
- Analyzed sample complexity of the federated Q-learning algorithm and studied the impact of heterogeneity in behavior policies and communication period on the sample efficiency.

LeArning in Networking: Algorithm, Design, and Analysis (LANADA) Lab, KAIST
Sep. 2016 - Aug. 2018
Graduate Researcher (Advisor: Yung Yi)

- Developed a graph inference algorithm estimating the connectivity of a graph from a collection of partially observed epidemic cascades via approximate maximum likelihood estimation, which guarantees near-optimal sample complexity.
- Improved a rumor source localization algorithm via active querying with provable guarantees and analyzed the dependency between accuracy and querying cost.
- Designed a lightweight DQN structure via parameter sharing based on the symmetricity of MDP, which significantly reduces the computational complexity while guaranteeing local optimality.

Algorithmic Intelligence Laboratory (ALIN-LAB), KAIST
Jun. 2015 - Dec. 2015
Undergraduate Intern (Advisor: Jinwoo Shin)

- Studied Minimum weight perfect matching (MWPM) and maximum weight matching (MWM) problems. Focused on parallelizable algorithms for MWPM and MWM with multiple intermediate max-product belief propagations (BPs).
- Studied the principles of graphical models. Focused on variational methods in parameter estimation.

Artificial Intelligence & Probabilistic Reasoning Laboratory (AIPR-LAB), KAIST
Jan. 2015 - May. 2015
Undergraduate Intern (Advisor: Kee-Eung Kim)

- Studied and implemented reinforcement learning (RL) methods for competition examples. Focused on kernel-based RL.

Projects

Learning-Based Framework for Improving Large-scale Search
Jul. 2017 - Jun. 2018
NAVER Corporation

- Developed a recommendation algorithm that daily selects a small set of keywords among a massive size of candidates to maximize user satisfaction on the search engine result pages.
- Significantly reduced the computational complexity of deep reinforcement learning by designing parameter shared Deep Q-Networks (DQN) based on the permutation equivariant and invariant properties of the problem's Markov Decision Process (MDP).
- Contributed to the MDP formulation and mathematical proofs for the local optimality of the weight shared DQN structure.

Versatile Network System Architecture for Multi-dimensional Diversity
Sep. 2016 - Dec. 2017
Institute for Information & communications Technology Promotion (IITP) funded by the Korea
government (MSIP)

- Developed FogOS, a distributed operating system for IoT services, which manages the cloud and the resources at the edge and connects individually owned edge devices with incentives in a distributed manner.
- Participated in the implementation of a matching module in FogOS, which optimizes the resource allocation between service requests and available edge devices.

Real-Time Analysis and Interactive Visualization Platform for Large-Scale IoT Data
Jun. 2015 - Nov. 2015
Korea IT Business Promotion Association (IPA)

- Developed a web-based data visualization platform, which provides real-time information about large-scale streaming data. Applied the platform to smart city data collected from sensors, such as air pollution and energy consumption, and provided real-time urban information to citizens.
- Implemented interactive data visualization web pages with MEAN stack (MongoDB, Express.js, AngularJS, and Node.js).

Honors & Awards

Hsu Chang Memorial Fellowship
United States
Electrical and Computer Engineering Department at Carnegie Mellon University (CMU)
2023

KAIST Support Scholarship
South Korea
Korea Advanced Institute of Science and Technology (KAIST)
Fall 2016 - Spring 2018

Excellence Award in Creative Challenge Type SW R&D Program	*Seoul, South Korea*
Korea IT Business Promotion Association (IPA)	*Nov. 2015*

3rd place in "Show Me The Street" Innovation Challenge 2015	*Incheon, South Korea*
Cisco Global Center of Excellence (GCoE)	*Nov. 2015*

The National Scholarship for Science and Engineering	*South Korea*
Korea Student Aid Foundation (KOSAF)	*Spring 2011 - Spring 2015*

Teaching

Data Structures and Algorithms for Electrical Engineering (EE205)	*Fall 2017*
Teaching Assistant, Korea Advanced Institute of Science and Technology (KAIST)	

Calculus 1, 2 (MAS101, MAS102)	*Fall 2016, Fall 2017*
Tutor, Korea Advanced Institute of Science and Technology (KAIST)	

EE Co-op Program (Field Training and Education Program)	*Spring 2017*
Teaching Assistant, Korea Advanced Institute of Science and Technology (KAIST)	

Relevant Coursework

Machine Learning

- Distributed and Federated Learning Algorithms
- Advanced Introduction to Machine Learning
- Artificial Intelligence and Machine Learning
- Fundamentals of Machine Learning
- Convex Optimization
- Information Theory

Statistics/Math

- Engineering Statistics
- Introduction to Graph Theory
- Mathematical Statistics
- Lebesgue Integral Theory
- Introduction to Differential Geometry
- Logic and Set Theory
- Analysis
- Discrete Mathematics
- Probability and Statistics
- Differential Equations and Applications
- Linear Algebra
- Calculus

Programming/Systems

- Operating Systems and System Programming for Electrical Engineering
- System Programming
- Data structure
- Computer Network
- Introduction to Programming

Technical Skills

Programming	Python, MATLAB, C, Java, LaTeX
ML, Data Science	Pytorch, Tensorflow, Spark, Hive, Hadoop
Others	HTML, CSS, Javascript, MongoDB, Express, AngularJS, NodeJS