Yongho Shin

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Research Interests

Online/approximation algorithms for combinatorial optimization problems

Education

Ph.D. in Computer Science, Yonsei University, South Korea Mar. 2018 – Aug. 2024 (expected)

- ◇ Dissertation topic: Relaxing hard requirements of online optimization via learning augmentation and limited revocability
- ◇ Advisor: Hyung-Chan An

B.S. in Computer Science, Yonsei University, South Korea Mar. 2012 – Feb. 2018

- ◇ Awarded *high honors at graduation*

Research Papers

Yongho Shin, Changyeol Lee, and Hyung-Chan An. On optimal consistency-robustness trade-off for learning-augmented multi-option ski rental. *arXiv preprint arXiv:2312.02547*, 2023.

- ◇ This paper bridges the gap for both deterministic and randomized learning-augmented algorithms for the multi-option ski rental problem. For deterministic algorithms, we present a best-possible algorithm that matches the known lower bound; for randomized algorithms, we show the first nontrivial lower bound on the consistency-robustness trade-off, and also present an improved randomized algorithm. Our algorithm matches our lower bound on robustness within a factor of e/2 when the consistency is at most 1.086.

Yongho Shin, Changyeol Lee, Gukryeol Lee, and Hyung-Chan An. Improved learning-augmented algorithms for the multi-option ski rental problem via best-possible competitive analysis. In *Proceedings of the 40th International Conference on Machine Learning (ICML 2023)*, PMLR 202:31539-31561, 2023.

- ◇ Ski rental problems are one of the canonical problems in the field of online optimization. However, only deterministic algorithms were previously known for multi-option ski rental, with or without learning augmentation. We present the first randomized learning-augmented algorithm for this problem, surpassing previous performance guarantees given by deterministic algorithms. Our learning-augmented algorithm is based on a new, provably best-possible randomized competitive algorithm for the problem. Our results are further complemented by lower bounds for deterministic and randomized algorithms.

Kangsan Kim, **Yongho Shin**, and Hyung-Chan An. Constant-factor approximation algorithms for parity-constrained facility location and k-center. *Algorithmica 85*, 1883–1911, 2023.

- ◇ Preliminary version: Kangsan Kim, **Yongho Shin**, and Hyung-Chan An. Constant-factor approximation algorithms for the parity-constrained facility location problem. In *Proceedings of the 31st International Symposium on Algorithms and Computation (ISAAC 2020)*, 21:1-21:17, 2020.
- ◇ *Facility location* is a prominent optimization problem in combinatorial optimization, and has been investigated under various settings. However, little is known on how the problem behaves in conjunction with parity constraints. This shortfall of understanding was rather disturbing when we consider the central role of *parity*

in the field of combinatorics. In this paper, we present the first constant-factor approximation algorithm for the facility location with parity constraints.

Yongho Shin and Hyung-Chan An. Making three out of two: Three-way online correlated selection. In *Proceedings of the 32nd International Symposium on Algorithms and Computation (ISAAC 2021)*, 49:1-49:17, 2021.

◇ *Two-way online correlated selection (two-way OCS)* is an online algorithm that, at each timestep, takes a pair of elements from the ground set and irrevocably chooses one of the two elements, while ensuring negative correlation in the algorithm's choices. Fahrbach, Huang, Tao, and Zadimoghaddam initially invented OCS to tackle the edge-weighted online bipartite matching, and posed an open question: Can we obtain a nontrivial *n-way OCS* for $n > 2$? In this paper, we affirmatively answer this open question by presenting a *three-way OCS*. We also show that our OCS yields a 0.5093-competitive algorithm for the edge-weighted online matching, demonstrating its usefulness.

Yongho Shin, Kangsan Kim, Seungmin Lee, and Hyung-Chan An. Online graph matching problem with a worst-case reassignment budget. *arXiv preprint arXiv:2003.05175*, 2020.

◇ We propose to consider how requiring a *worst-case* hard budget on the number of reassignments affects the algorithms' performances under various models of online graph matching. Through a simple algorithm exploiting a shortest augmenting path of length within the given budget, we demonstrate that even a small hard budget can yield significant performance advantage, compared to those algorithms that do not perform reassignments. Moreover, we further show that this algorithm is a best-possible deterministic algorithm for all those models.

Awards

High honors at graduation, Yonsei University — Feb. 2018

Presentations

Improved learning-augmented algorithms for the multi-option ski rental problem via best-possible competitive analysis

◇ Poster presentation at ICML 2023, Honolulu, HI, USA — July 2023

Making three out of two: Three-way online correlated selection

◇ Discrete Analysis Seminar, Yonsei University, Seoul, South Korea — June 2024

◇ Discrete Math Seminar, IBS DIMAG, Daejeon, South Korea — May 2024

◇ Theory Tea, Cornell University, Ithaca, NY, USA — Dec. 2022

◇ Presentation at ISAAC 2021, Fukuoka, Japan (virtual) — Dec. 2021

◇ Presentation at AAAC 2021, Tainan, Taiwan (virtual) — Oct. 2021

Constant-factor approximation algorithms for the parity-constrained facility location problem

◇ Presentation at ISAAC 2020, Hong Kong, China (virtual) — Dec. 2020

Research Experience

Intern, Cornell University — Sept. 2022 – Dec. 2022

◇ Director: David B. Shmoys

Undergraduate intern, Yonsei University — Jan. 2017 – Feb. 2018

◇ Advisor: Hyung-Chan An

Teaching Experience

Teaching assistant, Yonsei University

- ◇ CSI2103/CCO2103 Data Structures — Spring 2018 – 2021, 2023, 2024
- ◇ CSI3108 Algorithm Analysis — Fall 2018 – 2021, 2023
- ◇ AIC2130 Computer Algorithms for AI Applications — Fall 2023
- ◇ GEK6205 Design and Analysis of Optimization Algorithms — Fall 2023

Undergraduate voluntary tutor, Yonsei University

- ◇ CSI3108 Algorithm Analysis — Fall 2016, 2017
- ◇ CSI2103 Data Structures — Spring 2017

Miscellaneous Experience

Co-organizer of Yonsei CS theory student group, Yonsei University — Jan. 2023 – Feb. 2024

- ◇ Initiated a reading group of TCS students in and out of Yonsei University
- ◇ Organizing seminar talks on various topics including mechanism design and quantum computing

Web programmer, Republic of Korea Air Force — Nov. 2013 – Aug. 2015

- ◇ In fulfillment of mandatory military service