

# Yongho Shin

Ph.D. candidate

Department of Computer Science, Yonsei University

50 Yonsei-ro, Seodaemun-gu

Seoul 03722, South Korea

Email: [yshin@yonsei.ac.kr](mailto:yshin@yonsei.ac.kr)

Homepage: <https://yonghoshin36.github.io>

## 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

◇ 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 the 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.

**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.

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.

- ◇ Journal version: 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.
- ◇ *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**, 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*

- ◇ Theory Tea, Cornell University, Ithaca, NY, USA
- ◇ Presentation at ISAAC 2021, Fukuoka, Japan (virtual)
- ◇ Presentation at AAAC 2021, Tainan, Taiwan (virtual)

Dec. 2022

Dec. 2021

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

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

- ◇ 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