Learning-Augmented Mechanism Design: Leveraging Predictions for Facility Location

PRIYANK AGRAWAL, Columbia University
ERIC BALKANSKI, Columbia University
VASILIS GKATZELIS, Drexel University
TINGTING OU, Columbia University
XIZHI TAN, Drexel University

CCS Concepts: • **Theory of computation → Algorithmic mechanism design**.

Additional Key Words and Phrases: Mechanism Design, Learning Augmented Framework

ACM Reference Format:
Priyank Agrawal, Eric Balkanski, Vasilis Gkatzelis, Tingting Ou, and Xizhi Tan. 2023. Learning-Augmented Mechanism Design: Leveraging Predictions for Facility Location . 1, 1 (May 2023), 2 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 ABSTRACT

This poster will be about the paper [1] accepted at the Twenty-Third ACM Conference on Economics and Computation (EC'22). In this work we introduce an alternative model for the design and analysis of strategyproof mechanisms that is motivated by the recent surge of work in "learning-augmented algorithms". Aiming to complement the traditional approach in computer science, which analyzes the performance of algorithms based on worst-case instances, this line of work has focused on the design and analysis of algorithms that are enhanced with machine-learned predictions regarding the optimal solution. The algorithms can use the predictions as a guide to inform their decisions, and the goal is to achieve much stronger performance guarantees when these predictions are accurate (consistency), while also maintaining near-optimal worst-case guarantees, even if these predictions are very inaccurate (robustness). So far, these results have been limited to algorithms, but in this work we argue that another fertile ground for this framework is in mechanism design.

We initiate the design and analysis of strategyproof mechanisms that are augmented with predictions regarding the private information of the participating agents. To exhibit the important benefits of this approach, we revisit the canonical problem of facility location with strategic agents in the two-dimensional Euclidean space. We study both the egalitarian and utilitarian social cost functions, and we propose new strategyproof mechanisms that leverage predictions to guarantee an optimal trade-off between consistency and robustness guarantees. This provides the designer with a menu of mechanism options to choose from, depending on her confidence regarding the

Authors' addresses: Priyank Agrawal, pa2608@columbia.edu, Columbia University; Eric Balkanski, eb3224@columbia.edu, Columbia University; Vasilis Gkatzelis, gkatz@drexel.edu, Drexel University; Tingting Ou, to2372@columbia.edu, Columbia University; Xizhi Tan, xizhi@drexel.edu, Drexel University.

XXXX-XXXX/2023/5-ART $15.00
https://doi.org/10.1145/nnnnnnn.nnnnnnn

prediction accuracy. Furthermore, we also prove parameterized approximation results as a function of the prediction error,

REFERENCES

[1] Priyank Agrawal, Eric Balkanski, Vasilis Gkatzelis, Tingting Ou, and Xizhi Tan. Learning-augmented mechanism design: Leveraging predictions for facility location. In David M. Pennock, Ilya Segal, and Sven Seuken, editors, *EC '22: The 23rd ACM Conference on Economics and Computation, Boulder, CO, USA, July 11 - 15, 2022*, pages 497–528. ACM, 2022.