

Online algorithms

- ▶ Guaranteed competitive ratio
- ▶ Bad performance on easy instances, *overly pessimistic*



Machine Learning predictions

- ▶ Often relevant information
- ▶ *No guarantee*, can be arbitrarily bad



absolute error η
 $\eta = \sum_t \eta_t$

Prediction-augmented algorithms

- ▶ Target competitive ratio: $O(\min\{ \text{ONLINE}, 1 + f(\eta/\text{OPT}) \})$

Previous work: Caching [Lykouris Vassilvitskii'18, Rohatgi'20, Wei'20]

Predict next arrival times $\eta = \sum |\text{predicted time} - \text{true time}|$

Competitive ratio example: $O(\min\{\log k, 1 + \log \frac{\eta}{OPT}\})$

Our contributions

Issue: lack of generality, useless with weights

Useful predictions for all Metrical Task Systems (general online problem)

- ▶ Prediction: recommended state for the algorithm
- ▶ Small error η' if there is a *good* state *nearby*

General MTS: $O(\min\{ONLINE, 1 + \frac{\eta'}{OPT}\})$ -apx (best possible)

Caching: $O(\min\{\log k, 1 + \log \frac{\eta'}{OPT}\})$ -apx (best on experiments)

Beyond MTS: Online Matching on the Line