A joint estimator for ideal point and metric

- Estimate the metric **and** distances via constrained SDP

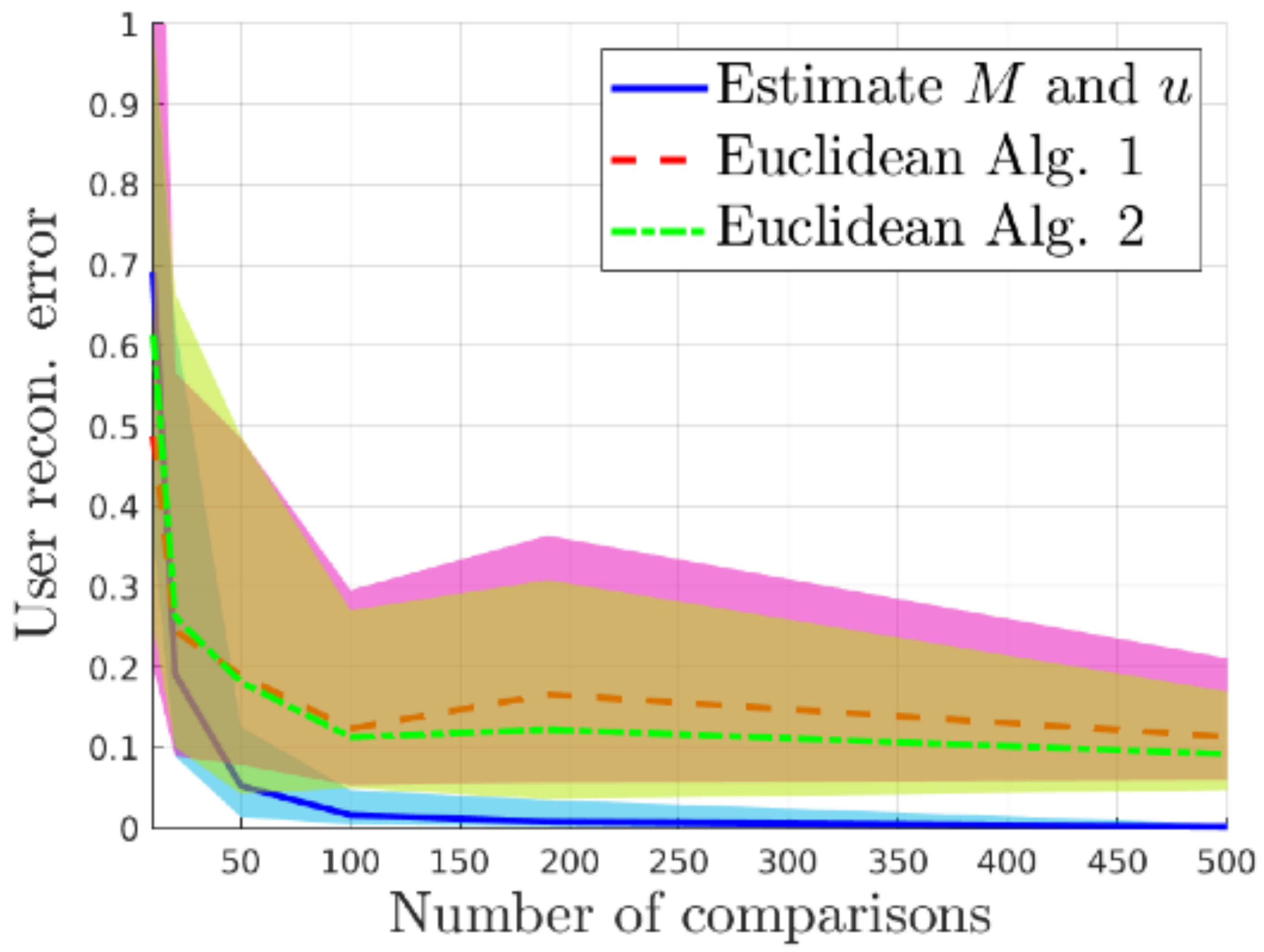
$$
\begin{aligned}
(\widehat{\mathbf{M}}, \hat{\mathbf{d}}, \hat{\zeta}) = \arg\min_{\mathbf{M},\mathbf{d},\zeta} \ & \ell(\mathbf{d}, \mathbf{y}) + \gamma_1 \|\zeta\|_1 + \gamma_2 \|\mathbf{M}\|_F^2 + \gamma_3 \|\mathbf{d}\|_2^2 \\
\text{s.t.} \qquad & -\zeta \leq (\mathbf{I} - \mathbf{R}\mathbf{R}^{\dagger})(\mathbf{a}_{\mathbf{M}} - \mathbf{Q}_{\Gamma}\mathbf{d}) \leq \zeta \\
& \zeta \geq \mathbf{0}, \quad \mathbf{M} \succeq \mathbf{0}
\end{aligned}
$$

- Use estimate for metric and distances to solve directly for ideal point

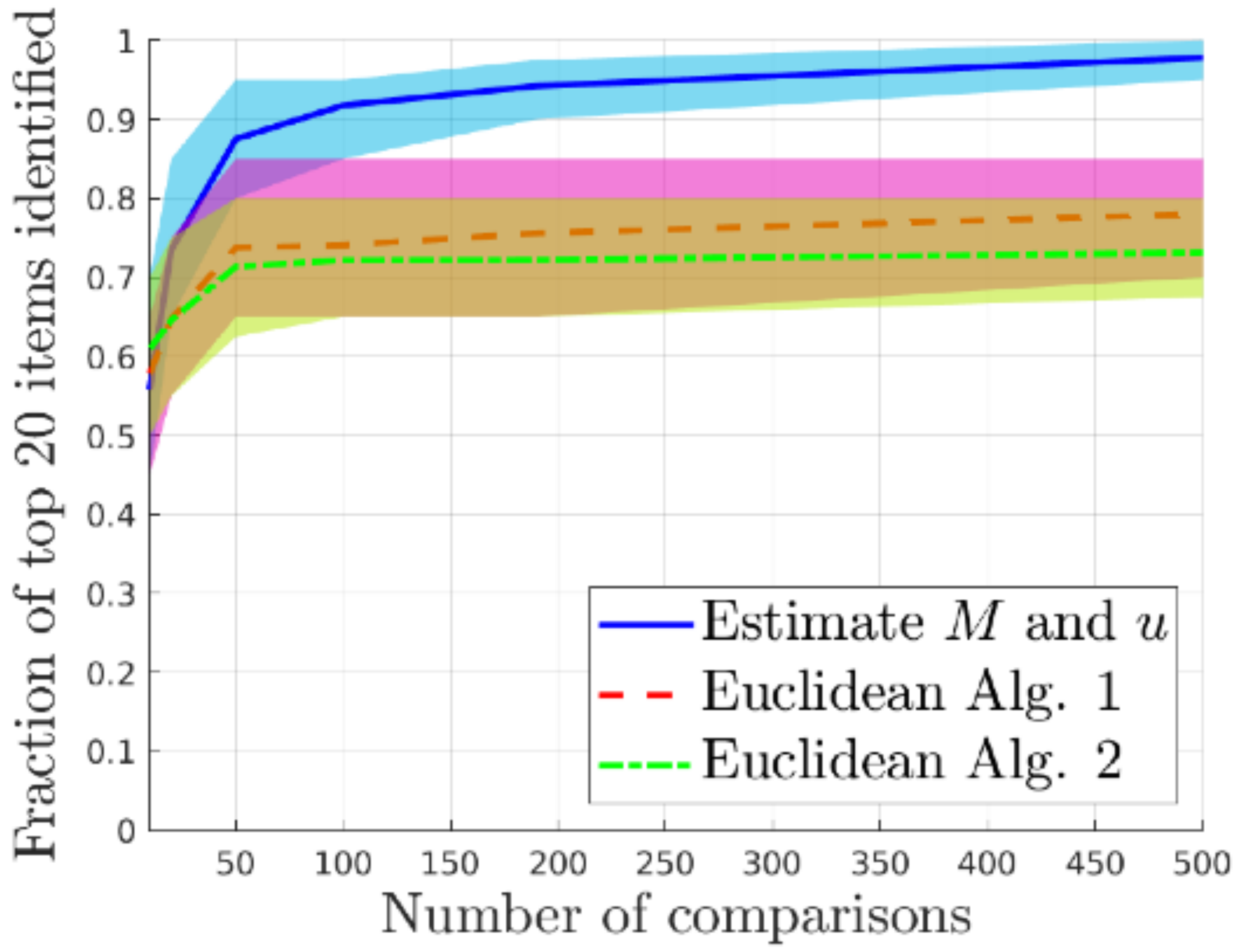
$$
\hat{\mathbf{u}} = \frac{1}{2}(\widehat{\mathbf{M}}\mathbf{R}^{\top}\mathbf{R}\widehat{\mathbf{M}} + \alpha\mathbf{I})^{-1}\widehat{\mathbf{M}}\mathbf{R}^{\top}(\mathbf{a}_{\widehat{\mathbf{M}}} - \mathbf{Q}_{\Gamma}\hat{\mathbf{d}})
$$

Synthetic experiments: baseline comparisons

- Comparison against *Davenport (2013)* and a variant of our estimator which assumes Euclidean distance
- Assume true metric is ***Mahalanobis***



"How well can we recover the ideal point?"



"How well can we recover the 20 most preferred items?"