Convex elicitation of continuous properties

Jessica Finocchiaro, Rafael Frongillo

University of Colorado- Boulder

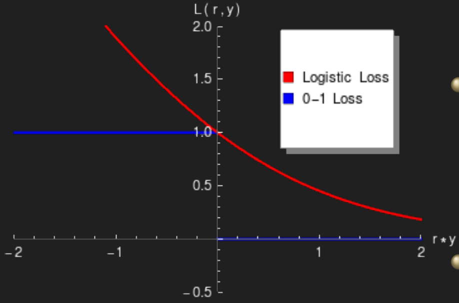
Empirical Risk Minimization (ERM)

- In ML, use *Empirical Risk* to form hypothesis $h^* : x \mapsto y$

$$h^* = \arg\min_{h \in \mathcal{H}} \sum_{(x,y) \in \text{data}} L(h(x), y)$$

- Algorithm minimizes empirical risk.
- h^* depends on the design of L.
  - Minimum requirement: consistent loss.

ERM → Property Elicitation



- A *property* $\Gamma : \Delta(\mathcal{Y}) \to \mathcal{R}$ maps probability distributions to predictions
- A loss $L : \mathcal{R} \times \mathcal{Y} \to \mathbb{R}$ *elicits* a property Γ if for all $p \in \Delta(\mathcal{Y})$,

$$\Gamma(p) = \arg\min_{r \in \mathcal{R}} \mathbb{E}_{Y \sim p} L(r, Y)$$

- *When are these loss functions convex?*

Main result

Theorem (Informal)

*Let Γ be a real-valued, continuous property defined over a finite outcome space.**

Then Γ is elicitable $\iff$ Γ is convex elicitable.

*more assumptions not listed

Main result

Theorem (Informal)

*Let Γ be a real-valued, continuous property defined over a finite outcome space.**
Then Γ is elicitable $\iff$ Γ is convex elicitable.

*more assumptions not listed

- Implications in prediction markets literature

Thank you

Come visit our poster with questions or thoughts!

Right now: 10:45-12:45 Room 210 and 230 AB #73