In deployments of the prediction with expert advice problem, experts’ reputation or financial compensation is often tied to the influence that they have on the prediction of the learner.

Experts might report differently from their true belief if that boosts their influence. E.g., FiveThirtyEight ranks pollsters according to their accuracy:

![FiveThirtyEight](image)

Do there exist online learning algorithms that are simultaneously no-regret for the learner and incentivize the experts to report their true beliefs?

**Model**

**Repeated Interaction Protocol**

For round $t \in [T]$:

1. Learner maintains a distribution $\pi_t = (\pi_{1,t}, \ldots, \pi_{K,t})$ over experts
2. (a) Each expert $i \in [K]$ has a private belief $b_{i,t} \in [0,1]$ about the outcome
   (b) Each expert $i \in [K]$ reports prediction $p_{i,t} \in [0,1]$ with probability $\pi_{i,t}$
3. With probability $\pi_{i,t}$, learner chooses prediction $p_t = p_{i,t}$
4. Learner and experts observe event realization $\tau_t \in [0,1]$.
5. All predictions have an associated bounded proper loss $\ell(\hat{p}_t,\tau_t)$ and $\ell(p_{i,t},\tau_t)$
6. Learner updates $\pi_t \rightarrow \pi_{t+1}$

**Main Result**

Two incentive-compatible online learning algorithms:

1. Weighted Score Update (WSU):
   \[ R(T) = O(\sqrt{T \ln K}) \]
   for the full information setting
2. Weighted Score Update with Uniform Exploration (WSU-UX):
   \[ R(T) = T^{\frac{2}{3}}(K \ln K)^{\frac{1}{3}} \]
   for the partial information setting

**A Seemingly Unrelated Problem**

Construction of incentive-compatible wagering mechanisms

Probability of winning WNBA championship?

- Yes: $\$15$
- No: $\$23$

[Lambert et al. ’08] defined a class of incentive-compatible wagering mechanisms: Weighted Score Wagering Mechanisms (WSWM)

**Experiments on FiveThirtyEight NFL Datasets**

![Graphs showing Regret over Time for K=100](image)

**References**

[Witkowski, Freeman, Pennock, Krause ‘18] Incentive Compatible Forecasting Competitions. AAAI’18.