MS&E 233 Lecture 13: Prediction Markets

Ashish Goel

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- What's the difference between markets and merchants?

Market	Merchant
mechanism for:	provides goods
pricing	provides services
reputation	sets prices
matching	

- Examples of markets: eBay, NYSE, Google (sponsored search, ads)

- Types of markets

    - Sponsored Search/Advertising (e.g. Google)
        * auctions
        * targeting
    - Peer to Peer (e.g. eBay)
        * reputation (of the sellers)
        * pricing
    - Amazon (which is also a merchant)
        * reputation of the product

- In all of these mechanisms somehow aggregate/synthesize knowledge of its users into quality information. Now let's consider a new type of market, a prediction market.

- Prediction Markets

    - Aggregates human knowledge to predict the outcome of particular events
        * Leveraging the "wisdom of the crowd"
        * Galton's Ox

- Simple prediction market:

– The "event" in question must have a well-defined binary outcome (for our simply analysis), e.g. answers to a question like "Will Obama win the 2012 presidential election?"

– Let's consider that question, "Will Obama win?" Possible outcomes are "Yes" and "No"

  * Assume that the prediction market does not affect the outcome of the proposition
  * There are N individuals participating in the market
  * Individual i's belief is that p_i is the probability of "Yes" (Obama wins)
  * Design the prediction market:
    · <u>Initially</u>: Every individual pays \$1 to the market maker and gets one "Yes" share and one "No" share.
    · <u>Finally</u>: When the outcome is known, if the outcome is "Yes" ("No") then every "Yes" ("No") share earns \$1.
    · Notice that the when market-maker gives out the $2N$ shares he earns a revenue of \$$N$, and he must pay out \$$N$ when an outcome is realized, i.e., there's no risk for the market-maker. Likewise, a participant could simply hold both his "Yes" and "No" share and earn back his \$1 without risk.
    · <u>Interim</u>: Shares get traded on a "stock exchange"
  * Details of this "stock exchange"
    · C_y = price at which a "Yes" share is traded
    · C_n = price at which a "No" share is traded
    · Notice that if $C_y + C_n \neq 1$ there is an arbitrage opportunity.
    · Assume no arbitrage and therefore assume $C_y + C_n = 1$
    · Again, assume that there are N individuals, and $p_i = i^{\text{th}}$ individual's probability estimate of a "Yes" outcome.
    · Assume that every individual can hold at most 2 shares
    · $\Rightarrow$ (# of individuals i with $p_i > C_y) \geq \frac{N}{2}$
    · $\Rightarrow$ (# of individuals i with $p_i < C_y) \geq \frac{N}{2}$
    · Conclusion: C_y is the median of the p_i

– The predictions (using the C_y/median p_i) of prediction markets are consistently better predictors of events than polling.

– Other uses?

– Could use prediction market to decide if a product will succeed/fail

  * Ask not: "Would you buy this product?", but ask "Do you think this product will succeed?". Of course this needs to be in the context of a prediction market with proper incentives.

– What's the next application with prediction market?

  * That's where you come in!!!

- IEM
- *dog enters the classroom, sits next to Ashish*
- ESP Game
  * Randomly paired players earn points if they describe a given photo with the same words as their partner (w/o communicating)
  * In a sense, each player is trying to predict what the other player will say
  * Result: very accurate photo tagging
- Mechanical Turk
  * Can pay for others to do "human intelligence tasks", e.g., translate this paragraph, describe this product
  * Issue: how to make sure the "providers" give quality response?
  * Solution: give the same task to 2 'providers", only pay them if they give the same response. Twice the price, but assured of quality
- Potential nefarious uses: auto-generate Gmail (or other) accounts (as a spammer might), etc., by paying "providers" to resolve CAPTCHAs

• Whole idea is to design market so that, given the incentives, what people naturally choose to do is in line with the goals of the market