

Prediction Markets: Aggregators for Organizational Knowledge



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July 21, 2008 * IAT Management Meeting * Los Alamos, New Mexico

Outline



PM for organizational knowledge



Prediction market primer



Implementation considerations



Outline



PM for organizational knowledge



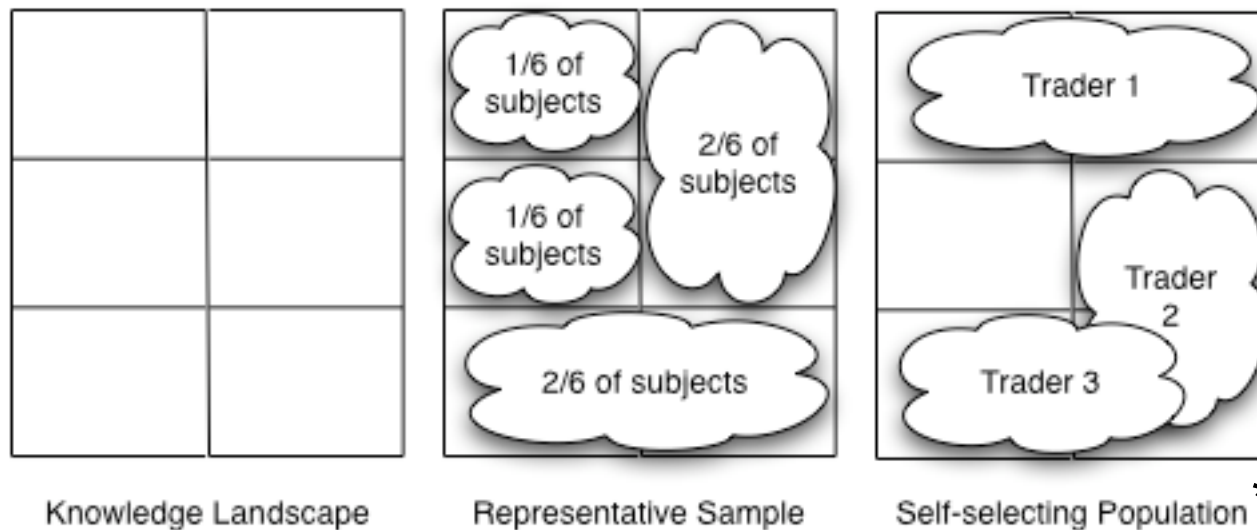
Prediction market primer



Implementation considerations



Challenge: When information is distributed across many people, how can that information be aggregated to produce accurate knowledge?



* The proper *combination* of information is key

Principle of Self-selection: It is better to have a brilliant collection of minds, than a collection of brilliant minds

Collective **D**ecision **M**aking **S**ystem:

An aggregator designed to combine the input of self-selecting individuals to produce collective intelligence

Diversity: attract it and preserve it

Weighting: one-man one-vote, expertise, confidence

Incentives: money, prestige, free service

Familiar Web-based Collective Decision Making Systems



Document Ranking

Wiki

Open Source



Folksonomy

Recommender System



Vote System

Prediction Market

Watkins, J.H., Rodriguez, M.A. (2008). A survey of web-based collective decision making systems. In R. Nayak and L.C. Jain (Eds.), *LNCS: Evolution of web in AI environment* (pp. 245-279). Berlin: Springer-Verlag.

Prediction Markets

Everybody's doing it

HP Chrysler
GE Eli Lilly
Google Nokia
Best Buy Yahoo!
Microsoft Arcelor Mittal
Intel

They work

- In 2004, the market odds on Intrade predicted the presidential vote of every state but Alaska. In 2006, the odds correctly indicated the outcome of every Senate race.
- Iowa Electronic Markets (IEM) in the 2004 presidential election correctly predicted the number of electoral votes by which Bush would win
- HP reports that price estimates went from a 4% error using traditional methods to a 2.5% error with BRAIN

What do organizations use prediction markets for?

- **HP**: estimate the price of DRAM
- **Google** and **Yahoo!**: fun and research
- **Microsoft**: determine whether product deadlines will be reached - stop bad outcomes before they happen

DARPA: Policy Analysis Market

Public markets to forecast:

- military activity
- political instability
- economic growth
- US military activity
- US financial involvement

For 8 nations (Middle East)

Forecasting goals:

- military and political instability around the world
- how US policies would effect such instability
- how such instability would impact US

Combinatorial Markets

Cancelled: July 29, 2003 for allowing people to bet on terrorist attacks. Also caught in Poindexter's Information Awareness Office funding problems and his resignation.

Hanson, R. *Policy Analysis Market Archive*.
<http://hanson.gmu.edu/policyanalysismarket.html>

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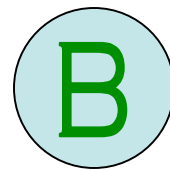


The online prediction market is a forecasting tool where contracts for specific event outcomes (e.g., “Obama wins election”) are bought and sold and their price reflects the probability that the outcome will take place.

EXAMPLE: Who will win the 2008 US presidential election?



Trader A firmly believes Obama is less likely than McCain to win



Trader B is convinced that a coup at the Republican national convention will leave Paul a contender

Who will win the 2008 United States Presidential Election?

Created by:
PerfectHandle
Track on your
blog/website
Ends: 11/04/08 @ 05:16
PM PST

TIP: Current value = probability prediction will occur, e.g. \$10 = 10% chance prediction will occur.

Select a prediction:

PREDICTIONS	CURRENT VALUE	TODAY
Barack Obama	\$63.47	\$-10.64
John McCain	\$34.15	\$10.54
Ron Paul	\$2.24	\$0.09
Hillary Clinton	\$0.09	0.00
Bob Barr	\$0.03	0.00
John Edwards	\$0.00	0.00
Al Gore	\$0.00	0.00
Bill Richardson	\$0.00	0.00
Fred Thompson	\$0.00	0.00

SELECTED PREDICTION

Barack Obama

CURRENT PRICE

\$63.47

TIP: A price of \$63.47 means there is currently a 63.5% chance this will occur.

Do **you** think:

- Chances are higher than 63.47% this will occur
- Chances are lower than 63.47% this will occur



SELECTED PREDICTION

Ron Paul

CURRENT PRICE

\$2.24

TIP: A price of \$2.24 means there is currently a 2.2% chance this will occur.

Do **you** think:

- Chances are higher than 2.24% this will occur
- Chances are lower than 2.24% this will occur



SELECTED PREDICTION

Barack Obama

CURRENT PRICE

\$63.47

TIP: A price of \$63.47 means there is currently a 63.5% chance this will occur.

If you think the current odds of 63% are:

☐ Way too high...

Sell 50 shares
estimated new price
\$58.73

you're paid
\$3,055.94

☐ High...

Sell 20 shares
estimated new price
\$61.61

you're paid
\$1,250.84

☐ Just above...

Sell 5 shares
estimated new price
\$63.02

you're paid
\$316.21

☐ Advanced...

Sell shares
estimated new price
...

you're paid
...



SELECTED PREDICTION

Ron Paul

CURRENT PRICE

\$2.24

TIP: A price of \$2.24 means there is currently a 2.2% chance this will occur.

If you think the current odds of 2% are:

☐ Way too low...

Buy 50 shares
estimated new price
\$2.74

your cost
\$124.20

☐ Low...

Buy 20 shares
estimated new price
\$2.44

your cost
\$46.80

☐ Just below...

Buy 5 shares
estimated new price
\$2.30

your cost
\$11.36

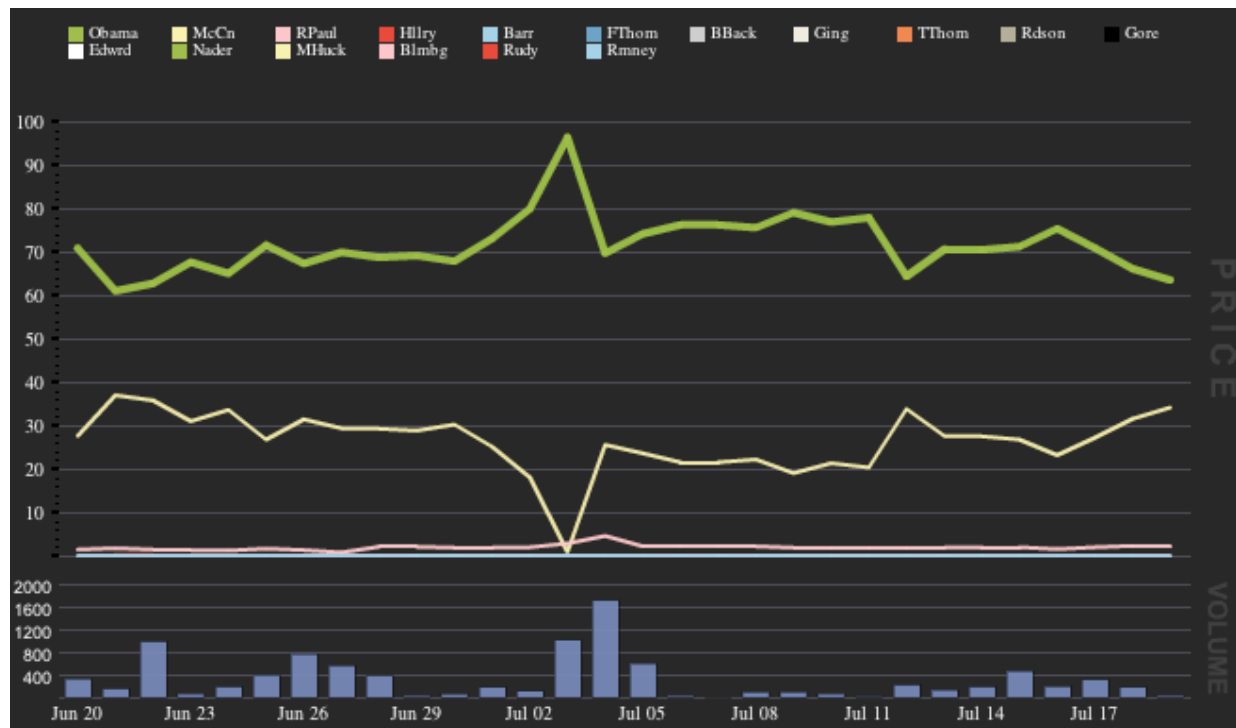
☐ Advanced...

Buy shares
estimated new price
...

your cost
...



Who will win the 2008 US presidential election month-long forecast



Outline



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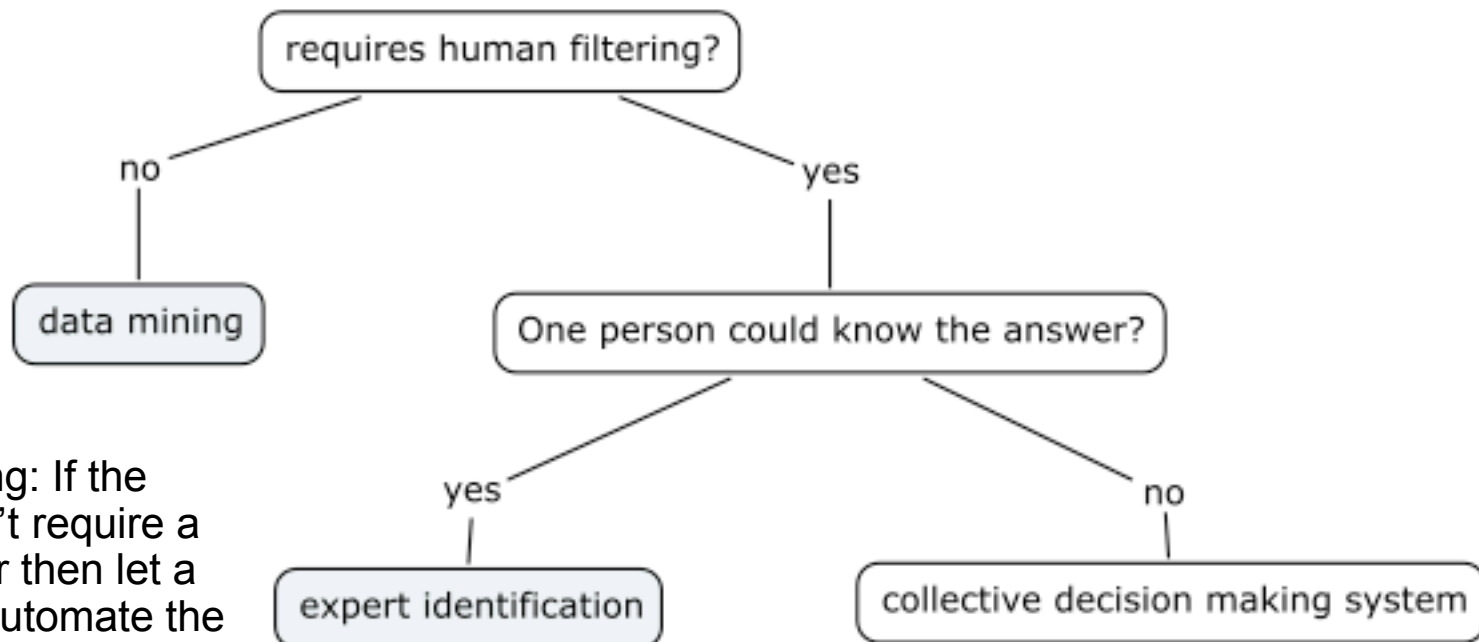
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Is a prediction market needed?



•Data mining: If the data doesn't require a human filter then let a computer automate the process

- Expert identification: There is no point in calling in a collective if only a single expert is needed. In organizations, job titles, phone books, and knowledge management tools can serve as expert identifiers

Question Format



Good questions should have:

- a determinable outcome
 - options that are disjoint and exhaustive
 - information that is revealed through time
 - a specified closing time and arbiter
-
- A prediction market where people only buy or sell once is a weighted vote.

Incentive Structure



Stocks are valued between 0 and 100;
therefore, prices are easily interpreted as a
probability.

To earn money:

- Buy low and sell high (just like NYSE)
 - Earn the difference in price
- Hold a winning position when the market closes
 - The value of the winning position goes to 100

Comparison

Prediction markets are often compared to polls

Prediction Markets	Polls
“What will happen?”	“What do you want to happen?”
Self-selecting population	Representative sample
Dynamic information	Static information
Automated weighting	One person, one vote
Incentivizes information discovery and truthful revelation	-

Accuracy



- The IEM determine accuracy primarily by comparing their results to polls
 - Be correct sooner
 - Be correct by a closer margin (measured in forecast standard error)
- Most accurately, a probability (say 80%) means that if the event were to occur 100 times, 80 of those events would result in the favored outcome, but 20% would not.

Berg, J., Nelson, F., & Rietz, T. A. (2003). Accuracy and Forecast Standard Error of Prediction Markets. University of Iowa Tech Report.

PM Aggregators

- Continuous double-auction
 - This is the standard bid-ask format familiar from traditional markets; used by **IEM**
- Market scoring rules (logarithmic)
 - By Robin Hanson, this market maker format encourages liquidity; used by **Inkling**
- Dynamic pari-mutuel
 - By David Pennock, a combination of pari-mutuel and CDA; used by **Tech Buzz Game**

Hanson, R. (2007). Logarithmic market scoring rules for modular combinatorial information aggregation. *Journal of Prediction Markets*, 1(1), p. 3-15.

Pennock, D. (2004). A dynamic pari-mutuel market for hedging, wagering, and information aggregation. *ACM Conference on Electronic Commerce*. New York.

Real Money vs. Other Incentives

Play money markets perform as well as real money markets

Real money: better motivate information discovery

Play money: more efficient information aggregation, players only have wealth due to past prediction success

Other incentives: leader board, prizes

Servan-Schrieber E., Wolfers J., Pennock D., & Galebach B. (2004). Prediction markets: Does money matter? *Electronic Markets*, 14(3).

PM Providers

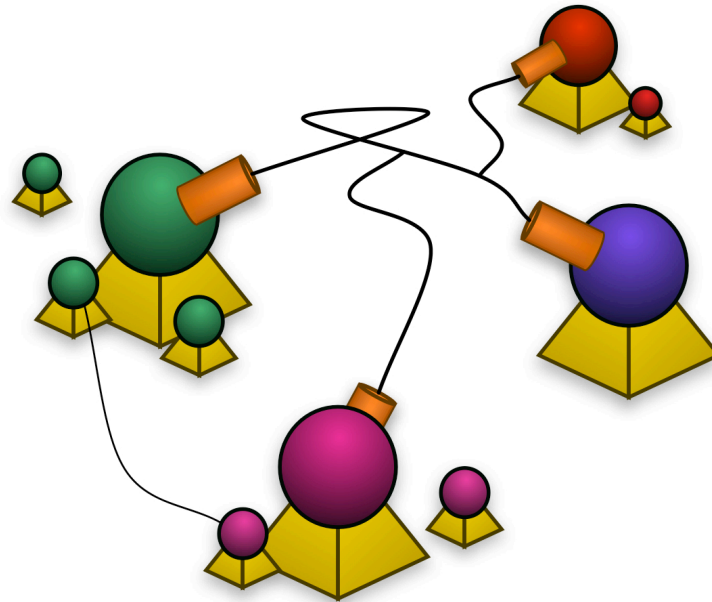
- Open source
 - Zocalo by Chris Hibbert in Java
 - IdeaFutures used by Foresight Exchange in Perl
- Commercial
 - Inkling
 - NewsFutures
 - ConsensusPoint

Key “Players”

- Chris Masse - Midas Oracle blog and .com
- Chris Hibbert - Zocalo writer and blogger
- Robin Hanson - mastermind of DARPA project and LMSR
- David Pennock - developer of DPM
- Justin Wolfers & Eric Zitzewitz - economists in love with PM
- Bernardo Huberman & Leslie Fine - HP BRAIN researchers

Questions?

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