Social Computing Models

Moshe Tennenholtz
Al meets GT in the 50s: when John (McCarthy) met John (Nash)

Marvin Minsky: I learned even more from my own generation of students at Princeton: Particularly John Nash, Lloyd Shapley, Martin Shubik, and John McCarthy

(the society of mind, Page 323)
AI meets GT in the 50s: when John (McCarthy) met John (Nash)

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(the society of mind, Page 323)
The (impossible?) Big Dream

• The design of game theoretic agents is an ultimate challenge for AI:

Agent design:
How should an agent reason / plan / learn in order to optimize decision facing other decision makers? --

*no satisfactory answer*

Mediator Design:
How should a mediator lead a set of agents who “selfishly” reason/plan/learn to a socially efficient outcome?

*very partial answer following the “equilibrium” paradigm.*
Search

Say we know probability distribution over pages that the user desires.

Trivial greedy algorithm is optimal.

- [http://rottentomatoes.com](http://rottentomatoes.com)
- [http://movies.yahoo.com](http://movies.yahoo.com)
- [http://www.metacritic.com/movies](http://www.metacritic.com/movies)
- [http://rogerebert.suntimes.com](http://rogerebert.suntimes.com)
- [http://www.movies.com/movie-reviews](http://www.movies.com/movie-reviews)
- [http://www.moviefone.com/reviews](http://www.moviefone.com/reviews)
- [http://moviereviews.com](http://moviereviews.com)
- [http://www.imdb.com](http://www.imdb.com)
- [http://netflix.com/reviews](http://netflix.com/reviews)
- [http://mrqe.com](http://mrqe.com)
- [http://movies.msn.com](http://movies.msn.com)
Which search engine is better for me?

I'll see which one ranks http://movies.yahoo.com (my favorite) higher?

From now on, I'll use Google.
Perils of greed

Search

movie reviews

prob. website

18% http://rottentomatoes.com
16% http://movies.yahoo.com
15% http://www.metacritic.com/movies
13% http://rogerebert.suntimes.com
12% http://www.movies.com/movie-reviews
9% http://moviereviews.com
8% http://www.imdb.com
8% http://netflix.com/reviews
7% http://mrqe.com
6% http://movies.msn.com

http://movies.yahoo.com
http://www.metacritic.com/movies
http://rogerebert.suntimes.com
http://www.movies.com/movie-reviews
http://www.moviefone.com/reviews
http://moviereviews.com
http://www.imdb.com
http://netflix.com/reviews
http://mrqe.com
http://movies.msn.com

http://rottentomatoes.com
Perils of predictability

Any deterministic algorithm can be badly beaten.
Optimization → Games

Ranking → Ranking duel

Greedy is \((1 - \frac{1}{n})\)-beatable

Binary search duel

Binary search is 62.5%-beatable

Routing → Ranking duel

Shortest (expected) path is \((1 - \epsilon)\)-beatable

Hiring problem duel

“Secretary alg.” is beatable

Compression duel

Huffman coding is 66-75%-beatable

TSP → Parking duel

TSP is \((1 - \epsilon)\)-beatable
Routing

Which route should an agent take?

Taking the route that goes through s is \( \alpha \) slower than taking the route the goes through f, but service is splitted when shared among agents.
Pricing

Store based pricing
Pricing

Location based differential pricing
Display Advertising
Sponsored Search
Ranking Systems
Facility Location

A mechanism is **strategyproof** if agents can never benefit from lying = the distance from their location cannot decrease by misreporting it.

- **Problem:** average is not strategyproof
(Social) Trust Systems
Predicting and learning social structure
– How are friendships structured?
• How do things spread in society?
  – Epidemics, Information

Fig. 3 The influenza pandemic of 1918–20. First outbreaks (■) March 1918; lines of spread of first wave (-----), and lines of spread of second wave (→); numbers of month after March 1918 (0) when epidemic infection was recorded (number accompanies arrow); focal points of second wave (●). (From the records of Gill 1928; Crosby 1976; Beveridge 1977; Pyle and Patterson 1984; Pyle 1986; Patterson 1987.) Reprinted from Nicholson et al. (1998) Textbook of Influenza, with permission from the Publishers, Blackwell Science, Oxford
The small world phenomenon

• People who do not know each other are often surprised to learn they have a mutual acquaintance

“What a small world!”

“What are the odds?”
Stanley Milgram’s “Six Degrees of Separation”

In 1967 Stanley Milgram set out to test the small world phenomenon.

– Milgram is also well known for his “obedience” experiments

Instead of looking for a shared acquaintance, he looks for longer connecting chains between individuals.

What is the length of the path that is needed to connect two “arbitrary” individuals?
• Milgram finds: Successful chains have 5-6 steps on average.
Parts of the course will include material from the more advanced material in the book:

“Networks, Crowds, and Markets: Reasoning About a Highly Connected World” by David Easley and Jon Kleinberg.

– A preprint version is available online at:
מחקר בנויה
"بيانתו של מחקר התערובת והוראות המ прогнמיים"

• רקע דריש: מועדף לסטודנטים מצטיינים במתמטיקה, מדעי המחשב, הנדסת חשמל (עם רקע מתמטי חזק), או כלכלת (עם רקע מתמטי חזק וdffב על תיאוריה הכללית). הקורק האופטימי, הנדרש לשם השחטיבה במחקר זה, הוא אדם עם רקע חזק במתמטיקה, ידע בתחום המחשבים, וידע בשיטות מחשביות

 mutedat, חותר המשתרעת, מדעי המחשב ומטרות המיעוטים, ותיירות הכללית. ב chloride של העברת שלמרות התשובהוסטרים, על רקע מ_profפק בכל הנושאים

 ישוק רק סטודנטים מתאימים למסגרת המוסמך התשובה

 רקע רלוונטי, יעיל ובולטים פונטיאלי בולט

 עלובדה ומקוריית העצמאות. לפרטיסים ומספים ינס

 לפנות לפורפ' מסה טוננול, בדואר Alec pourpin

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ERC AdG: 
Mechanism Design for Data Science

The project aims at building theoretical foundations, providing algorithms, as well as validating through experiments, a fundamental bridge between mechanism design and data science. The ultimate success of this research would be the replacement of classical relevance ranking, segmentation, on-line explore & exploit, and influencers’ detection algorithms by incentive-compatible ones, creating the next generation of data science algorithms.