Computational Challenges in E-Commerce

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What is E-Commerce?

- **Electronic commerce**: commonly known as *e-commerce* or *ecommerce*, consists of the *buying and selling* of products or services *over electronic systems* such as the Internet and other computer networks.

- In this article, we focused on *Internet-based commerce*. 
Four Areas of Computational Challenges

- Individuals & organizations that use computers are *autonomous*. Generally, they will act to *maximize* their *self-interest* which is not considered in traditional algorithm design.

- Incentives plays a crucial role in the four areas of computation:

  *Resource Allocation, Knowledge Integration, Peer Production and Interaction, and Security and Privacy*. 
Resource Allocation

- Resource Allocation is a fundamental process that used to assign the available resources in an economic way.

- Participants declare their perceived value for the resource.

- Market computes the best allocation and the prices that participants should pay.
Auction

- Auction is a decentralized prescription for resource allocation.
- Classical auctions emphasize simple rules for setting allocations and prices manually.
- Combinatorial Auctions allow bidders to express values for bundles of goods. Sometimes it’s NP-hard. For example, they are used to source truckload-transportation logics for Procter & Gamble, Walmart, and Target.
Advertising is a business based on *allocating attention*.

Historically, advertising sales featured straightforward *allocation rules* and *manual negotiations*.

Now, more aspects of advertising are being *automated*.

- Google & Yahoo!
- Edelman et al. and Varian model
Knowledge Integration

- In general, knowledge integration is the eliciting and aggregation of information from diverse and frequently self-interested sources.

- “price discovery” - a side effect of market-based resource allocation.
  - “Prediction Market”
  - Rating and reputation systems
Prediction market

- **Liquidity:**
  - Adjust prices *dynamically*.
  - Ensure *a bound* on the worst case loss.

- **Expressiveness:**
  - Severe computational cost.
  - *Compromise* with computational complexity.
Rating and Reputation System

- Gathering *Subjective opinions* on a variety of things.
- *No* fundamental truths.
- Provide *considerable value*. 
Peer Production and Interaction

- Peer production refers to large-scale collaboration that is not based on *price signals*.
  - Salient examples: Wiki, Linux.
  - Social production: Youtube, Facebook.

- **Motivations**: pleasure, communications or other regarding preferences.

- **Challenges**:
  - observe behaviors with a view to learning preferences.
  - modulate environment through appropriate constraints and affordances.
Peer to Peer

- Early protocols failed to provide appropriate *incentives* for the uploading of files.
  - Gnutella suffered from a large amount of free-riding.

- The BitTorrent protocol.
  - Limit users’ download rate according to upload history
  - Inefficient market.
Trust Metrics

- EigenTrust algorithm
  - Sybil attack

- Improved algorithm
  - Shortest path

Challenges:
- Find a satisfactory definition of informativeness.
Security and Privacy

- An economic *trade-off* between privacy intrusion and satisfactory interactions.
  - Individuals
  - Organizations

- Unwanted communication.
  - email spam
  - Link spam, shilling and click fraud

- Copyright enforcement
Summary

- Self-interest plays a crucial role in the procedures of e-commerce.
- The design of Internet protocols and services have often been guided by technology rather than economics.
- Economic and social science will drive Internet protocols and services into the future.