Outline of the Web Science optional module, trimester 3.2.

Book: Easly & Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World. https://www.cs.cornell.edu/home/kleinber/networks-book/

- Graphs and Social Network

  We study basic graph theory concepts such as components, triadic closure, strong and weak ties, homophily (similarity between 'friends') and positive and negative relationships. These concepts are put to work on modeling network data such as collaborations, information linkage, citation, interactions, etc. Students will be able to understand and model network data as graphs, and develop algorithms for analyzing basic graph properties of large volumes of network data (big data).

- Information Networks

  Our goal is to understand the structure of information networks on the internet that emerges from citation, liking, commenting, co-authoring, connection with 'friends', hypertext linking, etc. We study properties such as reputation, authority and relevance of web pages and persons. Students will learn to model, understand, and analyze such informational properties in terms of graph theory concepts.

- Game Theory and Network Traffic

  We study basic game theoretic models and concepts, such as modeling strategic behavior in normal or extensive form games, best responses, pure and mixed strategies, Nash and dominant strategy equilibria. These concepts are put to work in a network context, modeling network traffic in terms of normal form games. We specifically analyze best response dynamics, user equilibria in networks, and the effects of lack of central coordination on the social cost, also known as the price of anarchy. Students will be able to understand, model, and formally analyze the effects of strategic behavior in general, and in the context of network traffic in particular.

- Auctions and Matching Markets

  Our goal is to understand how business models in the web, such as Google's ad auctions, actually work. In order to understand that, we study the basics of auction theory, including in particular first and second price auctions, and the role of game theory in order to understand strategic behavior in such contexts. As a second step, we study matching markets, the computation of market clearing prices, generalized second price auctions, and the celebrated VCG mechanism for sponsored search markets. Students will thereby learn to model and understand the rationale behind various types of auctions and mechanisms, as a basis for understanding and designing business models for the web.

- Network Dynamics – Population Models and Structural Models

  We study how people connected in a network influence each other's behaviour and decisions. First we consider population models which help us to understand informational (or herding) effects and direct-benefit (or network) effects in social processes, and apply this knowledge to analyze the notion of popularity. Then we

consider structural models to understand diffusion of information through groups of people, as opposed to a homogeneous population, and explain the small world phenomenon. Students will learn how to model and analyze the processes by which new ideas and innovations are adopted by a population in which groups of people are connected by very short paths.

- Institutions and Aggregate Behavior

  Our goal is to understand institutions such as markets and voting systems where rules and characteristics and expectations of actors affect their behavior and consequently determine aggregate behavior of the set of actors as a whole. In particular, we study prediction markets such as horse races or stock trading, markets with asymmetric information or reputation systems, as well as voting systems such as elections or televised talent shows. Students will learn to model and understand the rationale and design behind various types of institutions in terms of the aggregate behavior they produce.

Mogelijke datasets

- DBLP
- Facebook
- Twitter
- eBay
- Enron emails
- Datasets van Fox-IT
- NFI datasets
- Open source repositories.
- Game distribution platform Steam
- Dataset voor web services (http://www.uoguelph.ca/~qmahmoud/qws/)
- Amazon web services dataset (http://aws.amazon.com/public-data-sets/),

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Web Science
is about additionality

Not the union of the disciplines

But more than their intersection