Algorithmic Game Theory

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Game Theory and Algorithms

John von Neumann (1903-1957)

Initiated two intellectual currents: Game theory and Algorithms

1944 Jointly with Oscar Morgenstern, published *Games and Economic Behaviour*

1946 Draft report on the EDVAC, inaugurating the era of digital computer and its *algorithms*

1952 First paper in which a *polynomial time algorithm* was hailed as a meaningful advance

1956 Recipient of Gödel's letter in which the *P vs. NP question* was first discussed.

His twin creations would converge half a century later

Internet

Internet emerged after the end of Cold War (a war that was, fortunately, fought mostly by game theory and decided by technological superiority -essentially by algorithms- ...)

- The first computational artifact that was not created by a single entity, but emerged form the *strategic interaction* of many.
- Transformed, informed and accelerated *markets*, being itself, in important ways, a market.

Internet turned the tables on students of both markets and computation

Game Theory, Algorithms and Internet

- Computer scientists were faced for the first time with internet, an object with the same awe with which economists have approached the market
- Computer scientists turned to Game Theory for inspiration:
  "*The Internet is an equilibrium, we just have to identify the game*"
  [Scott Shenker]
- A fusion of ideas from Game Theory and Algorithms was used to illuminate the mysteries of the Internet

Algorithmic Game Theory

Topics of AGT-MIRI

- Introduction to Algorithmic Game Theory
- Strategic games and computational aspects of Nash equilibria
- Price of Anarchy and Price of Stability
- Cooperative game theory
- Computational social choice