Next Generation Network Science: MURI Third Year Review

Ali Jadbabaie and Michael Kearns
University of Pennsylvania

Third Year Review: October 29, 2010
AUGUST 2009

- **Jadbabaie**  
  Collective behavior, social aggregation

- **Chung Graham**  
  Network games and percolation

- **Hill**  
  Social network signatures

- **Kearns**  
  Behavioral network science

- **Steckler**  
  Hastily Formed Networks

- **Hassibi**  
  Information flow and consensus

- **Doyle**  
  Architecture of complex networks

- **Carlson**  
  Complex disaster phenomena

- **Alderson**  
  Network centric infrastructure

**Theory**
- First principles
- Rigorous math
- Algorithms
- Proofs

**Data Analysis**
- Correct statistics
- Only as good as underlying data

**Numerical Experiments**
- Simulation
- Synthetic, clean data

**Lab Experiments**
- Stylized
- Controlled
- Clean, real-world data

**Field Exercises**
- Semi-Controlled
- Messy, real-world data

**Real-World Operations**
- Unpredictable
- After action reports in lieu of data
Jadbabaie
Coordination &
distributed
optimization

Preciado
Local Motifs and
Global Invariants

Hill
Re-identification in
social networks

Kearns
Behavioral
network formation

Craparo
Emergency
decision-making

Hassibi
Information flow
in networks

Chung Graham
Graph analysis of
scaling and clustering

Doyle
Universal Laws
and Architectures

Alderson
Disaster
response

Bassett
Info exchange and
collective behavior

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OCTOBER 2010
Schedule of the day

- 09:30-10:00  Fan Chung (UCSD)  **Graph analysis of scaling and clustering**
- 10:00-10:30  Babak Hassibi, (Caltech), **Information flow in networks**
- 10:30-11:00  John Doyle, (Caltech), **Universal laws and architectures**
- 11:00-11:30  Coffee Break
- 11:30-12:00  Ali Jadbabaie, (Penn),  from social learning to fast distributed network optimization
- 12:00-12:30  Shawndra Hill (Penn), **Re-identification in social networks**
- 12:30-1:30  Lunch Break (served in Levine 307)
- 1:30-2:00  Victor Preciado, (Penn), **From Local Network motifs to global invariants:**
  - 2:00-2:30  Michael Kearns, (Penn) **Behavioral network formation**
  - 2:30-3:00  David Alderson (NPS), Jean Carlson (UCSB), Emily Craparo (NPS),
    - **Time-critical decisions for disaster response and threat evasion**
  - 3:00-3:30  Danielle Bassett(UCSB), Jean Carlson (UCSB), David Alderson (NPS),
    - **The role of information exchange on collective behavior**
- 3:30- 4:00  Coffee Break
- 4:00-4:30  David Alderson (NPS), Danielle Bassett(UCSB), Jean Carlson(UCSB), Emily Craparo(NPS), Michael Kearns (Penn), **Evacuation Games: theory and experiment**
- 4:30-5:00  Discussion
- 5:00-5:30  Feedback from the government team
Singh Program in Market and Social Systems Engineering

• bring network science and related topics to the undergraduate level
• a “major for the 21st century”
• launches Fall 2011
• “elite” admissions; ~40 matriculants/year
• joint CIS/ESE program; partner with Economics and others
• new faculty hires:
  – Andreas Haeberlen: incentive-centric system design
  – Aaron Roth: differential privacy and algorithmic game theory
  – more coming...
• core scientific and engineering content (sample):
  – network science: mathematical models, large-scale data projects
  – Internet advertising: sponsored search auctions, contextual/targeted, privacy
  – algorithmic game theory and mechanism design
  – scalable and cloud computing
  – strong project component: data, technology design, implementation and usage
  – partnerships with technology companies, startups, VCs,...
• emphasize scientific rigor and social aspects of technology
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