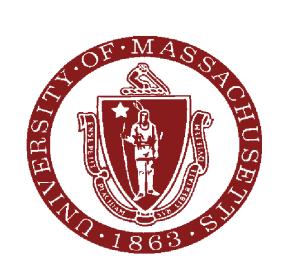# RESEARCH OVERVIEW FOR PROSPECTIVE STUDENTS

Mark C. Wilson
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Main interests: applications

- Questions related to computational social science:
  - How can a group best agree on a common goal or action?
  - How should resources fairly be shared between group members?
  - Which interaction rules help or hinder cooperation?
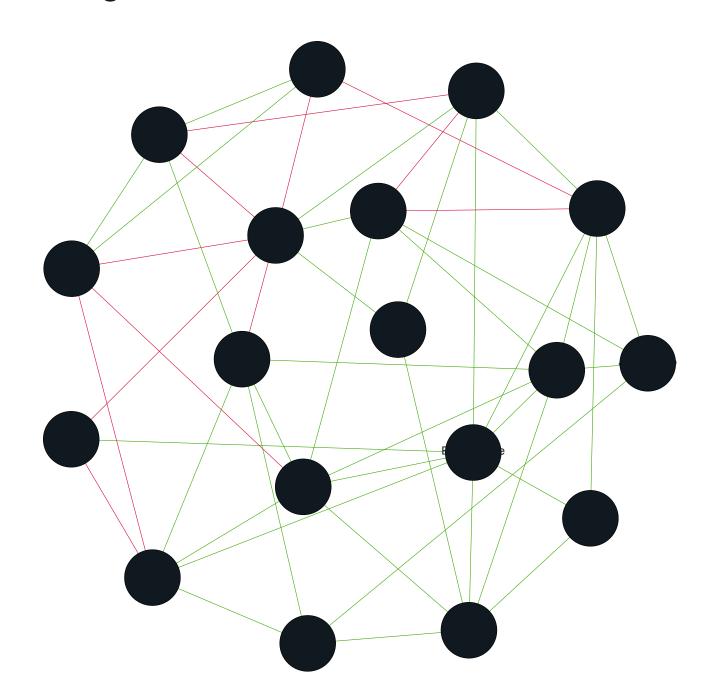 - How to best make use of the distributed knowledge of group members?

  These questions have been asked for a long time by political scientists, economists, sociologists, etc, but have recently become particularly important in Artificial Intelligence.
- Descriptive theories (how people actually behave) are interesting; I am more interested in how agents ought to behave, and particularly how we should design systems to increase collective welfare.
- I have other interests in computational combinatorics, scientometrics, etc.

Main interests: methodology

I am a mathematician by training, and so am interested in theorems and proofs. However I also spend considerable time on computer simulations of complex systems, and on real data. Some of the main tools I use are:

- Noncooperative game theory
- Cooperative game theory
- Network science
- Social choice theory
- Agent-based simulation
- Combinatorics and probability
- Machine learning

Current and prospective work

- NSF funded project (with team from Harvard, MIT, Rutgers, Minnesota) on connecting brain structure and cooperation via data science techniques, 2019-2021.
- Electoral swing models with B. Grofman (Political Science, UC Irvine)
- New resource allocation algorithms with R. Freeman (Business, U. Virginia) and G. Pritchard (Statistics, U. Auckland)
- Analytic Combinatorics in Several Variables with R. Pemantle (Math, U. Penn) et al.
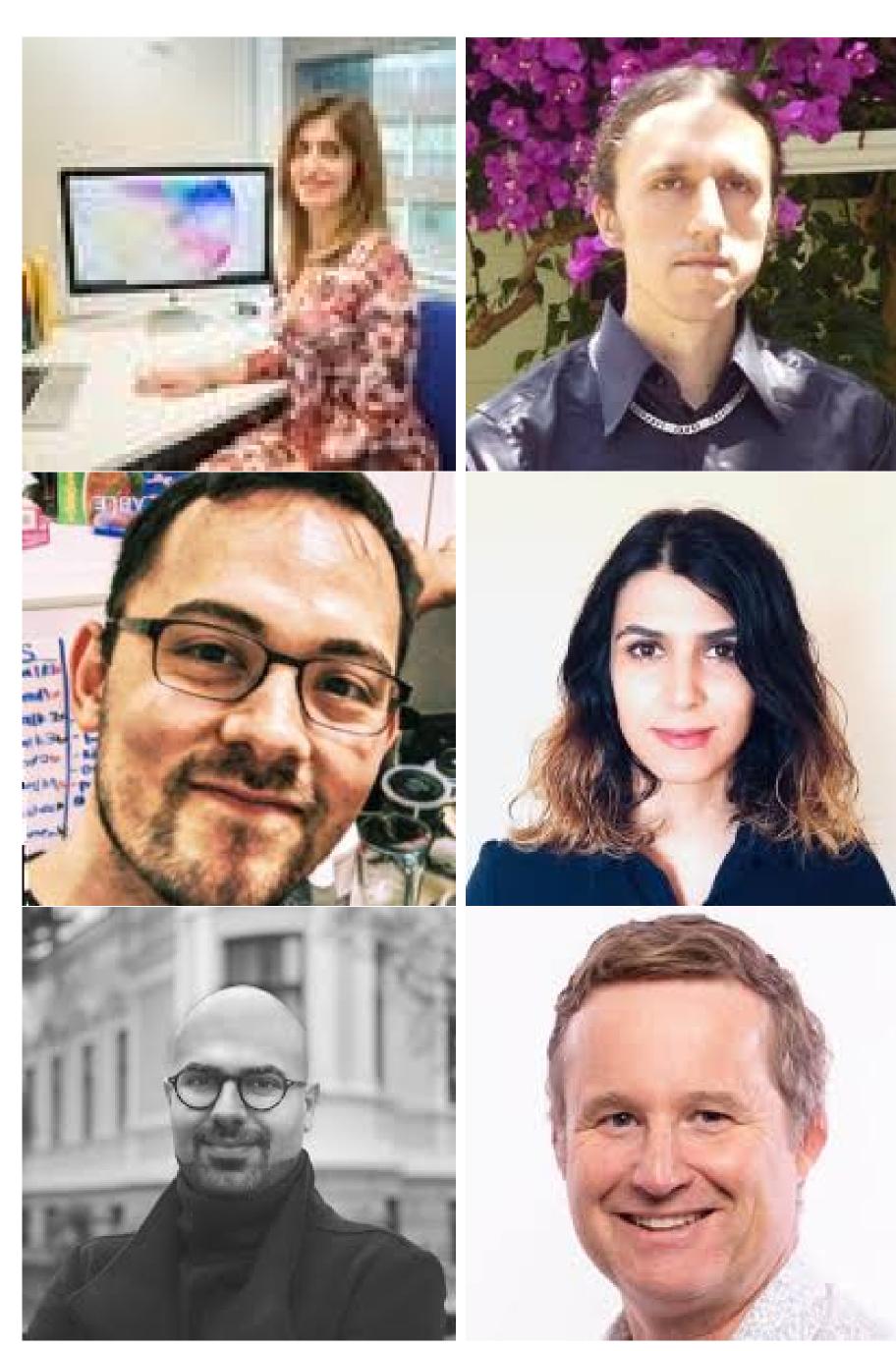

Recent work

- Structure and application of signed networks with S. Aref (U. Auckland)
- Network of NZ legislative documents with N. Sakhaee (U. Auckland)
- Geometrically based voting rules with B. Hadjibeyli (U. Lyon)
- New citation measures with Z. Tang (UMass Amherst)

Some previous research students

- Jesse Goodspeed (UMass Amherst, currently supported student)
- Neda Sakhaee (PhD, University of Auckland 2020)
- Samin Aref (PhD, University of Auckland 2018, now Max Planck Institute, Rostock)
- Reyhaneh Reyhani (PhD, University of Auckland 2013, now data scientist San Diego)
- Egor Ianovski (BSc(Hons), University of Auckland 2010, now Higher School of Economics, St Petersburg, Russia)

See also

- My website `https://markcwilson.site/`