CAREER: The Symbiosis of Graphical Models and Games

Offeror: Stony Brook University
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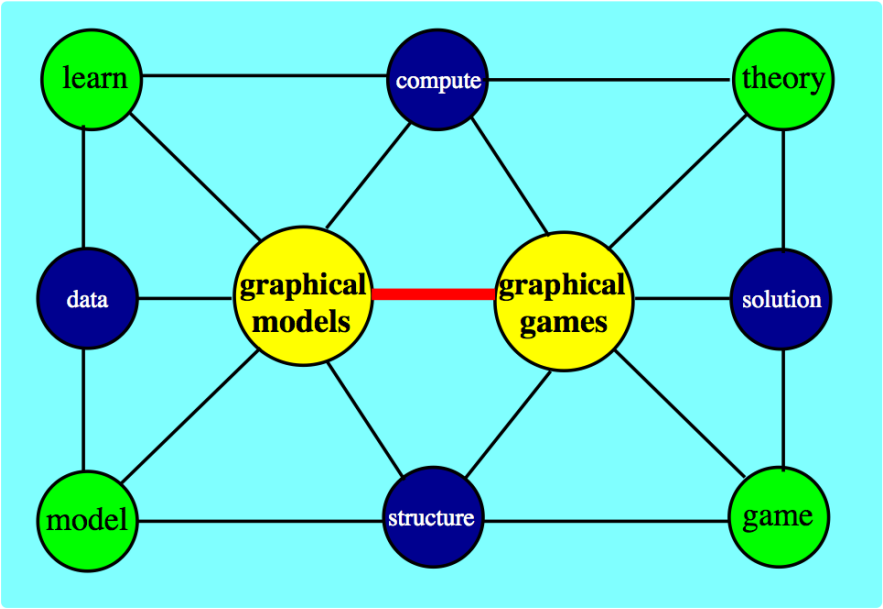

Motivation:

- Relates to Robust Intelligence because it regards computational aspects of *intelligent strategic behavior* in realistic complex domains
- Research is motivated by the need for computational tools to study large, real-world complex systems of strategic interaction in networks
- Critical gap to be addressed is the remaining CGT-GM divide
- Vertically advances the field because clearing the divide opens new research avenues for computational game theory *and* graphical models
- Transformative because it lays a concrete foundation for knowledge transfer between graphical models and game-theory

Objective:

To advance computational aspects of graphical models, game theory and machine learning by (1) strengthening the connection between probabilistic graphical models and graphical games; (2) creating novel approaches to learning graphical games from behavioral data; and (3) characterizing the effect of *equilibrium structure* on its computation.

Technical Approach:

(1) Leverage advances in machine learning and graphical models for problems in graphical games, and *vice versa*

(2) Transfer the latest insights on instances and methods for logical and belief inference into graphical games

Outreach and Broader Impacts Plan:

- Impact many interdisciplinary areas of science
- Bridge Computer Science and Economics at Stony Brook
- Outreach and dissemination of research results via, e.g., computation tracks and workshops in annual NSF-sponsored *International Summer Festival on Game Theory* at Stony Brook's Center for Game Theory and Economics
- Research and Education are integrated by the infusion of project-derived research results and educational materials into old and new courses at all academic levels

Prior Results, Deliverables:

- Result: Contributions to GMs for game theory and economics
- Result: CGT applications to real-world complex systems
- Deliverables: models, algorithms, theory, concepts, experiments, source code and proofs-of-concept

Schedule:

Year 1 should yield initial results on formulation of inference as equilibrium computation and the learning problem; the output, including identification and evaluation of algorithms, should progress throughout the project's duration. The component on characterization of equilibrium structure and computation should start producing results by Year 2, and to continue steadily afterwards.

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