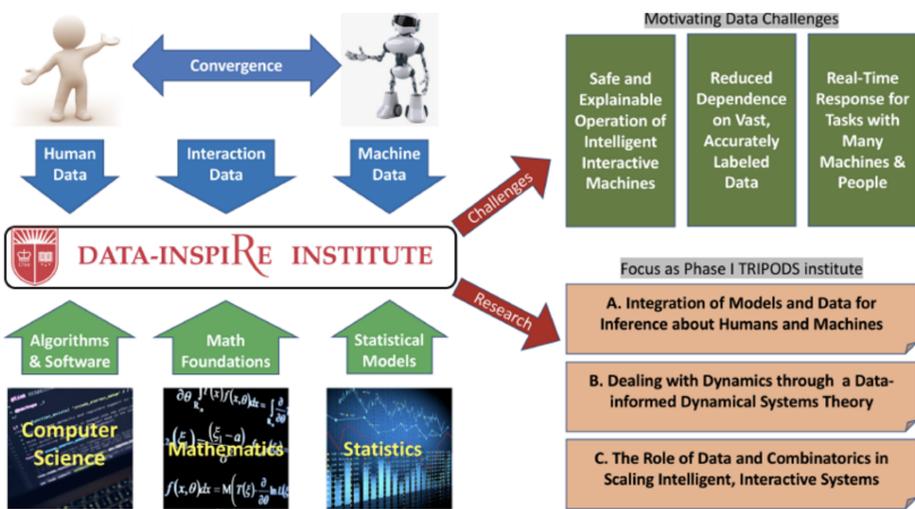


Overview of DATA-INSPIRE

- A TRIPODS institute founded on September 2019, and led by DIMACS (Center for Discrete Mathematics and Theoretical Computer Science) at Rutgers University
- In the belief that a foundational understanding of data science principles is needed to further improve the performance and better explain the operation of intelligent machines in harmony with human society
- Math, CS, and statistics integrated to catalyze a new community for the development of intelligent, interactive machines



Research Directions

Human and Machine Inference

- Bridge the verification and explainability gap of data-driven approaches
- Alleviate the burden of training data in learning
- Guarantees about system performance, or real-time constrain inference

Data-informed Dynamical Systems

- Aimed to address complex dynamics and feedback loops in complex systems like non-linearities and oscillations
- Dynamical systems, real-algebraic geometry, and topology employed to develop data-informed algorithms
- Provide performance guarantees in terms of safety, efficiency, and robustness

Combinatorics of Intelligent, Interactive Systems

- Timelines and scale of coordinated machines with people solving tasks in complex, unstructured environments
- Statistical assumptions about the distribution of problem instances and mathematical characterizations of the space of possible solutions
- Seek practical solutions to combinatorial challenges
- Big data utilized for performance and scaling

Who we are

- *PI*: Fred S. Roberts, DIMACS
- *Computer Science*: Kostas Bekris (co-PI), Matthew Stone (co-PI), Pranjal Awasthi, Jingjin Yu
- *Mathematics*: Konstantin Mischaikow (co-PI), Fioralba Cakoni, Wujun Zhang
- *Statistics*: Cun-Hui Zhang (co-PI), Rong Chen, Ying Hung, Jason M. Klusowski

Current Activities

Seminar Series

The seminar series brings the Institute participants together regularly and features both internal and external speakers. For example, in addition to local speakers we have had, or have scheduled, talks by Patrick Shafto (Rutgers Newark), YingLi Tian (City College of New York, CUNY), Dana Randall (Georgia Tech), Tanya Berger-Wolf (Ohio State University), etc.

Graduate Courses

The Institute faculty offers graduate courses among Math, CS, and Statistics students to bring the disciplines together and aid in curriculum development:

- Advanced Topics in Computational Robotics: Foundations and Tools (2020 Spring)
- Selected Topics in Systems Biology (2020 Spring)
- Statistical Modeling and Uncertainty Quantification of Computer Simulations (2020 Fall)

Education and training

- The DATA-INSPIRE faculty co-advises PhD students and postdocs across the participating disciplines. An Institute-supported postdoc has been hired, starting in September 2020. Our graduate students and postdocs engage with all the research groups and are housed together at DIMACS in order to facilitate collaboration and Institute-building.
- A “boot camp” is planned for the fall of 2020, addressing advanced undergraduates and graduate students who will be exposed to the main themes of the Institute

Research Experiences for Undergraduates(REU)

This summer, we will mentor five undergraduate students to conduct original research on topics related to the Institute for nine weeks. Each student will be matched with a faculty member in CS, Mathematics, or Statistics on a specific project based on the mentor’s interests.

Publications

- A Deep Learning Example: the Generic Vector Projection Model, Interpolation and Generalization Analysis. Linda Ness *Workshop for Women in Data Science and Mathematics (WiSDM 2019)*