Sankaran Vaidyanathan

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Education

Sep '21–present	**Ph.D., Computer Science**, University of Massachusetts Amherst	
Sep '19–present	**M.S., Computer Science**, University of Massachusetts Amherst	*GPA: 3.97/4.0*
Aug '13–May '17	**B.E., Electrical and Electronics Engineering**, Anna University	*GPA: 8.45/10*

Research Experience

Jan '20–present **Research Assistant**, Knowledge Discovery Lab, University of Massachusetts Amherst
Advisor: David Jensen

Jul '17–Jun '19 **Project Associate**, RISE-IIL Lab, Indian Institute of Technology Madras
Advisor: Balaraman Ravindran

Publications

Applied Network Science '20
Hypergraph Clustering by Iteratively Reweighted Modularity Maximization
Tarun Kumar, **Sankaran Vaidyanathan**, Harini Ananthapadmanabhan, Srinivasan Parthasarathy, Balaraman Ravindran

Complex Networks '19
A New Measure of Modularity in Hypergraphs: Theoretical Insights and Implications for Effective Clustering
Tarun Kumar*, **Sankaran Vaidyanathan***, Harini Ananthapadmanabhan, Srinivasan Parthasarathy, Balaraman Ravindran *(* denotes equal contribution)*

Projects

Sep '22 – present **Causal Inference in Relational Domains using Gaussian Processes**
- Estimating individual-level causal effects in relational data, where individual data instances are not independent due to network interactions between multiple types of interacting entities.
- Extending the structural causal model (SCM) framework to the relational setting.
- Modeling causal dependencies in multi-entity relational data using Gaussian Processes (GPs), and defining custom GP kernels for relational causal dependencies across distinct entity types.
- Implementing relational modeling and inference pipeline in the Pyro probabilistic programming language.

May '20–Aug '22 **Competence-Aware Machine Learning**
Joint work with David Jensen (UMass Amherst), Joydeep Biswas (UT Austin) and Charles River Analytics

- Determined the causes of failure for a pre-trained reinforcement learning agent navigating in the AirSim driving environment, by estimating causal effects of various environmental conditions on mission failure.
- Learned causal models that estimated the agent's competence (probability of mission success) for a route with pre-specified environmental conditions.
- Developed a system that allowed a human operator to specify environmental conditions for a new episode prior to deployment, and returned an upper and lower bound on the agent's estimated competence.

Jul '17–Jun '19 **Hypergraph Clustering by Iteratively Reweighted Modularity Maximization**
Supervised by Balaraman Ravindran (IIT Madras) and Srinivasan Parthasarathy (Ohio State)

- Discovered clusters in bibliographic and social networks modeled as hypergraphs.
- Extended the modularity maximization framework for graph clustering to the hypergraph clustering task.
- Developed a method for eliminating redundant cluster assignments by reweighting hyperedges that cut across clusters.

Jan-May '17 **Control of Autonomous Quadrotor for Real-Time Object Tracking**
- Built a quadcopter with an Arduino-based flight controller that tracked and followed selected objects in its field of view.
- Implemented video stabilization on the camera feed using Kalman filtering, and Lucas-Kanade optical flow for object tracking.

Teaching Experience

Feb-May '23   **COMPSCI 688: Probabilistic Graphical Models**, University of Massachusetts Amherst
- Developed homework assignments, answered questions on Piazza, and conducted office hours.

Sep-Dec '22   **COMPSCI 383: Artificial Intelligence**, University of Massachusetts Amherst
- Developed a system for outreach and one-on-one check-ins with students who were falling behind, designed programming assignments, and conducted office hours.

Dec '21   **MATH 605: Probability Theory**, University of Massachusetts Amherst
- Gave a guest lecture on sampling methods, Markov Chain Monte Carlo, and Hamiltonian Monte Carlo.

Jan–May '19   **Introduction to Machine Learning**, Indian Institute of Technology Madras
- Developed iPython-based interactive demos and gave supplementary video lectures, designed exams and programming assignments, and led in-person discussion sessions.

Technical Skills

- **Programming Languages**: Python, R, C++
- **Frameworks**: Pyro, PyTorch, sklearn, NumPy, OpenCV
- **Tools and Platforms**: Figma, Git, Kubernetes, Arduino, Linux

Coursework

Bayesian Statistics, Machine Learning, Intro to Causal Inference, Research Methods in Empirical CS, Probabilistic Graphical Models, Artificial Intelligence, Reinforcement Learning, Probability Theory, Distributed and Operating Systems, Quantum Information Systems, Fixing Social Media