# Sankaran Vaidyanathan

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## Education

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| Sep '21–present | **Ph.D., Computer Science**, University of Massachusetts Amherst |
| Sep '19–present | **M.S., Computer Science**, University of Massachusetts Amherst |
| Aug '13–May '17 | **B.E., Electrical and Electronics Engineering**, SSN College of Engineering, Anna University |

## Research Experience

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

- Modeling the probability of mission success of an autonomous robot in an outdoor campus environment, by identifying conditions in the environment that have causal effects on mission success. Part of the DARPA CAML (Competence-Aware Machine Learning) program.

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

- Discovering clusters in large hypergraphs on bibliographic and social networks.
- On the side, built a Kubernetes GPU cluster (50 GPUs and 70+ users) and served as a system administrator.

## 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

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

- Estimated the causal effects of various conditions in the environment on mission success for a reinforcement learning (RL) agent performing a navigation task in the AirSim driving simulator.
- Developed causal models that estimated competence (probability of mission success) under interventions on various conditions in the environment, for RL agents navigating in the MiniGrid and AirSim environments.
- Developing models of competence for a Jackal robot navigating through a real-life college campus.

**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 task of hypergraph clustering.
- 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

**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.
- The course was intended for a business professional audience, as part of a Certificate in Technology and Management offered in collaboration with the Indian Institute of Management Bangalore

## Technical Skills

- **Programming Languages**: Python, C++, R
- **Frameworks**: PyTorch, sklearn, numpy, OpenCV
- **Tools and Platforms**: Linux, Kubernetes, LaTeX, Arduino

## Relevant Coursework

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