# Kiran Vodrahalli

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## Summary

I primarily study machine learning and theoretical computer science, with a focus on the foundations of machine learning, optimization, and statistics as well as their applications in natural language understanding, neuroscience, robotics, and economics. I am interested in research opportunities involving the application of algorithms and statistics, particularly to scientific inquiry and artificial intelligence.

Currently, I am very excited about questions at the intersection of multi-agent learning, strategic learning, economics, and algorithmic game theory, especially regarding controlling learning agents via changes to their environment to ensure they have **reliable, aligned, and controllable behavior**.

I am also interested in methods for **resource-efficient** machine learning: especially in terms of space-constrained learning and model compression, and in particular as these can be applied to language modeling and reinforcement learning.

## Education

**Columbia University**, September 2017 — June 2022 (planned)

Ph.D. in Computer Science
Advisors: Professor Daniel Hsu, Professor Alex Andoni
Thesis: Sparse, Low-Rank, and Memory-Bounded: Resource-Efficient Methods in Machine Learning

**Princeton University**, September 2012 — June 2017

A.B. Mathematics (cum laude), M.S.E. Computer Science
Advisors: Professor Sanjeev Arora (CS), Professor Ken Norman (Neuroscience)

## Research

Note that * indicates equal contribution. In theory publications, the citation order is alphabetical by last name.

### Preprints

13. *History-Restricted Online Learning.*
    Jon Schneider*, **Kiran Vodrahalli**\*.

12. *Nonlinear Initialization Methods for Low-Rank Neural Networks.*
    **Kiran Vodrahalli**, Rakesh Shivanna, Maheswaran Sathiamoorthy,
    Sagar Jain, Ed H. Chi.

### Conference Proceedings

11. *The Platform Design Problem.*
    Christos Papadimitriou*, **Kiran Vodrahalli**\*, Mihalis Yannakakis*.
    **Oral Presentation**. Conference on Web and Internet Economics, Dec. 2021.
    **Spotlight Oral Presentation** (top 10%). StratML Workshop, NeurIPS 2021.
    **Oral Presentation** at NetEcon Workshop, EC 2021. Poster at EC 2021.

10. *The Logical Options Framework.*
    Brandon Araki, Xiao Li, **Kiran Vodrahalli**, Jonathan DeCastro, J. Micah Fry,
    Daniela Rus.
    **(Long) Oral Presentation** and Poster. ICML, July 2021.

9. *Deep Bayesian Nonparametric Learning of Rules and Plans from Demonstrations with a Learned Automaton Prior.*
    Brandon Araki, **Kiran Vodrahalli**, Thomas Leech, Cristian Ioan Vasile,
    Mark Donahue, Daniela Rus.
    **Spotlight Presentation**. AAAI Conference on Artificial Intelligence, Feb. 2020.

8. *Privacy Accounting and Quality Control in the Sage Differentially Private ML Platform.*
    Mathias Lécuyer, Riley Spahn, **Kiran Vodrahalli**, Roxana Geambasu,
    Daniel Hsu.
    **Oral Presentation**. Symposium on Operation Systems Principles, October 2019.

7. *Learning to Plan with Logical Automata.*
    Brandon Araki*, **Kiran Vodrahalli***, Thomas Leech, Cristian Ioan Vasile,
    Mark Donahue, Daniela Rus.
    **Spotlight Presentation** and Poster. Robotics: Science and Systems, June 2019.
    **Spotlight Oral Presentation** at NeurIPS 2018 Infer2Control Workshop.

6. *Attribute-Efficient Learning of Monomials over Highly-Correlated Variables.*
    Alex Andoni*, Rishabh Dudeja*, Daniel Hsu*, **Kiran Vodrahalli***.
    **Oral Presentation**. Algorithmic Learning Theory, March 2019.

5. *A Large Self-Annotated Corpus for Sarcasm.*
    Mikhail Khodak, Nikunj Saunshi, **Kiran Vodrahalli**.
    Poster. Language Resources and Evaluation, May 2018.

4. *A Compressed Sensing View of Unsupervised Text Embeddings, Bag-of-n-Grams, and LSTMs.*
    Sanjeev Arora*, Mikhail Khodak*, Nikunj Saunshi*, **Kiran Vodrahalli***.
    Poster. International Conference on Learning Representations, April 2018.
    **Oral Presentation**. ICML 2018 Workshop on Theory of Deep Learning.
    Poster at ACL 2018 Workshop on Representation Learning for NLP.

3. *A Temporal Decay Model for Mapping between fMRI and Natural Language Annotations.*
    **Kiran Vodrahalli**, Cathy Chen, Viola Mocz, Christopher Baldassano,
    Uri Hasson, Sanjeev Arora, Kenneth A. Norman.
    Poster. Cognitive Computational Neuroscience, September 2017.

**Journal Publications**

2. *Learning and Planning with Logical Automata.*
    Brandon Araki, **Kiran Vodrahalli**, Thomas Leech, Cristian-Ioan Vasile,
    Mark Donahue, Daniela Rus.
    Autonomous Robots, August 2021.

1. *Mapping between fMRI responses to movies and their natural language annotations.*
    **Kiran Vodrahalli**, Po-Hsuan Chen, Yingyu Liang, Christopher Baldassano,
    Janice Chen, Christopher Honey, Uri Hasson, Peter Ramadge,
    Kenneth A. Norman, Sanjeev Arora.
    Neuroimage, June 2017.
    **Oral Presentation** at NeurIPS 2016 Workshop on Representation Learning
    in Artificial and Biological Networks.
    **Oral Presentation** at ICML 2016 Workshop on Multi-View Representation
    Learning.

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| **Invited Talks** | Meta Research, Virtual, May 2022. |
| | Google Brain AutoML, Virtual, May 2022. |
| | Berkeley Center for Human-Compatible Artificial Intelligence (CHAI) Seminar, Virtual, May 2022. |
| | Google Research NYC, Virtual, April 2022. |
| | Google Brain Neural Modeling Group, Virtual, February 2022. |
| | Simons Flatiron Center for Computational Neuroscience, Virtual, February 2022. |
| | Amazon AWS, Virtual, February 2022. |
| | Simons Theory of Computing, Learning in Games Program, Equilibrium Computation and Machine Learning Reading Group, Virtual, February 2022. |
| | Simons Flatiron Center for Computational Mathematics, Virtual, January 2022. |
| | Google Algorithms Seminar, Virtual, November 2021. |
| | Google Learning Theory Group, Virtual, October 2021. |
| | Google Brain, Virtual, August 2021. |
| | NY Academy of Sciences Machine Learning Symposium, Virtual, March 2020. |
| | Yahoo Research, New York, NY, August 2019. |
| | NY Academy of Sciences Machine Learning Symposium, New York, NY, March 2019. |
| | Princeton Neuroscience Institute, Princeton, NJ, September 2017. |

**Awards**

**Spotlight Prize at NYAS Annual ML Symposium** $(2019, 2020)$
Selected as one of ten ($\approx$ **top** $10\%$) speakers to give a spotlight presentation.

**NSF Graduate Research Fellowship Award**
Awarded March 2016 for Computer Science in the subfield Machine Learning.

**Industry Experience**

**Google Brain**, Student Researcher (Fall 2021-Spring 2022)
Part-time employment at Google Brain as a student researcher.

**Google Brain**, Research Intern (Summer 2021)
Research internship on training deep neural networks with resource constraints.

**Teaching**

**Columbia University**

**Courses**
Fall 2018: TA for COMS 6998 — Computation and the Brain (graduate)

**Princeton University**

**Courses**
Spring 2017: TA for COS 511 — Theoretical Machine Learning (graduate)

Fall 2016: TA for COS 397 — Independent Work Seminar in NLP

Spring 2014: Grader for COS 226 — Intro Algorithms

Fall 2013 — 2014: COS Lab TA for COS $126, 226, 217$ — Intro Algorithms and Systems

**Mentorship**

Summer 2021: Advisor for Algorithmic Game Theory Undergraduate Theory Seminar, and designed the seminar syllabus.

Spring 2017: Advised the junior independent work of Cathy Chen (COS '18) and Viola Mocz (NEU '18) in neuroscience with Professor Ken Norman

Spring 2014 — Fall 2016: Seminar Leader for the NLP-ML Reading Group with Dr. Christiane Fellbaum

## Service

**Reviewing**

Reviewer for Transactions of Machine Learning Research (TMLR), ICLR 2021; NeurIPS $2021, 2020$; ICML 2022, $2021, 2020$ (Top 33% Reviewer in 2020, Expert Reviewer in 2021, 2022); NeuroImage 2017.

## References

Alexandr Andoni, Associate Professor, Columbia University
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Daniel Hsu, Associate Professor, Columbia University
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Christos Papadimitriou, Professor, Columbia University
christos@columbia.edu