

## Research Interests

### Machine Learning and Deep Learning

A main focus of my research has been on scientifically understanding properties of representations learned by deep neural networks. I've also worked on broader modelling questions in big data settings, and have recently been working on applying some of our representation analysis methods to healthcare data.

## Education

### Cornell University and Google Brain

PhD. in Computer Science

New York and Mountain View, USA

Aug. 2014 — present

### University of Cambridge (Trinity College)

BA and Masters in Mathematics. First Class Honours

Cambridge, UK

Oct. 2010 — June 2014

## Research and Industry Experiences

### UC Berkeley, Simons Institute

Foundations of Machine Learning Workshop

Invited participant for workshop on better understanding fundamentals of machine learning.

Visiting Student

January 2017 – June 2017

### Stanford University

with Surya Ganguli

Understanding fundamentals of deep neural networks and connections to neuroscience

Visiting Researcher

June 2016 – June 2017

### Google Inc., Brain Team

with Quoc Le, Samy Bengio and Jascha Sohl-Dickstein

Working on experiments and theory to provide greater understanding and interpretability in deep neural networks.

Research Resident

January 2016 – present

### Google Inc., Strategic Technologies

with Andrew Tomkins, Ravi Kumar and Tamas Sarlos

Predicting user trails (website visits, song listens, location checkins) with Markov models and LSTMs

Research Intern

May 2015 – August 2015

### Brown University

with Eli Upfal

Developed and analysed a random sampling procedure that could greatly reduce the amount of metadata storage required during garbage collection in flash memory.

Visiting Researcher

July 2013 – September 2013

### Tata Institute of Fundamental Research

with C.S. Rajan

Scholarship student at summer school aimed at exposing students to advanced mathematics. Studied Galois Theory and Elliptic Curves.

Visiting Scholar

June 2012 – August 2012

## Selected Awards

### HHMI Janelia Visiting Scholarship

Awarded on merit of research in deep neural networks, to facilitate participation in workshop in Machine Learning.

2016

### Cornell PhD McMullen Fellowship

Awarded to excellent incoming graduate students.

2014 — 2015

### Rouse Ball Essay Prize

Awarded for excellent dissertation essay on properties of Random Walks on Graphs.

2013

<b>Trinity College Cambridge Senior Scholarship</b>	2013
Awarded for outstanding results in University of Cambridge Part II Examinations.	
<b>China Girls Maths Olympiad: Bronze Medal</b>	2010
One of a team of four representing United Kingdom at an international Olympiad.	
<b>British Mathematical Olympiad: Gold Medal</b>	2009 — 2010
Top (nationally) twenty and top ten, 2009, 2010	

## Publications

### Direct Uncertainty Prediction with Applications to Healthcare

Maithra Raghu\*, Katy Blumer\*, Rory Sayres, Ziad Obermeyer, Sendhil Mullainathan, Jon Kleinberg 2018  
In Submission to NIPS 2018

### Insights on Representational Similarity in Neural Networks with CCA

Ari Morcos\*, Maithra Raghu\*, Jascha Sohl-Dickstein, Samy Bengio 2018  
In Submission to NIPS 2018

### Adversarial Spheres

J Gilmer, L Metz, F Faghri, S Schoenholz, Maithra Raghu, M Wattenberg, I Goodfellow 2018  
In Submission to NIPS 2018, also in ICLR Workshop 2018

### Can Deep Reinforcement Learning Solve Erdos-Selfridge-Spencer Games?

Maithra Raghu, Alexander Irpan, Jacob Andreas, Robert Kleinberg, Quoc V. Le, Jon Kleinberg 2018  
ICML 2018, also in ICLR Workshop 2018

### SVCCA for Deep Learning Dynamics and Interpretability

Maithra Raghu, Justin Gilmer, Jason Yosinski, Jascha Sohl-Dickstein 2017  
Neural Information Processing Systems 2017

### On the expressive power of deep neural networks

Maithra Raghu, Ben Poole, Jon Kleinberg, Surya Ganguli, Jascha Sohl-Dickstein 2017  
In International Conference on Machine Learning 2017. Also appeared in Janelia Workshop in Machine Learning and Computer Vision, BayLearn 2016, Research@Google, NIPS Interpretable Machine Learning Workshop 2016, Women in Machine Learning (WiML) 2016.

### Explaining the Learning Dynamics of Direct Feedback Alignment

Justin Gilmer, Colin Raffel, Sam Schoenholz, Maithra Raghu, Jascha Sohl-Dickstein 2017  
In International Conference on Learning Representations (ICLR) Workshop 2017

### Exponential expressivity in deep neural networks through transient chaos

B Poole, S Lahiri, M Raghu, J Sohl-Dickstein, S Ganguli 2016  
In Neural Information Processing Systems (NIPS) 2016

### Linear Additive Markov Processes

with Tamas Sarlos, Ravi Kumar and Andrew Tomkins (alphabetical order) 2016  
WWW 2017

### Team Performance with Test Scores

Jon Kleinberg, Maithra Raghu (alphabetical order) 2015  
In Economics and Computation (EC) 2015. Invited for submission to the journal ACM Transactions on Economics and Computation (TEAC).

### Random Walks on Graphs

Dissertation (Trinity College)

Maithra Raghu 2013  
Entered and won Cambridge Rouse Ball Essay prize.

## Invited Talks

### Simons Institute

2018

Insights from Deep Representations

<b>Facebook AI Research</b>	2018
Insights from Deep Representations with Applications to Healthcare	
<b>UMass Amherst</b>	2018
Insights from Deep Representations	
<b>Institute of Advanced Study, Princeton</b>	2017
Understanding Generalization in Reinforcement Learning	
<b>Columbia University</b>	2017
Understanding Generalization in Reinforcement Learning	
<b>OpenAI</b>	2017
Interpreting Deep Representations	
<b>International Conference on Machine Learning</b>	2017
Expressivity of Deep Networks	
<b>Massachusetts Institute of Technology</b>	2017
Neural Network Learning Dynamics	
<b>REWORK: Deep Learning Summit</b>	2017
Neural Network Learning Dynamics	
<b>World Wide Web Conference</b>	2017
Modelling Sequential Data with Linear Additive Markov Processes	
<b>DeepMind</b>	2016
Better interpretability for deep networks.	
<b>NIPS Workshop: Women in Machine Learning (WiML)</b>	2016
<b>New York University</b>	2016
<b>Northstar Science Film Panel for Arrival</b>	2016
Success of modern methods of machine translation, and women in STEM	
<b>Janelia Workshop on Machine Learning and Computer Vision</b>	2016
Interpreting results from Deep Neural Architectures	
<b>Economics and Computation</b>	2015
Evaluating Team Performance with Tests	

## Professional Activities

### Workshop Organization

<b>National Academy of Sciences Sackler Colloquium: Science of Deep Learning</b>	2019
Invited to be one of five organizers for colloquium at National Academy of Sciences on Deep Learning.	
<b>NIPS Workshop: Deep Learning: Bridging Theory and Practice</b>	2017
Co-organized NIPS workshop looking at a systematic exploration of phenomena observed with deep neural networks.	
<b>Women in Machine Learning (WiML) Organizer</b>	2015
Co-located with NIPS, this workshop brings together hundreds of leading women and men machine learning researchers, and displays top peer-reviewed results in Machine Learning by female researchers. Organizers are vetted by leading women ML researchers.	

### Peer Review

<b>Neural Information Processing Systems (NIPS)</b>	2018
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Conference on Learning Theory (COLT)	2018
International Conference on Machine Learning (ICML)	2018
International Conference on Learning Representations Workshop (ICLR)	2018
International Conference on Learning Representations (ICLR)	2018
NIPS Workshop Deep Learning: Bridging Theory and Practice	2017
Women in Machine Learning (WiML)	2017
Neural Information Processing Systems (NIPS)	2017
International Conference on Machine Learning (ICML)	2017
International Conference on Learning Representations (ICLR)	2017
Neural Information Processing Systems (NIPS)	2016
Women in Machine Learning	2015

## Press Coverage

WIRED Coverage of Interpretability Work  
 Quartz Post on SVCCA  
 Washington Post article on our work on team selection

## Misc.

<b>Ask Me Anything Reddit (r/machinelearning)</b>	2016
with the Google Brain Team, answering questions on Machine Learning and Deep Learning, and academia and industry	
<b>Cambridge University Mathematics Society</b>	2013 – 2014
<b>United Kingdom Mathematics Trust, Senior Mentor</b>	2010 – 2012
Mentored talented students for the national mathematical olympiads	