

# Vishesh Karwa

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Harvard University  
Department of Statistics  
Science Center, Cambridge.

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## Research Interests

Statistical foundations of data privacy, including differential privacy.  
Causal inference under network interference.  
Practical methods for sharing data for reproducibility of statistical inference.  
Computational methods for intractable likelihoods and massive datasets.  
Exponential random graph models for networks and network privacy.  
Application of algebraic statistics to log-linear and network models.

## Education

- 2009-2014** Ph.D. in Statistics, G.P.A. 3.99/4.0  
**The Pennsylvania State University**, State College, PA.  
Adviser: Aleksandra B. Slavkovic  
Thesis: *Likelihood based inference in data privacy and other discrete missing data problems*
- 2007-2009** M.S. in Transportation Engineering, G.P.A. 4.0/4.0  
**The Pennsylvania State University**, State College, PA.  
Adviser: Eric T. Donnell  
Thesis: *Effects of pavement marking retro-reflectivity - An application of Causal Bayesian Networks*
- 2003-2007** B.Tech in Civil and Environmental Engineering.  
**Indian Institute of Technology, Kharagpur**, West Bengal, India.  
Adviser: K. S. Reddy  
Thesis: *A Numerical Solution of Layered Elastic Systems using Gauss Laguerre Integration*

## Appointments

- Aug 2014 - Current** Postdoctoral Fellow, Center for Research and Computation for Society.  
**Department of Statistics and Department of Computer Science, Harvard University.**  
Advisers: Edo Airoldi (Statistics) and Salil Vadhan (Computer Science)
- Aug 2014 - Aug 2016** Visiting Research Scientist.  
**Heinz College and Department of Statistics, Carnegie Mellon University.**  
Adviser: Steve Fienberg

## Awards

- Aug 2015 Post Doctoral Fellowship, Center for Research and Computation for Society, Harvard University  
Aug 2014 SIAM travel award to attend Conference on Applied Algebraic Geometry, South Korea  
Aug 2012 Quantitative Social Science Pre-Doctoral Fellow, Department of Political Science, Penn State  
Aug 2012 Big Data Social Science IGERT Affiliate, Penn State  
Aug 2012 William G Harkness Travel Award for JSM, Penn State  
June 2011 SAS Summer Fellow, SAS  
Jan 2011 Distinction award for scoring highest in Ph.D. qualifier, Penn State

## Work and Research Experience

- June 2014 - Aug 2014 Summer Research Intern, Microsoft Research, Mountain View, CA  
Advised by: Cynthia Dwork
- May 2012 - July 2012 Summer Research Intern, AT & T Labs, Florham Park, NJ  
Advised by: Graham Cormode and Magda Procopiuc
- May 2011 - July 2011 SAS Summer Fellow, SAS, Raleigh, NC  
Advised by: Ying So and Maura Stokes
- Aug 2009 - Aug 2014 Graduate Research Assistant, Department of Statistics, Penn State University  
Advised by: Aleksandra Slavkovic
- Aug 2010 - Dec 2010 Graduate Research Assistant, Department of Computer Science, Penn State University  
Advised by: Adam Smith
- Aug 2007 - Aug 2009 Graduate Research Assistant, Larson Transportation Institute  
Advised by: Eric T. Donnell

## Publications

### Preprints

1. Vishesh Karwa and Edo Airoldi. “*Estimating average treatment effects in presence of interference: modes of failure and solutions*”.
2. Vishesh Karwa and Salil Vadhan. “*Finite Sample Optimal Differentially Private confidence intervals*”, Under Review.
3. Bai Li, Vishesh Karwa, Rebecca Steorts and Aleksandra Slavković. “*A privacy preserving algorithm to release sparse high-dimensional histograms*”, Under Review
4. Vishesh Karwa, Debdeep Pati, Sonja Petrović, Liam Solus, Nikita Alexeev, Mateja Raič, Dane Wilburne, Robert Williams and Bowei Yan, “*Exact tests for stochastic block models*”, Under Review, ArxivId: 1612.06040.

### Published

1. Vishesh Karwa, Michael J. Pelsmajer, Sonja Petrović, Despina Stasi, Dane Wilburne. (2015) “*Statistical models for cores decomposition of an undirected random graph*”, To appear, **Electronic Journal of Statistics**. ArxivId: 1410.7357.
2. Vishesh Karwa and Sonja Petrović. (2016), “Discussion of co-authorship and citation networks for statisticians,” **The Annals of Applied Statistics**. ArxivId: 1608.06667.
3. Vishesh Karwa, Pavel Krivitsky, Aleksandra Slavković. (2016), “Sharing social network data - Differentially private estimation of exponential random graph models,” **The Journal of Royal Statistical Society, Series C**. ArxivId: 1511.02930.
4. Vishesh Karwa, Aleksandra Slavković. (2016), “Inference using noisy degrees - Differentially private synthetic graphs and  $\beta$  models,” **The Annals of Statistics**, Vol 44, Number 1, 87-112.
5. Vishesh Karwa, Sofya Raskhodnikova, Adam Smith, Grigory Yaroslavtsev. (2014), “Private Analysis of Graph Structure,” **ACM Transactions on Database Systems (TODS)**, Vol 39(3), 22.
6. Vishesh Karwa, Aleksandra Slavković, Pavel Krivitsky. (2014), “Differentially private Exponential Random graph models,” **Privacy in Statistical Databases**, (J. Domingo-Ferrer, ed.), Lecture Notes in Computer Science, 8744, 143-155.
7. Vishesh Karwa and Aleksandra Slavković. (2013), “Conditional inference given partial information in contingency tables using Markov Bases,” **Wiley Series on Computational Statistics**, Vol 5(3), 207-218 (Invited).
8. Minal Lalpuria, Vishesh Karwa, RC Anantheswaran, JD Floros. (2013), “Modified agar diffusion bioassay for better quantification of Nisaplin,” **Journal of applied Microbiology**, Vol 114(3), 663-671.

9. Vishesh Karwa and Aleksandra Slavković. (2012), "Differentially private graphical degree sequences and synthetic graphs," **Privacy in Statistical Databases**, (J. Domingo-Ferrer and I. Tinnirello, eds.), Lecture Notes in Computer Science, 7556,273-285.
10. Vishesh Karwa, Aleksandra Slavković, and Eric T. Donnell. (2011), "Causal Inference in Transportation Safety Studies: Comparison of Potential Outcomes and Causal Bayesian Networks," **The Annals of Applied Statistics**, Vol 5, Number 2B, 1428-1455.
11. Vishesh Karwa, Sofya Raskhodnikova, Adam Smith, Grigory Yaroslavtsev. (2011), "Private Analysis of Graph Structure," **Proceedings of Very Large DataBases**, Vol 4, Issue 11, 1146-1157.
12. Naomi Altman, Qing Wang, Vishesh Karwa, Aleksandra Slavković. (2010), "Resolving Isoform Expression using Digital gene Expression Data," **Journal of Indian Society of Agricultural Statistics, Special Issue on Statistical Genomics**, Vol 64, Issue 1, pages 19-31
13. Vishesh Karwa, and Eric T. Donnell. (2010), "Predicting Pavement Marking Retroreflectivity using Artificial Neural Networks," **The ASCE Journal of Transportation Engineering**, 137(2), 91-103.
14. Lekshmi Sasidharan, Vishesh Karwa, E.T. Donnell. (2009), "Use of Pavement Marking Degradation Models to Develop a Pavement Marking Management System," **Public Works Management and Policy**, 14(2):148-173.
15. Eric T. Donnell, Vishesh Karwa, Sudhakar Sathyanarayanan. (2009), "Analysis of Effects of Pavement Marking Retroreflectivity on Traffic Crash Frequency on Highways in North Carolina," **Transportation Research Record**, 2103:50-60.

## Refereed Workshop Papers

1. Vishesh Karwa, Dan Kifer, Aleksandra Slavković. (2015), "Private posterior distributions from Variational approximations," **NIPS 2015 Workshop on Learning and Privacy with Incomplete Data and Weak Supervision**.

## Invited Talks and Workshops

1. Special Session on Algebraic Statistics, Joint Math Meetings, Atlanta, Jan 2017.
2. Workshop on Practical Privacy, US Census, Washington DC, Oct 2016.
3. Plenary Speaker, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, NC, Oct 2106.
4. Statistical Foundations of Privacy, Joint Statistical Meetings, Chicago, Aug 2016
5. Invited Discussion, Annals of Applied Statistics Session, JSM, Chicago, Aug 2016.
6. Workshop on Differential Privacy, PCMI, Midway, Utah, July 2016.
7. Plenary Speaker, Applications of Algebraic Methods to Statistics, Kyoto University, Japan, June 2016.
8. MRC Conference on Algebraic Statistics, Snowbird, Utah, June 2016.
9. AMS Fall Section Meetings, Loyola University, Chicago, Oct 2015.
10. Privacy-Preserving Data Analysis, Joint Statistical Meetings, Seattle, Aug 2015.
11. 60th ISI World Statistics Congress, Rio De Janeiro, July 2015.
12. The Promise of Differentially Private Network Analysis, Singapore Management University, March 2015.
13. Conditional Inference with Missing Data using Markov bases, IMS Annual Meeting, Sydney, Aug 2014.
14. Workshop on Big Data and Differential Privacy, Simons Institute, Berkeley, Dec 2013.
15. Private analysis of  $p_1$  models, Algebraic Statistics Seminar, IIT Chicago, Oct 2103.

16. Challenges of Data privacy in the Era of Big Data, BigData Seminar Series, Penn State, Aug 2012.
17. Differentially Private graphical degree sequences, Joint Statistical Meetings, San Diego, Aug 2012.
18. Workshop on Singular Learning theory, American Institute of Mathematics, Palo Alto, Dec 2011.
19. Workshop on Macaulay2, Institute of Mathematics and its applications, Minneapolis, July 2011.
20. Algebraic Ecological Inference, SIAM Applied Algebraic Geometry session, Raleigh, Aug 2011.
21. Algebraic Statistics Framework for Causal Inference, SIAM, Pittsburgh, June 2010.
22. Statistical and Learning-Theoretic Challenges in Data Privacy, IPAM, UCLA, Feb 2010.

## Contributed Talks and Workshops

1. Workshop on Social Network Data: Collection and Analysis SAMSI, Raleigh, Oct 2013.
2. Workshop on Computational methods in Social Sciences, SAMSI, Raleigh, Aug 2013.
3. Generating synthetic graphs under differential privacy, Joint Statistical Meetings, Montreal, Aug 2013.
4. Private Analysis of Social Networks, Network Science Seminar, Department of Physics, Penn State, Oct 2012.
5. Causal Inference using Potential Outcomes and Bayesian Networks, Joint Statistical Meetings, Florida, Aug 2011.
6. An introduction to Causal Diagrams framework, Causal inference working group, Penn State, March 2010.
7. An application of Generalized Estimating Equations to transportation safety, Washington DC, Jan 2009.
8. Effectiveness of Dynamic Speed Display Signs, Washington DC, Jan 2008.

## Synergistic Activities

Reviewer for Annals of Statistics, Annals of Applied Statistics, Journal of Royal Statistical Society, Journal of American Statistical Association, Journal of Multivariate Analysis, Foundations of Computer Science (FOCS), Journal of Statistical Computation and Simulation, ACM Transactions on Privacy and Security, Transactions on Signal Processing, Transactions on Knowledge and Data Engineering, NIPS, AISTATS.

Graduate Student Representative, Department Head Search Committee, Penn State  
 President, Student Advisory Committee, Department of Statistics, Penn State  
 President, Two Cents of Hope, Penn State