

## BRENDAN P.W. AMES, PHD

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### ACADEMIC EMPLOYMENT

**The University of Alabama, Tuscaloosa AL** — *Assistant Professor, Department of Mathematics*  
AUGUST 2014 - PRESENT

**California Institute of Technology, Pasadena CA** — *von Kármán Instructor, Department of Computing  
+ Mathematical Sciences*  
SEPTEMBER 2013 - AUGUST 2014

**Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN** —  
*Postdoctoral Research Fellow*  
SEPTEMBER 2011 - AUGUST 2013

### EDUCATION

**University of Waterloo, Waterloo ON** — *Ph.D. in Combinatorics and Optimization*  
SEPTEMBER 2007 - AUGUST 2011, DEPARTMENT OF COMBINATORICS AND OPTIMIZATION  
*Thesis:* Convex relaxation for the planted clique, biclique, and clustering problems  
*Advisor:* Dr. Stephen Vavasis

**University of Guelph, Guelph ON** — *M.Sc. in Applied Mathematics*  
JANUARY 2006 - MAY 2007, DEPARTMENT OF MATHEMATICS AND STATISTICS  
*Thesis:* Taylor expansions of the spectrum of a symmetric matrix  
*Advisor:* Dr. Hristo Sendov

**University of Guelph, Guelph ON** — *B.Sc. in Mathematics, With Distinction.*  
SEPTEMBER 2001 - DECEMBER 2005, DEPARTMENT OF MATHEMATICS AND STATISTICS  
*Major:* Mathematics, *Minor:* Physics

### PUBLICATIONS

1. A. Pirinen and **B. Ames**. *Exact clustering of weighted graphs via semidefinite programming*. Journal of Machine Learning Research 20 (2019) 1-3.
2. **B. Ames** and M. Hong. *Alternating direction method of multipliers for penalized zero-variance discriminant analysis*. Computational Optimization and Applications. 64(3): 725-754. 2016.
3. **B. Ames** and H. Sendov. *Derivatives of compound matrix valued functions*. Journal of Mathematical Analysis and Applications. 433(2): 1459-1485. 2016.
4. **B. Ames**. *Guaranteed recovery of planted cliques and dense subgraphs by convex relaxation*. Journal of Optimization Theory and Applications. 167(2): 653-675. 2015.
5. **B. Ames**, A. Beveridge, R. Carlson, C. Djang, V. Isler, S. Ragain, and M. Savage. *A leapfrog strategy for pursuit-evasion in a polygonal environment*. International Journal of Computational Geometry and Applications. 25(77), 2015.

6. R. Horstmeyer, R.Y. Chen, X. Ou, **B. Ames**, J.A. Tropp, and C. Yang. *Solving ptychography with a convex relaxation*. New Journal of Physics, Vol 17, May 2015.

## PUBLICATIONS (PRIOR TO JOINING THE UNIVERSITY OF ALABAMA)

7. **B. Ames**. *Guaranteed clustering and biclustering via semidefinite programming*. Mathematical Programming. 147(1): 429-465. 2014.
8. **B. Ames** and S. Vavasis. *Convex optimization for the planted  $k$ -disjoint-clique problem*. Mathematical Programming. 143(1-2): 299-337, 2014.
9. **B. Ames** and H. Sendov. *A new derivation of a formula by Kato*. Linear Algebra and Its Applications, 436: 722-730, 2012.
10. **B. Ames** and S. Vavasis. *Nuclear norm minimization for the planted clique and biclique problems*. Mathematical Programming, 129(1): 69-89, 2011.
11. **B. Ames** and H. Sendov. *Asymptotic expansions of the ordered spectrum of symmetric operators*. Nonlinear Analysis, Series A: Theory, Methods and Applications, 72(11): 4288-4297, 2010.

## TECHNICAL REPORTS AND CONFERENCE ABSTRACTS

12. N. Laffey and **B. Ames**. *A sparse regression approach for evaluating and predicting NHL results*. Technical report. Available from: [bit.ly/2HcbdIV](http://bit.ly/2HcbdIV). (Conference paper accepted as part of the 2017 Alabama Program in Sports Communication competitive panel).

## SUBMITTED ARTICLES UNDER REVIEW

13. S. Atkins, G. Einarsson, **B. Ames**, and L. Clemmensen. *Proximal methods for sparse optimal scoring and discriminant analysis*. Submitted for publication May 2017. <https://arxiv.org/abs/1705.07194>
14. P. Bombina and **B. Ames**. *Convex optimization for the densest subgraph and densest submatrix problems*. Submitted for publication April 2019. <https://arxiv.org/abs/1904.03272>

## SOFTWARE

1. *accSDA: proximal gradient methods for sparse optimal scoring discriminant analysis*. R package available from the Comprehensive R Archive Network (CRAN) at: <https://cran.r-project.org/package=accSDA>. Published August 24, 2017.
2. *accSDA-Matlab*: Matlab implementation of proximal gradient methods for sparse optimal scoring and discriminant analysis. Available from: [https://github.com/gumeo/accSDA\\_matlab](https://github.com/gumeo/accSDA_matlab). Published August 2018.
3. *admmDensestSubmatrix*: ADMM heuristic for dense submatrix localization. R package available from the Comprehensive R Archive Network (CRAN) at: <https://cran.r-project.org/package=admmDensestSubmatrix>. Published October 31, 2019.
4. *admmDensestSubmatrix\_Matlab*: Matlab implementation of ADMM heuristic for dense submatrix localization. Available from: [https://github.com/pbombina/admmDensestSubmatrix\\_Matlab](https://github.com/pbombina/admmDensestSubmatrix_Matlab) Published September 2019.

## CONFERENCE AND SEMINAR PRESENTATIONS

1. When can we cluster data? Exact clustering by semidefinite programming under the heterogeneous planted cluster model. October 20, 2019. 2019 INFORMS Annual Meeting, session SA SA41 - Optimization in Clustering and Dense Submatrix Localization, Seattle, WA, October 20-23, 2019.
2. When can we cluster data? Exact recovery via convex relaxation. Poster presentation May 13, 2019. NSF-CBMS Conference: Mathematical Molecular Bioscience and Biophysics, The University of Alabama, AL, May 13-17, 2019.
3. Exact clustering by semidefinite programming under the heterogeneous planted cluster model. January 25, 2019. University of Alabama Applied Math Seminar, The University of Alabama, Tuscaloosa, Alabama.
4. Non-convex factorization methods for the k-disjoint-clique problem. November 6, 2018. 2018 INFORMS Annual Meeting, session TB05 - Recent Developments and Methods in Nonconvex Optimization, Phoenix, AZ, November 4-7, 2018. (Presented by co-author A. Barnes.)
5. Semidefinite relaxations of the clustering problem and first-order methods for their solution. September 29, 2017. University of Alabama Applied Math Seminar, The University of Alabama, Tuscaloosa, Alabama.
6. Semidefinite relaxations of the clustering problem and first-order methods for their solution. July 7, 2017. Workshop on Modern Convex Optimization and Applications (AN70). The Fields Institute for Research in Mathematical Sciences, University of Toronto, Toronto, Ontario.
7. Proximal methods for sparse discriminant analysis. May 24, 2017. 2017 SIAM Conference on Optimization, Session CP16 Sparse Optimization, Vancouver, British Columbia.
8. A sparse regression approach for evaluating and predicting NHL results. January 27, 2017. 2017 Alabama Program in Sports Communication Symposium, University of Alabama, Tuscaloosa, Alabama.
9. Ptychographic phase retrieval by convex relaxation. March 12, 2016. 2016 SIAM Southeastern Atlantic Section Conference, session on Inverse Problems and Imaging, University of Georgia, Athens, Georgia.
10. Alternating Direction Methods for Dimension Reduction, Classification, and Feature Selection. November 7, 2015. University of Alabama System Applied Mathematics Meeting, The University of Alabama in Huntsville, Huntsville, Alabama.
11. Proximal methods for sparse discriminant analysis. November 1, 2015. INFORMS 2015 Annual Meeting, session on Theory and Applications of Coordinate Descent and Alternating Direction Methods, Philadelphia Convention Center, Philadelphia, Pennsylvania, November 1-4, 2015.
12. Alternating Direction Methods for Dimension Reduction, Classification, and Feature Selection. August 13, 2015. DTU Compute Seminar, The Technical University of Denmark, Lyngby, Denmark.
13. Alternating Direction Methods for Penalized Classification. November 10, 2014. 2014 INFORMS Annual Meeting, session on Optimization Modeling and Methodologies in Big Data, Hilton San Francisco Union Square & Parc 55 Wyndham, San Francisco, California, November 9-12, 2014.
14. Robust convex relaxation for the sparse planted clique problem. November 9, 2014. 2014 INFORMS Annual Meeting, session on Applications of Conic Optimization, Hilton San Francisco Union Square & Parc 55 Wyndham, San Francisco, California, November 9-12, 2014.
15. Alternating Direction Methods for Dimensionality Reduction, Classification, and Feature Selection. October 10, 2014. University of Alabama Applied Math Seminar, The University of Alabama, Tuscaloosa, Alabama.

16. Alternating Direction Methods for Penalized Classification. May 20, 2014. 2014 SIAM Conference on Optimization, MS52 Optimization for Clustering and Classification, Town and Country Resort and Convention Center, San Diego, California, May 19-22, 2014.
17. Finding hidden cliques and clusters by convex optimization. March 20, 2014. CUNY College of Staten Island, Staten Island, New York.
18. Finding hidden cliques and clusters by convex optimization. February 28, 2014. Georgia Southern University, Statesboro, Georgia.
19. Finding hidden cliques and clusters by convex optimization. February 20, 2014. University of Alabama, Tuscaloosa, Alabama.
20. Finding hidden cliques and clusters by convex optimization. February 4, 2014. Math and Stat Colloquium, Oakland University, Rochester, Michigan.
21. Finding hidden cliques and clusters using convex optimization. January 30, 2014. Computational and Applied Mathematics Colloquium, Rice University, Houston, Texas.
22. Finding hidden cliques and dense subgraphs via convex optimization. August 16, 2013, Modeling and Optimization: Theory and Applications (MOPTA) Conference, technical session on Semidefinite Optimization, Lehigh University, Bethlehem, Pennsylvania.
23. How to find a hidden clique. April 11, 2013, Clemson University Algebra and Discrete Math (ADM) Seminar, Clemson University, Clemson, South Carolina.
24. How to find a hidden clique. March 21, 2013, Department of Mathematics Colloquium, University of Idaho, Moscow, Idaho.
25. How to find a hidden clique. March 15, 2013, MSCS Research Seminar, St. Olaf College, Northfield, Minnesota.
26. Clique and cluster identification using convex optimization. February 8, 2013, Applied Math Colloquium, University of Maryland, Baltimore County, Baltimore, Maryland.
27. Clique and cluster identification using convex optimization. February 5, 2013, IMA Postdoc Seminar, University of Minnesota, Minneapolis, Minnesota.
28. Clique and cluster identification using convex optimization. November 28, 2012, Kansas State University Mathematics Colloquium, Kansas State University, Manhattan, Kansas.
29. Guaranteed biclustering via semidefinite programming. July 12, 2012, CP18: Optimization, 2012 SIAM Annual Meeting, Hyatt Regency, Minneapolis, Minnesota.
30. Finding overlapping communities. July 5, 2012, IMA Postdoc Seminar, University of Minnesota, Minneapolis, Minnesota.
31. Robust convex relaxation for the clique and densest k-subgraph problems. May 22, 2012, IMA Postdoc Seminar, University of Minnesota, Minneapolis, Minnesota.
32. Semidefinite relaxation for the clustering and biclustering problems. February 25, 2012, 2012, INFORMS Optimization Society Conference, University of Miami School of Business Administration, Coral Gables, Florida.
33. Derivatives of eigenvalue functions. December 13, 2011, IMA Postdoc Seminar, University of Minnesota, Minneapolis, Minnesota.
34. Exact semidefinite relaxation for the clustering and biclustering problems. November 8, 2011, IMA Postdoc Seminar, University of Minnesota, Minneapolis, Minnesota.
35. Semidefinite relaxation for the clique partitioning and clustering problems. July 19, 2011, MS144 Semidefinite Approaches to Combinatorial Problems - Part I of III, 7th International Congress on Industrial and Applied Mathematics - ICIAM 2011, Vancouver Conference Center, Vancouver, British Columbia.
36. Convex relaxation for the clique and clustering problems. May 19, 2011, MS83 An Algebraic View of Sparse Optimization, 2011 SIAM Conference on Optimization, Darmstadtium Conference Center,

Darmstadt, Germany. Also presented May 2 at Optimization Days 2011, GERAD-HEC Montreal, May 2-4, 2011.

37. Convex relaxation for the planted cluster problem. July 14, 2010, MS68 Minisymposium on Matrix Rank Minimization, 2010 SIAM Annual Meeting, The David Lawrence Convention Center, Pittsburgh, Pennsylvania.
38. Convex relaxation for the clique, biclique and clustering problem. March 2, 2010 at the Workshop on Randomization, Relaxation, and Complexity (10w5119), Banff International Research Station, Alberta.

## GRANTS, SCHOLARSHIPS, AND AWARDS

### **University of Alabama Cyberseed Program** — (\$27610)

MAY 2020 - PRESENT

*Title:* Searching for Dark Matter with Deep Learning and Strong Gravitational Lensing (DeepLENSE)  
(co-PI with PI Sergei Gleyzer)

### **University of Alabama Research Grants Committee (RGC)** — (\$6000)

JANUARY 2019 - PRESENT

*Title:* Coordinate descent methods for large scale clustering and classification (RG14838)

### **University of Alabama Research Grants Committee (RGC)** — (\$4500)

MAY 2015 - MAY 2017

*Title:* Convergence and consistency of penalized classification (RG14678)

### **National Science and Engineering Research Council (NSERC) Postgraduate Scholarship—** (\$21000/year)

SEPTEMBER 2009 - AUGUST 2011

### **Department of Combinatorics and Optimization Outstanding Teaching Assistant Award**

DECEMBER 2011

University of Waterloo, Department of Combinatorics and Optimization

### **Ontario Graduate Scholarship** — (\$15000/year)

SEPTEMBER 2007 - AUGUST 2009 (declined 2009)

### **University of Waterloo President's Scholarship** — (\$10000/year)

SEPTEMBER 2007 - AUGUST 2011

## GRADUATE STUDENT SUPERVISION

### **Sharmin Afroz, University of Alabama** — *Doctoral Thesis Advisor*

SEPTEMBER 2019 - PRESENT (EXPECTED GRADUATION MAY 2022)

*Title:* TBA

### **Polina Bombina, University of Alabama** — *Doctoral Thesis Advisor*

SEPTEMBER 2018 - PRESENT (EXPECTED GRADUATION MAY 2021)

*Title:* TBA

### **Linda Katherine Ford, University of Alabama** — *Doctoral Thesis Advisor*

SEPTEMBER 2018 - PRESENT (EXPECTED GRADUATION MAY 2021)

*Title:* TBA

### **Phylisicia Carter, University of Alabama** — *Doctoral Thesis Advisor*

JANUARY 2016 - AUGUST 2018 (GRADUATED AUGUST 2018)

*Title:* Sparse regression for textual analysis

**Alexander Barnes, University of Alabama** — *Doctoral Thesis Advisor*

AUGUST 2015 - AUGUST 2018 (GRADUATED AUGUST 2018)

*Title:* Heuristics for large-scale semidefinite programming for the k-disjoint-clique problem

**Carter Yancey, University of Alabama** — *Master's Project Advisor*

JANUARY 2020 -APRIL 2020 (GRADUATED MAY 2020)

*Title:* Interpretable classification in remote sensing by sparse discriminant analysis

**Tung Thanh Lam, University of Alabama** — *Master's Project Advisor*

SEPTEMBER 2018 - AUGUST 2019 (GRADUATED AUGUST 2019)

*Title:* Exact biclustering by semidefinite relaxation under the heterogeneous stochastic block model

**Truc Phan, University of Alabama** — *Master's Project Advisor*

APRIL 2018 - MAY 2019 (GRADUATED MAY 2019)

*Title:* Deflation-free methods for the sparse discriminant analysis and penalized eigenproblems

**Hanqiu Tan, University of Alabama** — *Master's Project Advisor*

MARCH 2018 - AUGUST 2018 (GRADUATED AUGUST 2018)

*Title:* Optimized sparse zero-variance discriminant analysis

**Polina Bombina, University of Alabama** — *Master's Project Advisor*

AUGUST 2017 - MAY 2018 (GRADUATED MAY 2018)

*Title:* Alternating direction method of multipliers for dense submatrix identification

**David Neal, University of Alabama** — *Master's Project Advisor*

AUGUST 2015 - MAY 2018 (GRADUATED MAY 2018)

*Title:* Improved zero-variance discriminant analysis

**Summer Atkins, University of Alabama** — *Master's Project Advisor*

AUGUST 2015 - MAY 2016 (GRADUATED MAY 2016)

*Title:* Proximal methods for sparse discriminant analysis

## PROFESSIONAL SERVICE

### MANUSCRIPT REVIEW

Alabama Journal of Mathematics, Automatica, Discrete Applied Mathematics, Electronic Journal of Statistics, Foundations of Computational Mathematics, Global Optimization, IEEE Transactions on Information Theory, IEEE Transactions on Signal Processing, INFORMS Journal on Computing, International Journal of Bioinformatics Research and Applications, Journal of Machine Learning Research, Mathematical Programming, Mathematics of Operations Research, Neural Processing Letters, Networks. Optimization Letters, Optimization Methods and Software, PLOS-One, SIAM Journal on Matrix Analysis and Applications, SIAM Review.

## GRANTS PANEL REVIEW

National Science Foundation: Communications and Information Foundations (NSF-CIF).

## SEMINAR AND CONFERENCE ORGANIZATION

### **INFORMS 2019 Annual Meeting, Seattle, WA**

OCTOBER 20-23, 2019

Session chair and minisymposium organizer for *MS Optimization in clustering and dense submatrix localization*. Invited as part of the General Session *Conic Optimization*.

### **INFORMS 2018 Annual Meeting, Phoenix AZ**

NOVEMBER 4-7, 2018

Session chair and minisymposium organizer for *MS New Theory and Methods in Nonconvex Optimization*. Invited as part of the General Session *Conic Optimization IV*.

### **2017 SIAM Conference on Optimization, Vancouver, BC**

MAY 22-25, 2017

Session chair for *CP16 Sparse Optimization*. May 24, 2017.

### **INFORMS 2015 Annual Meeting, Philadelphia, PA**

NOVEMBER 1-4, 2015

Session chair and minisymposium organizer for *MS Theory and Applications of Coordinate Descent and Alternating Direction Methods*.

Part of cluster on *Modeling and Methodologies in Big Data*. November 1, 2015.

### **2014 SIAM Conference on Optimization, San Diego, CA**

MAY 19-22, 2014

Session chair and minisymposium organizer for *MS52: Optimization for Clustering and Classification*.

### **IMA Postdoc Seminar (Fall 2012)**

SEPTEMBER 2012 - DECEMBER 2012

Institute for Mathematics and its Applications. Minneapolis, MN.

## STUDENT GROUP ADVISING

### **UA Machine Learning/Artificial Learning Club**

AUGUST 2017 - PRESENT

Faculty advisor UA ML/AI club

### **Undergraduate Advising**

FEBRUARY 2016 - PRESENT

Undergraduate advisor for UA Department of Mathematics.