

Alexej Gossmann

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AREAS OF INTEREST

Development of statistical and machine learning techniques for feature selection and prediction on big high-dimensional datasets, with focus on understanding how false research findings can arise, and how they can be avoided; applications in genomics and neuroimaging, and other medical applications of machine learning; translation of the statistical and machine learning methodology into a useful (software) product.

SKILLS

Core: Data science, statistics, machine learning, (applied) mathematics, scientific research.
Software, programming, tools: R, Ruby, C++, Python, Matlab, L^AT_EX, Linux/Unix, git and github, HTML, CSS, Vim.
Domain knowledge: Genomics and medical imaging.
Language knowledge: German, Russian, English.

EDUCATION

PhD, Bioinnovation
Tulane University, New Orleans, Louisiana, in progress

Doctoral research, Mathematics
Tulane University, New Orleans, Louisiana, through January 2017
GPA: 3.978

MS, Statistics
Tulane University, New Orleans, Louisiana, May 2014
GPA: 3.975

BS, Mathematics
Technische Universität Darmstadt, Darmstadt, Germany, May 2012
GPA: 3.7 (1.54 German grade)

Workshops and summer schools
IPAM New Deep Learning Techniques, Los Angeles, CA, February 2018. SAMSI Distributed and Parallel Data Analysis Workshop, September 2016. SAMSI Optimization Opening Workshop, August 2016. SAMSI Optimization Summer School, August 2016. 2nd Summer Institute in Statistics for Big Data, University of Washington, Seattle, June 2016. 21st Summer Institute in Statistical Genetics, University of Washington, Seattle, WA, June 2016. 20th Summer Institute in Statistical Genetics, University of Washington, Seattle, WA, June 2015. SAMSI Industrial Mathematical and Statistical Modeling Workshop for Graduate Students, June 2014.

EXPERIENCE

Research assistantship (doctoral research)	The Multiscale Bioimaging and Bioinformatics Laboratory
Tulane University, New Orleans, LA	Jan 2015 – present
Research in statistics and machine learning with application in genomics and neuroimaging under the supervision of Dr. Yu-Ping Wang, resulting in six peer-reviewed publications ([Gossmann et al., 2015, Cao et al., 2015a, Cao et al., 2015b, Gossmann et al., 2017a, Gossmann et al., 2017b, Brzyski et al., 2018]), presentations at multiple conferences and workshops, and several open source software packages (developed in R and C++).	

Student intern (ORISE)	Division of Imaging, Diagnostics, and Software Reliability (CDRH/OSEL/DIDSR) at the U.S. Food & Drug Administration May – Aug 2017, and Jan – Feb 2018
FDA, Silver Spring, MD	
Machine learning research (with software implementation in R) resulting in a conference presentation and associated publication [Gossmann et al., 2018] that can inform future policy on evaluation of machine learning systems in medicine.	
Student developer	Google Summer of Code 2015
Remote position	May – August 2015
Project: Adding Linear Mixed Effects Models Support to SciRuby (supervised by Piotr Prins from the Ruby Science Foundation). The created statistical software package (implemented in Ruby) received about 2700 downloads (https://rubygems.org/gems/mixed_models), and was considered for deployment at http://www.genenetwork.org .	
Research assistantship	Department of Mathematics
Tulane University, New Orleans, LA	Jun – Aug 2014
Worked under the supervision of Dr. Oleksandr Gromenko on statistical methods for the analysis of spatio-temporal processes with software implementation in R and C++, and with application in weather prediction (results unpublished).	
Statistics MS research project	Department of Mathematics
Tulane University, New Orleans, LA	Sept 2013 – May 2014
Analysis of bone growth data using mixed-effects smoothing spline ANOVA methods (supervised by Dr. Michelle Lacey) with data analyses performed in R, resulting in a journal publication [Sammarco et al., 2015].	
Mentor	Google Summer of Code 2016 (with the Ruby Science Foundation)
Remote position	May – August 2016
Involved with project proposals, selection/interviewing of students, mentoring. Mentored project: Categorical data support for Daru, Statsample and Statsample-glm. The mentored student (Lokesh Sharma) made major improvements to several open source software packages for data analysis in Ruby.	
Mentor	Google Summer of Code 2017 (with the Ruby Science Foundation)
Remote position	May – August 2017
Involved with project proposals, selection/interviewing of students, mentoring. Mentored project: Creating the fastest math libraries for Ruby by using the GPU through OpenCL and ArrayFire. Outcome: a Ruby library for scientific computing on the GPU (https://github.com/arrayfire/arrayfire-rb) and multiple conference presentations by the mentored student (Prasun Anand).	
Instructor, co-teacher, teaching assistant	Technische Universität Darmstadt, and Tulane University
Darmstadt, Germany, and New Orleans, LA	Fall semester 2010 – Fall semester 2014
Instructor for Calculus 1, co-teacher for Statistics for Scientists, and teaching assistant for Real Analysis 1 and 2 as well as for various undergraduate courses in mathematics and statistics.	

PUBLICATIONS

[Brzyski et al., 2018] Brzyski, D., Gossmann, A., Su, W., and Bogdan, M. (2018). Group SLOPE-adaptive selection of groups of predictors. *Accepted for publication in the Journal*

of the American Statistical Association Theory and Methods Section.

- [Cao et al., 2015a] Cao, S., Qin, H., Gossmann, A., Deng, H.-W., and Wang, Y.-P. (2015a). Unified tests for fine scale mapping and identifying sparse high-dimensional sequence associations. In *Proceedings of the 6th ACM Conference on Bioinformatics, Computational Biology and Health Informatics*, BCB '15, pages 241–249, New York, NY, USA. ACM.
- [Cao et al., 2015b] Cao, S., Qin, H., Gossmann, A., Deng, H.-W., and Wang, Y.-P. (2015b). Unified tests for fine scale mapping and identifying sparse high-dimensional sequence associations. *Bioinformatics*.
- [Gossmann et al., 2017a] Gossmann, A., Cao, S., Brzyski, D., Zhao, L. J., Deng, H. W., and Wang, Y. P. (2017a). A sparse regression method for group-wise feature selection with false discovery rate control. *IEEE/ACM transactions on computational biology and bioinformatics / IEEE, ACM*, PP(99):1–13.
- [Gossmann et al., 2015] Gossmann, A., Cao, S., and Wang, Y.-P. (2015). Identification of significant genetic variants via SLOPE, and its extension to Group SLOPE. In *Proceedings of the 6th ACM Conference on Bioinformatics, Computational Biology and Health Informatics*, BCB '15, pages 232–240, New York, NY, USA. ACM.
- [Gossmann et al., 2018] Gossmann, A., Pezeshk, A., and Sahiner, B. (2018). Test data reuse for evaluation of adaptive machine learning algorithms: Over-fitting to a fixed “test” dataset and a potential solution. In *Proceedings of SPIE: Medical Imaging 2018*.
- [Gossmann et al., 2017b] Gossmann, A., Zille, P., Calhoun, V., and Wang, Y.-P. (2017b). FDR-corrected sparse canonical correlation analysis with applications to imaging genomics. *arXiv preprint arXiv:1705.04312 (under review in IEEE/TMI)*.
- [Sammarco et al., 2015] Sammarco, M. C., Simkin, J., Cammack, A. J., Fassler, D., Gossmann, A., Marrero, L., Lacey, M., Van Meter, K., and Muneoka, K. (2015). Hyperbaric oxygen promotes proximal bone regeneration and organized collagen composition during digit regeneration. *PloS one*, 10(10).

CONFERENCE PRESENTATIONS

- Gossmann A., Pezeshk, A., Sahiner, B., Test data reuse for evaluation of adaptive machine learning algorithms: over-fitting to a fixed “test” dataset and a potential solution; (Paper 10577-19). To be presented at the *SPIE Medical Imaging symposium, Image Perception, Observer Performance, and Technology Assessment conference*, February 11, 2018, Houston, TX.
- Gossmann A., Wang Y.-P., SlopeCCA and gslopeCCA: sorted L1 penalized canonical correlation analysis; (Abstract/Program #2803W). Presented at the *66th Annual Meeting of The American Society of Human Genetics*, October 19, 2016, Vancouver, Canada.
- Gossmann A., Cao S., Wang Y.-P., Identification of Significant Genetic Variants via SLOPE, and its Extension to Group SLOPE; (Abstract/Program #1343F). Presented at the *65th Annual Meeting of The American Society of Human Genetics*, October 9, 2015, Baltimore, MD.
- Gossmann A., Cao S., Wang Y.-P., Identification of Significant Genetic Variants via SLOPE, and its Extension to Group SLOPE. The *6th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics*, Atlanta, GA, September 2015.

SOFTWARE

- **grpSLOPE** – Group SLOPE (Group Sorted L1 Penalized Estimation) is a penalized linear regression method that is used for adaptive selection of groups of significant predictors in a high-dimensional linear model. This R package has been used to perform simulations and/or analyses of real genomic data as reported in [Gossmann et al., 2017a,

Brzyski et al., 2018]. Project repository: <https://github.com/agisga/grpSLOPE>. CRAN: <https://cran.r-project.org/web/packages/grpSLOPE/index.html>.

- **grpSLOPEMC** – An extension package to the R package grpSLOPE, which contains additional Monte Carlo based methods implemented in R and C++ (interfaced to R via Rcpp). This R package has been used to perform simulation studies and analyses of real genomic data presented in [Gossmann et al., 2017a]. Project repository: <https://github.com/agisga/grpSLOPEMC>.
- **mixed_models** – Fit statistical linear models with fixed and random effects in Ruby. It was created during Google Summer of Code 2015, and has been considered for deployment at <http://www.genenetwork.org>. Project repository: https://github.com/agisga/mixed_models. RubyGems: https://rubygems.org/gems/mixed_models.
- For my contributions to several other open source software projects see <https://github.com/agisga>.

EXTRA-CURRICULAR ACTIVITIES

- Elected *President* of the SIAM student chapter at Tulane University (Society for Industrial and Applied Mathematics), September 2014 – September 2016.
- Organized the Graduate Student Colloquium at the Department of Mathematics, Tulane University, September 2014 – September 2016.
- Participation in *Google Summer of Code* as a student developer in 2015, and as a mentor in 2016 and 2017, working on scientific open source software.
- Participation in the middle school outreach program *Girls in STEM at Tulane (GIST)*, November 2017.

HONORS & AWARDS

- Reviewers Choice Abstract (top 10% of poster abstracts), 66th Annual Meeting of The American Society of Human Genetics, October 19, 2016, Vancouver, Canada.
- SIAM Student Chapter Certificate of Recognition, SIAM (Society for Industrial and Applied Mathematics), April 2015.