

Mario Diaz

Postdoctoral Researcher

Centro de Investigación en Matemáticas A.C.

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Education

- Degree: **Ph.D. Mathematics and Statistics (2013 - 2017)**
 Institution: Queen's University, Kingston, Canada
 Advisors: James Mingo and Serban Belinschi
 Thesis: *Global Fluctuations of Random Matrices and The Second-Order Cauchy Transform*
- Degree: **M.Sc. Probability and Statistics (2011 - 2013)**
 Institution: Centro de Investigación en Matemáticas A.C., Guanajuato, Mexico
 Advisor: Víctor Pérez-Abreu
 Thesis: *Analysis of the Asymptotic Spectra of Multiantenna Channels via Free Probability*¹
- Degree: **B.Eng. Electronics and Communications (2006 - 2011)**
 Institution: Universidad de Guadalajara, Guadalajara, Mexico
 Advisor: Víctor Pérez-Abreu
 Thesis: *Analysis of the Asymptotic Ergodic Spectral Efficiency of MIMO Systems with Kronecker C.*¹

Academic Experience

Joint Postdoctoral Scholar

Arizona State University (ECEE) & Harvard University (SEAS), U.S. 2017 - 2018

Worked on the mathematical and statistical theory of data privacy

National System of Researchers (SNI) Research Assistant

Centro de Investigación en Matemáticas A.C., Mexico 2009 - 2011

Worked on the analysis of the asymptotic ergodic capacity of multiantenna wireless systems

Research Assistant

Institute of Robotics and Intelligent Systems, Universidad de Guadalajara, Mexico 2008 - 2009

Worked on non-asymptotic improvements to motion planning algorithms

Publications

Journal Papers

1. S. Asoodeh, **M. Diaz**, F. Alajaji, and T. Linder. "Estimation efficiency under privacy constraints." *IEEE Transactions on Information Theory*, vol. 65, no. 3, pp. 1512 – 1534, 2019. [DOI:10.1109/TIT.2018.2865558](https://doi.org/10.1109/TIT.2018.2865558)
2. **M. Diaz** and V. Pérez-Abreu. "On the capacity of block multiantenna channels." *IEEE Transactions on Information Theory*, vol. 63, no. 8, pp. 5286 – 5298, 2017. [DOI:10.1109/TIT.2017.2712711](https://doi.org/10.1109/TIT.2017.2712711)
3. S. Asoodeh, **M. Diaz**, F. Alajaji, and T. Linder. "Information extraction under privacy constraints." *Information*, vol. 7, no. 1, Art. no. 15, 2016. [DOI:10.3390/info7010015](https://doi.org/10.3390/info7010015)
4. **M. Diaz**, H. Wang, F. P. Calmon and L. Sankar. "On the robustness of information-theoretic privacy measures and mechanisms." *Submitted*. [arXiv:1811.06057](https://arxiv.org/abs/1811.06057)
5. **M. Diaz**, J. Mingo, and S. Belinschi. "On the global fluctuations of block Gaussian matrices." *Submitted*. [arXiv:1711.07140](https://arxiv.org/abs/1711.07140)

Conference Papers

6. H. Wang, **M. Diaz**, F. P. Calmon and L. Sankar. "The utility cost of robust privacy guarantees." *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, pp. 706 – 710, 2018. [DOI:10.1109/ISIT.2018.8437735](https://doi.org/10.1109/ISIT.2018.8437735)

¹ Written in Spanish.

7. S. Asoodeh, **M. Diaz**, F. Alajaji, and T. Linder. "Privacy-aware guessing efficiency." *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, pp. 754 – 758, 2017. DOI:10.1109/ISIT.2017.8006629
8. **M. Diaz**. "On the symmetries and the capacity achieving input covariance matrices of multiantenna channels." *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*, pp. 1073 – 1077, 2016. DOI:10.1109/ISIT.2016.7541464
9. **M. Diaz**, C. Huang, L. Sankar and P. Kairouz. "On the performance of finite-capacity adversaries in fairness and privacy." *Submitted*.
10. H. Wang, **M. Diaz**, JCS Santos Filho and F. P. Calmon. "Generalization bounds via Wasserstein distance." *Submitted*.
11. T. Sypherd, **M. Diaz**, L. Sankar and P. Kairouz. "A tunable loss function for binary classification." *Submitted*. [arXiv:1902.04639](https://arxiv.org/abs/1902.04639)

Awards

1. Candidate Member of the National System of Researchers (SNI), Mexico 2019
2. Nominated by Queen's University for the 2018 *Canadian Mathematical Society (CMS) Doctoral Prize*
Each Canadian university nominates at most one doctoral student for this outstanding performance award
3. *Ontario Trillium Scholarship*, Canada 2013 - 2017
Only 75 of these scholarships are awarded every year in the whole province of Ontario
4. *Science and Technology National Council (CONACYT) Graduate Scholarship*, Mexico 2011 - 2013
5. *National System of Researchers (SNI) Undergraduate Research Assistantship*, Mexico 2009 - 2011

Teaching Experience

Lecturer

Teoría Matemática para Aprendizaje Máquina. Universidad de Guanajuato, 2019

Matrices Aleatorias: Teoría y Aplicaciones Contemporáneas². Centro de Investigación en Matemáticas A.C., 2018

Current and Past Students

Caudillo Amador, Diego de Jesús (M.Sc. Prob. & Stats., on-going)

Madrid Padilla, Carlos Misael (B.Sc. Math., on-going)

Tavarez Rodríguez, Judith (M.Sc. Prob. & Stats., on-going)

Teaching Assistant

Centro de Investigación en Matemáticas A.C. and Universidad de Guanajuato, Mexico 2012 - 2013

Courses: Markov Chains, Stochastic Models, Elements of Probability and Statistics

Most Relevant Conferences and Workshops Attended

1. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2018
Mini course: Some occurrences of random matrix theory in information theory
2. *Int'l Symposium on Information Theory (ISIT)*. Vail, U.S. 2018
Contributed Talk: The Utility Cost of Robust Privacy Guarantees
3. *Information Theory and Applications Workshop (ITA)*. San Diego, U.S. 2018
Invited Talk: Robust Privacy Guarantees for Privacy-Utility Trade-offs
4. XIII Symposium on Probability and Stochastic Processes. Mexico City, Mexico 2017
Invited Talk: A New Approach to the CLT for the Linear Statistics of Random Matrices
5. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2017
Invited Talk: Matricial Second-Order Conditional Expectations
6. *Mathematical Congress of the Americas (MCA)*. Montreal, Canada 2017
Invited Talk: A New Application of Free Probability Theory: Data Privacy
7. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy)*. Thunder Bay, Canada 2017
Invited Talk: On the fluctuations of block Gaussian matrices

² Jointly with V. Pérez Abreu and C. Vargas.

8. *21st Int'l ITG Workshop on Smart Antennas*. Berlin, Germany 2017
Invited Talk: Random operator-valued models: combining stochastic and algebraic models
9. *Analytic versus Combinatorial in Free Probability*. Banff International Research Station, Canada 2016
Invited Talk: On the fluctuations of polynomials in Gaussian matrices
10. *Complex Analysis and Noncommutative Functions*. Toulouse, France 2016
11. *Int'l Symposium on Information Theory (ISIT)*. Barcelona, Spain 2016
Contributed Talk: On the symmetries and the CAICM of multiantenna channels
12. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy)*. Montreal, Canada 2016
13. *Great Plains Operator Theory Symposium (GPOTS)*. Urbana-Champaign, U.S. 2016
14. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy)*. Waterloo, Canada 2015
15. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2015
Invited Talk: Free probability based optimizations: capacity of multiantenna communication systems
16. *Conference on Stochastic Processes and their Applications (SPA)*. Buenos Aires, Argentina 2014
Contributed Talk: On an operator-valued free probability based model for systems with block dynamics
17. *Free Probability Concentration Week*. College Station, U.S. 2014
18. *Workshop on Risk Analysis in Economics and Finance*. Guanajuato, Mexico 2013
19. *Random Matrices School (EMA)*. Guanajuato, Mexico 2012
Invited Talk: Marchenko-Pastur law and multiantenna communications
20. *Workshop on Solutions to Industrial Problems*. Guanajuato, Mexico 2012
21. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2011
Invited Talk: Some numerical aspects of the Stieltjes transform: correlated MIMO systems
22. *National Conference and Int'l Conference in Computer Science ANIEI*. Jalisco, Mexico 2010
23. *Summer Research Program*. Guanajuato, Mexico, 2010
24. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2010
Invited Talk: Correlated MIMO systems
25. *Inter-institutional Seminar on Random Matrices (SIMA)*. Guanajuato, Mexico 2009
Invited Talk: Random Matrices: An Application to Wireless Communication (Multiuser Detection)
26. *Summer Program in Probability and Statistics*. Guanajuato, Mexico 2009
27. *Summer Research Program*. Guanajuato, Mexico, 2009
28. *Stochastic Methods and Dynamical Systems*. Guanajuato, Mexico 2009
29. *Workshop on Solutions to Probability Problems: Second Phase*. Yucatan, Mexico 2008
30. *Workshop on Solutions to Probability Problems: First Phase*. Guanajuato, Mexico 2008
31. *National Conference and Int'l Conference in Computer Science ANIEI*. Chihuahua, Mexico 2007
32. *Workshop on Solutions to Calculus Problems*. Guanajuato, Mexico 2007

Seminar and Colloquium Talks

Seminar and colloquium talks given at Arizona State University (U.S.), Huawei's Mathematical and Algorithmic Sciences Lab (France), Institut de Mathématiques de Toulouse (France), Universität des Saarlandes (Germany), Texas A&M University (U.S.), Queen's University (Canada), Centro de Investigación en Matemáticas A.C. (Mexico), and Universidad de Guadalajara (Mexico).

Miscellaneous Academic Activities

Reviewer for AMS Mathematical Reviews, IEEE Transactions on Information Theory, IEEE Transactions on Information Forensics and Security, EURASIP Journal on Wireless Communications and Networking, International Symposium on Information Theory (ISIT), and International Symposium on Information Theory and Its Applications (ISITA).

Organizer of the MAPLe Seminar (Matrices Aleatorias y Probabilidad Libre)
Centro de Investigación en Matemáticas A.C., Mexico 2019

Co-organizer of the XVII School of Probability and Statistics
Centro de Investigación en Matemáticas A.C., Mexico 2019

Coordinator of the Math & Stats Graduate Seminar³
Queen's University, Canada 2015 - 2016

Organizer of a series of mini courses on probability, statistics and related topics given by graduate students
Centro de Investigación en Matemáticas A.C., Mexico 2013

Lecturer of a mini course on Coding Theory
CUCEI Universidad de Guadalajara, Mexico 2011

Coach of the CUCEI Universidad de Guadalajara's programming contest teams
Universidad de Guadalajara, Mexico 2008 - 2011

TopCoder rating⁴: 1351, 2009. Profile: <https://www.topcoder.com/members/Cumbias/>

Coach of the Jalisco team for the Mexican Mathematical Olympiad (high-school)
Jalisco, Mexico 2006 - 2008

Most Relevant Results in Academic Contests

1. *Mexico and Central America ACM ICPC Programming Contest*, Mexico 2010. **Sixth Place**
Among approximately 80 teams from Mexico and Central America
2. *ANIEI Programming Contest*, Mexico 2010. **First Place**
Among approximately 30 teams from Mexico
3. *National Math Contest "Pierre Fermat"*, Mexico 2008. **Finalist**
On-site final in a nationwide competition
4. *World Finals ACM ICPC Programming Contest*, Canada 2008. **Honorable Mention**
Among approximately 100 teams from all around the world
5. *Mexico and Central America ACM ICPC Programming Contest*, Mexico 2007. **First Place**
Among approximately 80 teams from Mexico and Central America
6. *ANIEI Programming Contest*, Mexico 2007. **First Place**
Among approximately 10 teams from Mexico
7. *Universidad de Guadalajara Calculus Tournament*, Mexico 2007. **First Place**
Campuswide competition
8. *Historical Essay Contest "Vida y Obra de Benito Juárez"*, Mexico 2006. **First Place**
Among all the high-school in the city
9. *XIX Mexican Mathematical Olympiad*, Mexico 2005. **Second Place**
Among approximately 200 contestants from Mexico
10. *XV National Contest in Physical Devices and Experiments*, Mexico 2005. **Participant**
Among approximately 40 teams from Mexico

Computer Skills

Languages: C/C++, MatLab, R.

Applications: Simulink, LaTeX, MS Office.

Languages

Spanish: native speaker.

English: good command.

Last Update: February, 2019

³ Additional events organized: Research at MAST, Christmas Talks 2015, and Christmas Talks 2016.

⁴ TopCoder is a company which organizes online computer programming competitions.