Mario Diaz

Investigador Asociado C
Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS)
Universidad Autónoma de México (UNAM)
mario.diaz@sigma.iimas.unam.mx
www.mariodiaztorres.com

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

Postdoctoral Researcher
Centro de Investigación en Matemáticas A.C., México 2018 - 2019
Worked on the theoretical machine learning, data privacy and random matrices

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

Research Interests

My current research mainly focuses on data privacy, statistical learning theory and information theory. I also keep a research stream on free probability theory, random matrices and their applications.

Publications

Journal Papers

1. M. Diaz, H. Wang, F. P. Calmon and L. Sankar. "On the robustness of information-theoretic privacy measures and mechanisms." *Accepted for publication in IEEE Transactions on Information Theory.* DOI:10.1109/TIT.2019.2939472

2. M. Diaz, J. Mingo, and S. Belinschi. "On the global fluctuations of block Gaussian matrices." *Accepted for publication in Probability Theory and Related Fields.* DOI:10.1007/s00440-019-00925-1

---

[1] Written in Spanish.

3. 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

4. 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

5. 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

Conference Papers

6. T. Sypherd, M. Diaz, L. Sankar and P. Kairouz. "A tunable loss function for binary classification." *Proceedings of the IEEE International Symposium on Information Theory (ISIT), 2019*. DOI:10.1109/ISIT.2019.8849796

7. H. Wang, M. Diaz, JCS Santos Filho and F. P. Calmon. "An information-theoretic view of generalization via Wasserstein distance." *Proceedings of the IEEE International Symposium on Information Theory (ISIT), 2019*. DOI:10.1109/ISIT.2019.8849359

8. 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

9. 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

10. 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

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 Contemporáneas[2]. Centro de Investigación en Matemáticas A.C., 2018

Current and Past Students
Caudillo Amador, Diego de Jesús (M.Sc. Prob. & Stats. CIMAT, on-going)
Tavarez Rodríguez, Judith (M.Sc. Prob. & Stats. CIMAT, August 2019)
Madrid Padilla, Carlos Misael (B.Sc. Math. Universidad de Guanajuato, June 2019)

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. *Taller Conjunto de Deep Learning y Ciencia de Datos CIMAT - INAOE.* Guanajuato, Mexico 2019
    Invited Talk: A tunable loss function for classification

---

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

2. *Applications to Random Matrices and Free Probability of Free NC Functions.* Toronto, Canada 2019
   Invited Talk: Deep linear neural networks: a free probabilistic approach

3. *Free Probability: the Applied Perspective.* Montreal, Canada 2019
   Invited Talk: Utility cost of additive privacy mechanisms and eigenvalue gaps of sample covariance matrices

4. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2018
   Mini course: Some occurrences of random matrix theory in information theory

5. *Int'l Symposium on Information Theory (ISIT).* Vail, U.S. 2018
   Contributed Talk: The Utility Cost of Robust Privacy Guarantees

6. *Information Theory and Applications Workshop (ITA).* San Diego, U.S. 2018
   Invited Talk: Robust Privacy Guarantees for Privacy-Utility Trade-offs

7. 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

8. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2017
   Invited Talk: Matricial Second-Order Conditional Expectations

9. *Mathematical Congress of the Americas (MCA).* Montreal, Canada 2017
   Invited Talk: A New Application of Free Probability Theory: Data Privacy

10. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy).* Thunder Bay, Canada 2017
    Invited Talk: On the fluctuations of block Gaussian matrices

11. *21st Int'l ITG Workshop on Smart Antennas.* Berlin, Germany 2017
    Invited Talk: Random operator-valued models: combining stochastic and algebraic models

12. *Analytic versus Combinatorial in Free Probability.* Banff International Research Station, Canada 2016
    Invited Talk: On the fluctuations of polynomials in Gaussian matrices

13. *Complex Analysis and Noncommutative Functions.* Toulouse, France 2016

14. *Int'l Symposium on Information Theory (ISIT).* Barcelona, Spain 2016
    Contributed Talk: On the symmetries and the CAICM of multiantenna channels

15. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy).* Montreal, Canada 2016

16. *Great Plains Operator Theory Symposium (GPOTS).* Urbana-Champaign, U.S. 2016

17. *Canadian Ann. Symp. on Operator Algebras and Their Apps. (COSy).* Waterloo, Canada 2015

18. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2015
    Invited Talk: Free probability based optimizations: capacity of multiantenna communication systems

19. *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

20. *Free Probability Concentration Week.* College Station, U.S. 2014

21. *Workshop on Risk Analysis in Economics and Finance.* Guanajuato, Mexico 2013

22. *Random Matrices School (EMA).* Guanajuato, Mexico 2012
    Invited Talk: Marchenko-Pastur law and multiantenna communications

23. *Workshop on Solutions to Industrial Problems.* Guanajuato, Mexico 2012

24. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2011
    Invited Talk: Some numerical aspects of the Stieltjes transform: correlated MIMO systems

25. *National Conference and Int'l Conference in Computer Science ANIEI.* Jalisco, Mexico 2010

26. *Summer Research Program.* Guanajuato, Mexico, 2010

27. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2010
    Invited Talk: Correlated MIMO systems

28. *Inter-institutional Seminar on Random Matrices (SIMA).* Guanajuato, Mexico 2009
    Invited Talk: Random Matrices: An Application to Wireless Communication (Multiuser Detection)

29. *Summer Program in Probability and Statistics.* Guanajuato, Mexico 2009

30. *Summer Research Program.* Guanajuato, Mexico, 2009

31. *Stochastic Methods and Dynamical Systems.* Guanajuato, Mexico 2009

32. *Workshop on Solutions to Probability Problems: Second Phase.* Yucatan, Mexico 2008

33. *Workshop on Solutions to Probability Problems: First Phase.* Guanajuato, Mexico 2008
34. *National Conference and Int'l Conference in Computer Science ANIEI.* Chihuahua, Mexico 2007
35. *Workshop on Solutions to Calculus Problems.* Guanajuato, Mexico 2007

Seminar and Colloquium Talks

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

Miscellaneous Academic Activities

Reviewer[3] for AMS Mathematical Reviews, IEEE Transactions on Information Theory, IEEE Transactions on Information Forensics and Security, EURASIP Journal on Wireless Communications and Networking, IEEE Information Theory Workshop (ITW), IEEE 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 Seminar[4]
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 rating[5]**:** 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

Computer Skills

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

Applications: LaTeX, MS Office, Simulink.

Languages

Spanish: native speaker.

English: good command.

Last Update: October 2019

---

[3] AMS Mathematical Reviews; Web of Science Peer Reviews.

[4] Additional events organized: Research at MAST, Christmas Talks 2015, and Christmas Talks 2016.

[5] TopCoder is a company which organizes online computer programming competitions.