# Mohamad Dia

*PhD, Computer and Communication Sciences*

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Residence: Switzerland
Nationality: Lebanese

## Profile

I am a **research scientist** in computer and communication sciences, working at the interface between **communication and coding theory**, **machine learning**, and **statistical physics**. I have been researching and developing efficient and scalable solutions for **high-dimensional inference** problems in the context of error correcting codes, compressed sensing and community detection. I am a highly motivated researcher with solid analytical, teaching and interpersonal skills. I am passionate about system modeling, statistical learning and inference in **Big Data**, with special interest in economics and physics. I have a strong experience in numerical analysis and programming in the fields of graph signal processing and **deep learning**.

## Education

2014–2018 **PhD**, *Computer and Communication Sciences*, EPFL, Switzerland.
Dissertation: High-Dimensional Inference on Dense Graphs with Applications to Coding Theory and Machine Learning

2012–2014 **MSc**, *Communication Systems*, EPFL, Switzerland.
Thesis: Efficient iterative frequency domain equalization for single carrier transmission without cyclic prefix

2008–2012 **BE**, *Electrical and Computer Engineering - Minor in Mathematics*, AUB, Lebanon.

2009–2012 **BA**, *Economics*, AUB, Lebanon.

## Experience

Nov. 2018 – Present **Research Scientist**, *FHNW & European Space Agency*, Switzerland.
- Developing data science tools for the "Euclid" space mission consortium in order to investigate dark matter.
- Teaching machine learning and supervising student projects.

Sep. 2014 – Nov. 2018 **Doctoral Researcher**, *Information Processing Group - EPFL*, Switzerland.
- Used statistical physics techniques and message-passing algorithms to implement and analyze efficient solutions for high-dimensional inference problems in the context of error correcting codes, compressed sensing and machine learning.
- Used spatial coupling to construct dense graphical models that yield optimal performance under iterative algorithms.
- Taught and designed several courses in Machine Learning, Communication Systems and Quantum Computation for undergraduate and graduate classes of 20 to 300 students.
- Supervised master projects and summer internships.

Sep. 2017 – Dec. 2017 **Visiting Researcher**, *Nokia - Bell Labs*, Germany.
- Developed a novel probabilistic shaping scheme for the optical high-speed communication systems.

Feb. 2014 – Aug. 2014 **Research Engineer**, *Sony - European Technology Center*, Germany.
- Developed and implemented low complexity receiver algorithms for the European Digital Video Broadcast standards.

Jun. 2011 – Aug. 2011 **Intern**, *University of California - Berkeley*, USA.
- Interpreted Bluetooth and GPS data to validate the traffic-monitoring model for the "Mobile Millennium" project, a joint partnership between UC Berkeley's Institute of Transportation Studies, Nokia, and the US Department of Transportation.

## Awards

2016 Outstanding Teaching Award - EPFL

2014 EDIC Fellowship - EPFL

2012 Valedictorian - AUB's $143^{rd}$ commencement exercises

2012 Best Paper Award - FEA $11^{th}$ student conference

2004 & 2007 Excellence Award - Lebanese minister of higher education

## Teaching

- Machine Learning
- Quantum Computation
- Information, Computation and Communication
- Linear Algebra
- Communication Systems
- Wireless Communications

## Languages

Arabic (native), English (fluent), French (fluent), German (basic)

## Programming Skills

Languages Matlab, Python, C++, SQL

Technologies TensorFlow, Scikit-learn, Numpy, Pandas, Matplotlib, Tableau

## Publications

Conferences: 7, journals: 3, h-index: 6

**Refereed Conference Papers**

- M. Dia, V. Aref, L. Schmalen, "A Compressed Sensing Approach for Distribution Matching', in Proceedings of IEEE International Symposium on Information Theory (ISIT), Jun. 2018.

- E. Bıyık, J. Barbier, M. Dia, "Generalized Approximate Message-Passing Decoder for Universal Sparse Superposition Codes", in Proceedings of IEEE International Symposium on Information Theory (ISIT), Jun. 2017.

- J. Barbier, M. Dia, N. Macris, F. Krzakala, T. Lesieur, L. Zdeborova, "Mutual Information for Symmetric Rank-One Matrix Estimation: A Proof of the Replica Formula", Advances in $29^{th}$ Neural Information Processing Systems (NIPS), Dec. 2016.

- J. Barbier, M. Dia, N. Macris, F Krzakala, "The Mutual Information in Random Linear Estimation", in Proceedings of $54^{th}$ Annual Allerton Conference on Communication, Control, and Computing, Sep. 2016.

- J. Barbier, M. Dia, N. Macris, "Threshold Saturation of Spatially Coupled Sparse Superposition Codes for All Memoryless Channels", in IEEE Information Theory Workshop (ITW), Sep. 2016.

- J. Barbier, M. Dia, N. Macris, "Proof of Threshold Saturation for Spatially Coupled Sparse Superposition Codes", in Proceedings of IEEE International Symposium on Information Theory (ISIT), Jul. 2016.

- S. Taleb, M. Dia, J. Farhat, Z. Dawy, H. Hajj, "On the Design of Energy-Aware 3G/WiFi Heterogeneous Networks Under Realistic Conditions," in the $27^{th}$ IEEE International Conference on Advanced Information Networking and Applications (AINA), Mar. 2013.

**Journal Papers**

- J. Barbier, M. Dia, N. Macris, F. Krzakala, L. Zdeborova, "Rank-One Matrix Estimation: Analysis of Algorithmic and Information Theoretic Limits by the Spatial Coupling Method", Submitted to Journal of Machine Learning Research, 2018.

- J. Barbier, M. Dia, N. Macris, "Universal Sparse Superposition Codes with Spatial Coupling and GAMP Decoding", IEEE Transactions on Information Theory, 2018.

- J. Barbier, N. Macris, M. Dia, F Krzakala, "Mutual Information and Optimality of Approximate Message-Passing in Random Linear Estimation", IEEE Transactions on Information Theory, 2018.

*Note: The authors are listed in alphabetical and/or affiliation order.*

## Memberships & Activities

Teaching workshops attended: Teaching toolkit (EPFL 2017) - Presenting and explaining in class (EPFL 2016).

Summer/winter schools attended: Statistical physics, learning, inference and networks (Les Houches 2017) - Nexus of information and computation theories (Henri Poincaré Institute 2016) - Information processing for large networks (Les Diablerets 2015).

IEEE member (2009 – Present).

Member of Sidon Scuba Diving Club.