

CONTACT INFORMATION	Don Myers 222, Math & Stat American University 3501 Nebraska Ave NW Washington, DC 20016	<i>E-mail:</i> boukouva@american.edu https://zoisboukouvalas.github.io
ACADEMIC APPOINTMENTS	American University , Washington, DC USA <i>Assistant Professor</i>	August 2019 - Present
EDUCATION	University of Maryland Baltimore County , Baltimore, Maryland USA Ph.D., Applied Mathematics, May 2017 <ul style="list-style-type: none"> - Dissertation Topic: “<i>Development of ICA and IVA Algorithms with Application to Medical Image Analysis</i>” - Advisor: Dr. Tülay Adalı M.S., Applied Mathematics, January 2013 Rochester Institute of Technology , Rochester, New York USA M.S., Applied and Computational Mathematics, August 2011 <ul style="list-style-type: none"> - Master Thesis: “<i>Distance Metric Learning for Medical Image Registration</i>” - Advisor: Dr. Nathan Cahill University of Patras , Patras, Greece B.S., Mathematics, September 2008 <ul style="list-style-type: none"> - Degree Thesis: “<i>Matrix Groups and Topology</i>” - Advisor: Dr. Andreas Arvanitoyeorgos 	
RESEARCH INTERESTS	Machine learning, Differential Geometry, Statistical Signal Processing, Numerical Optimization, Big Data and Social Science.	
RESEARCH EXPERIENCE	Department of Computer Science and Electrical Engineering, University of Maryland Baltimore County , Baltimore, Maryland USA <i>Visiting Assistant Professor</i> Collaboration with Dr. Tülay Adalı on grant proposals. Close research interaction with other Machine Learning for Signal Processing Laboratory (MLSP-Lab) members. The IDEAL Lab, University of Maryland, College Park , College Park, Maryland USA <i>Postdoctoral Research Associate</i> Development of machine learning models and algorithms for big data, by combining aspects from information geometry, mathematical statistics, and numerical optimization. <ul style="list-style-type: none"> - Support: Office of Naval Research, <i>Machine Learning for Energetic Materials</i>. - Written or provided technical support of research proposals submitted to: DARPA, US Army. - Mentoring undergraduate students. Machine Learning for Signal Processing Laboratory (MLSP-Lab), University of Maryland Baltimore County , Baltimore, Maryland USA <i>Research Assistant</i>	October 2018 - October 2019 September 2017 - July 2019 October 2013 - May 2017

Advanced Document Imaging (ADI) LLC, Rochester, New York USA

Research Assistant

November 2010 - March, 2011

Development of text segmentation algorithms for the separation between text and images in a given document.

RESEARCH GRANTS **Funded**

AND CONTRACTS

Energetics Technology Center

Title: Human Assisted Machine Learning and Natural Language Processing Approaches for Energetics

Single PI: Zois Boukouvalas. \$160,000 Start: 10/2020. End: 10/2023

Role: (subcontractor to Energetics Technology Center) Develop human assisted machine learning and natural language processing (NLP) approaches to infer information about energetic materials and long-range precision fires technologies from highly technical open literature sources.

Energetics Technology Center

Title: Data-Driven Multi-modal Fusion for the Analysis of Energetic Material Systems

Single PI: Zois Boukouvalas. \$200,000 Start: 08/2020. End: 05/2023

Role: (subcontractor to Energetics Technology Center) Using Advanced Machine Learning techniques and data from multiple sources, and of different nature, i.e. multi-modal, to design, prototype, and evaluate an end-to-end system for the synthesis, analysis, and handling of energetic materials.

CAS Faculty Mellon Fund (American University)

Title: Data Analysis, Visualization, and Knowledge Discovery for Early Detection of Child Victimization

PI: Zois Boukouvalas. \$4,000 Start: 10/2019. End: 05/2021

Role: (Collaborative with faculty from Math & Stat and CS department) Using Machine Learning for knowledge discovery in emergency situations and early detection of child victimization.

Pending

National Science Foundation (NSF)

SaTC: CORE: Small: Collaborative: FullTrust: Fully Multivariate Fusion for Trustworthy Cyberspace with Application to High Impact Events

Lead PI: Zois Boukouvalas. \$1,199,574 (w/ PIs Nathalie Japkowicz, Christine Mallinson, Tülay Adalı, Joshi Anupam, Sudip Mittal)

National Science Foundation (NSF)

REU Site: Research Experiences for Undergraduates in Security Analytics

Research Mentor: Zois Boukouvalas. \$259,196.00 (PIs Lei Ding, Roberto Corizzo)

Previous

Office of Naval Research/Energetics Technology Center

Title: Machine Learning for Energetic Materials

Single PI: Zois Boukouvalas. \$40,000 Start: 10/2019. End: 07/2020

Role: (subcontractor to Energetics Technology Center) Using Machine Learning techniques to accelerate the discovery and design of new energetic materials.

PUBLICATIONS

Books

1. N. Japkowicz, **Z. Boukouvalas**, and Mohak Shah, “Evaluating Learning Algorithms”, 2nd edition, Cambridge University Press, (In preparation)

Journal articles

1. D. C. Elton, **Z. Boukouvalas**, M. D. Fuge, and P. W. Chung, “Deep learning for molecular design-a review of the state of the art”, *Molecular Systems Design & Engineering, Royal Society of Chemistry*, vol. 4, pp. 828-849, 2019.
2. A. von Lüthmann, **Z. Boukouvalas**, T. Adalı, and K. R. Müller, “A new blind source separation framework for signal analysis and artifact rejection in functional Near-Infrared Spectroscopy”, *NeuroImage*, Elsevier, 2019.
3. R. Mowakeaa, Q. Long, **Z. Boukouvalas**, and T. Adalı, “IVA Using Complex Multivariate GGD: Application to fMRI Analysis”, *Multidimensional Systems and Signal Processing, Springer*, pp. 1-20, 2019.
4. D. C. Elton, **Z. Boukouvalas**, M. S. Butrico, M. D. Fuge, and P. W. Chung, “Applying machine learning techniques to predict the properties of energetic materials”, *Nature Scientific reports*, vol. 8, no. 1, (2018): 9059.
5. **Z. Boukouvalas**, Y. Levin-Schwartz, V. D. Calhoun, and T. Adalı, “Sparsity and Independence: Balancing of two Objectives in Optimization for Source Separation with Application to fMRI Analysis,” *Elsevier, Journal of the Franklin Institute (JFI)*, 355, no. 4, 2018: 1873-1887.
6. Q. Long, S. Bhinge, Y. Levin-Schwartz, **Z. Boukouvalas**, V. D. Calhoun, and T. Adalı, “The Role of Diversity in Data-driven Analyses of Multi-subject fMRI Data: Comparison of Approaches Based on Independence and Sparsity Using Global Performance Metrics”, *Human Brain Mapping*, no. 2, pp. 489-504, 2018.
7. D. Emge, , Y. Levin-Schwartz, **Z. Boukouvalas**, and T. Adalı, “Power Spectra Constrained IVA for SSVEP Detection,” *Biomedical Physics & Engineering Express*, 5(1), 015008, 2018.
8. **Z. Boukouvalas**, S. Said, L. Bombrun, Y. Berthoumieu and T. Adalı, “A New Riemannian Averaged Fixed-Point Algorithm for MGGD Parameter Estimation,” *IEEE Signal Proc. Letts.*, vol. 22, no. 12, pp. 2314-2318, Dec. 2015.
9. **Z. Boukouvalas**, A. Arvanitoyeorgos, “A coordinate system for the three-sphere in the Euclidean four space,” *Mathematical Review of the Greek Mathematical Society*, (2006) 65.

Peer-reviewed conference publications

1. L. P. Damasceno, C. C. Cavalcante, T. Adalı, and **Z. Boukouvalas**, “Independent Vector Analysis using Semi-Parametric Density Estimation via Multivariate Entropy Maximization,” *IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, Toronto, ON, Canada, (Submitted)
2. B. Gabrielson, M. A. B. S. Akhonda, **Z. Boukouvalas**, and T. Adalı, “ICA with Orthogonality Constraint: Identifiability and a New Efficient Algorithm,” *IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, Toronto, ON, Canada, (Submitted)
3. **Z. Boukouvalas**, M. Puerto, D. C. Elton, P. W. Chung, and M. D. Fuge, “Independent Vector Analysis for Molecular Data Fusion: Application to Property Prediction and Knowledge Discovery of Energetic Materials,” *IEEE Machine Learning for Signal Processing Workshop (MLSP)*, October 2019, IEEE, pp. 1-6.
4. SK. Popuri, and **Z. Boukouvalas**, “Efficient Parameter Estimation for Semi-Continuous Data: An Application to Independent Component Analysis,” *IEEE Machine Learning for Signal Processing Workshop (MLSP)*, October 2019, IEEE, pp. 1-6.
5. **Z. Boukouvalas**, D. C. Elton, P. W. Chung, and M. D. Fuge, “Independent Vector Analysis for Data Fusion Prior to Molecular Property Prediction with Machine Learning”, *Machine Learning for Molecules and Materials NIPS 2018*. <http://www.quantum-machine.org/workshops/nips2018/>
6. **Z. Boukouvalas**, Y. Levin-Schwartz, R. Mowakeaa, G.-S. Fu, and T. Adalı, “Independent Component Analysis Using Semi-Parametric Density Estimation via Entropy Maximization,” *IEEE Statistical Signal Processing Workshop*, June 2018, pp. 403-407.
7. D. C. Elton, D. Turakhia, N. Reddy, J. Tan, **Z. Boukouvalas**, P. W. Chung, and M. D. Fuge, “Using natural language processing techniques to extract information on the properties and func-

tionalties of energetic materials from large text corpora”, *22nd International Seminar in New Trends in Research of Energetic Materials, NTREM 2019*.

8. B. C. Barnes, D. C. Elton, **Z. Boukouvalas**, D. E. Taylor, W. D. Mattson, M. D. Fuge, and P. W. Chung, “Machine Learning and Discovery for Energetic Materials”, *16th International Detonation Symposium*, Cambridge MD, USA, July 2018.
9. Q. Long, C. Jia, **Z. Boukouvalas**, B. Gabrielson, D. Emge, V. D. Calhoun, and T. Adali, “Consistent Run Selection for Independent Component Analysis: Application to fMRI Analysis”, *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, Calgary, Alberta, Canada, April 2018, pp. 2581–2585.
10. D. Emge, **Z. Boukouvalas**, Y. Levin-Schwartz, S. Bhinge, Q. Long, and T. Adali, “Power Spectra Constrained IVA for Enhanced Detection of SSVEP Content,” *Proc. Conf. on Info. Sciences and Systems (CISS)*, Baltimore, USA, March 2017, pp. 1–5.
11. **Z. Boukouvalas**, Y. Levin-Schwartz, and T. Adali, “Enhancing ICA performance by exploiting sparsity: Application to fMRI Analysis.” *IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, New Orleans, USA, March 2017, pp. 2532–2536.
12. S. Bhinge, Q. Long, Y. Levin-Schwartz, **Z. Boukouvalas**, and T. Adali, “Non-orthogonal constrained independent vector analysis: Application to data fusion.” *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, New Orleans, USA, March 2017, pp. 2666–2670.
13. R. Mowakeaa, **Z. Boukouvalas**, and T. Adali, “On the Characterization, Generalization, and Efficient Estimation of the Complex Multivariate Generalized Gaussian Distribution,” in *Proc. IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM)*, Rio de Janeiro, Brazil, July 2016, pp. 1–5.
14. S. Bhinge, **Z. Boukouvalas**, Y. Levin-Schwartz, and T. Adali, “IVA for Abandoned Object Detection: Exploiting Dependence Across Color Channels,” in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, Shanghai, China, March 2016, pp. 2494–2498.
15. G.-S. Fu, **Z. Boukouvalas**, and T. Adali, “Density estimation by entropy maximization with kernels,” in *Proc. IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP)*, Brisbane, Australia, April 2015, pp. 1896–1900.
16. **Z. Boukouvalas**, G.-S. Fu, and T. Adali, “An Efficient Multivariate Generalized Gaussian Distribution Estimator: Application to IVA,” in *Proc. Conf. on Info. Sciences and Systems (CISS)*, Baltimore, MD, March 2015, pp. 1–4.

Non peer-reviewed publications

1. **Z. Boukouvalas**, C. Mallinson, E. Crothers, N. Japkowicz, A. Piplai, S. Mittal, A. Joshi, and T. Adali, “Independent Component Analysis for Trustworthy Cyberspace during High Impact Events: An Application to Covid-19,” arXiv:2006.01284 (2020).
2. **Z. Boukouvalas**, J. Zhou, M. D. Fuge, and S. Said, “MGPD Parameter Estimation on the Space of SPD Matrices,” *International Conference on Machine Learning (ICML), Geometry in Machine Learning (GiMLi)*, Stockholm International Fairs, Stockholm, Sweden, July 2018.
3. **Z. Boukouvalas**, R. Mowakeaa, G.-S. Fu, and T. Adali, “Independent Component Analysis by Entropy Maximization with Kernels,” arXiv:1610.07104 (2016).

HONORS AND AWARDS

Third place in the Best Paper Competition, 22nd “New Trends in Research of Energetic Materials” (NTREM) Conference, April 2019

Outstanding Graduate Researcher in the Field of Mathematics, UMBC, 2017.

Outstanding Graduate Teaching Assistant in the Field of Mathematics, UMBC, 2012.

INVITED TALKS

Independent Vector Analysis for Multimodal Fusion: Application to Misinformation Detection, “Multimodal data mining methods and applications based on coupled matrix/tensor factorizations”, SIAM Conference on Applied Linear Algebra, Virtual Conference, May 2021.

Independent Vector Analysis using a Riemannian Averaged Fixed-Point Algorithm for MGGD Parameter Estimation, DFT 2020: The District Fourier Talks, American University, Washington DC, October 2020.

Data Fusion in the Age of Data: Recent Theoretical Advances and Applications, Math/Stat Department Colloquia, American University, Washington DC, September 2019.

Machine Learning Applications in Energetics, U.S. Army Research Laboratory, Aberdeen Proving Ground, MD, April 2018.

Independent Component Analysis: Algorithms and Applications to Medical Imaging and Video Surveillance, Math/Stat Department Colloquia, American University, Washington DC, February 2017.

A New Riemannian Averaged Fixed-Point Algorithm for MGGD Parameter Estimation: Application to IVA, UMBC Graduate Student Seminar, Baltimore MD, March 2016.

Multivariate Generalized Gaussian Distribution Estimation Algorithms for Independent Vector Analysis, UMBC Graduate Student Seminar, Baltimore MD, March 2015.

Introduction to Independent Component Analysis, UMBC Graduate Student Seminar, Baltimore MD, April 2014.

Image Deblurring, Spectra and Filtering, UMBC Graduate Student Seminar, Baltimore MD, April 2013.

Medical Image Registration, UMBC Graduate Student Seminar, Baltimore MD, April 2012.

Text Segmentation, RIT Summer Mathematics Institute Teachers' Workshop, Rochester NY, June 2011.

CONFERENCE
PRESENTATIONS

Efficient Parameter Estimation for Semi-Continuous Data: An Application to Independent Component Analysis, IEEE Machine Learning for Signal Processing Workshop (MLSP), NTREM 2019, Pittsburgh, USA, October 2019.

Using Natural Language Processing Techniques to Extract Information on the Properties and Functionalities of Energetic Materials from Large Text Corpora, 22nd International Seminar in New Trends in Research of Energetic Materials, NTREM 2019, Czech Republic, April 2019.

Independent Vector Analysis for Data Fusion Prior to Molecular Property Prediction with Machine Learning, Conference on Neural Information Processing Systems (NIPS) 2018, Machine Learning for Molecules and Materials, Montreal, Canada, December 2018.

MGGD Parameter Estimation on the Space of SPD Matrices, International Conference on Machine Learning (ICML), Geometry in Machine Learning (GiMLi), Stockholm International Fairs, Stockholm, Sweden, July 2018.

Independent Component Analysis Using Semi-Parametric Density Estimation via Entropy Maximization, IEEE Statistical Signal Processing Workshop, Freiburg, Germany, June 2018.

Sparsity and Independence: Balancing Two Objectives in Optimization for Source Separation, 12th Annual Machine Learning Symp., The New York Academy of Sciences, New York, March 2018.

Sparsity and Independence: Balancing Two Objectives in Optimization for Source Separation, Machine Learning for Materials Science (MLMR), College Park, USA, June 2017.

Development of ICA and IVA Algorithms with Application to Medical Image Analysis, IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP), New Orleans, USA, March 2017.

Enhancing ICA performance by exploiting sparsity: Application to fMRI Analysis, IEEE Int. Conf. Acoust., Speech, Signal Processing (ICASSP), New Orleans, USA, March 2017.

IVA for Abandoned Object Detection: Exploiting Dependence Across Color Channels, Research Presentation, UMBC, Baltimore MD, November 2016.

An Efficient Multivariate Generalized Gaussian Distribution Estimator: Application to IVA, Conference on Information Sciences and Systems (CISS), Johns Hopkins University, Baltimore MD, March

2015.

Classification Algorithms for Medical Image Registration, Graduate Research Conference, UMBC, Baltimore MD, February 2013.

Medical Image Registration using Distance Metric Learning, RIT Graduate Research Symposium, Rochester NY, July 2011.

TEACHING
EXPERIENCE

Course development

Wrote proposals for new curricula for DATA 442/642 and DATA 441/641. Coordinated and taught listed courses as special topic courses (STAT 496/696). Both courses will serve as core courses for the upcoming PhD program in Data Science.

- DATA 442/642, Advanced Machine Learning.
- DATA 441/641, Introduction to Applied Natural Language Processing.

Teaching

American University, Washington, DC USA

Assistant Professor

August 2019 - Present

- DATA 793, Data Science Practicum, Spring 2021.
- STAT 469/696, Introduction to Applied Natural Language Processing, Spring 2021.
- STAT 469/696, Advanced Machine Learning, Fall 2020.
- STAT 427/627, Statistical Machine Learning, Spring 2020, Fall 2020.
- STAT 415/615, Regression, Fall 2019.
- STAT 412/612, Statistical Programming in R, Fall 2019.

Adjunct Professorial Lecturer

January 2018 - May 2018

- STAT 204, Intro to Business Statistics, Spring 2018.

University of Maryland Baltimore County, Baltimore, Maryland USA

Guest Lecturer

September 2015 - May 2018

- ENEE 620, Probability and Random Processes, Fall 2015, Fall 2016, Fall 2017.
- ENEE 712, Special Topics in Signal Processing, Spring 2016, Spring 2018.
- ENEE 621, Detection and Estimation Theory, Spring 2017.

Instructor

May 2012 - July 2017

- MATH 150, Precalculus, Summer 2012, Summer 2015, Summer 2017.
- MATH 151, Calculus I, Summer 2013, Summer 2014.
- MATH 155, Applied Calculus, Summer 2016.

Math Teaching Assistant

August 2011 - May 2016

Head teaching assistant. Duties included mini lectures and worksheet preparation, shared administrative responsibilities with faculty instructor, fielding of all student inquiries, provide assistance with calculus-related questions, and grade weekly quizzes for over 100 students.

Courses: Precalculus, Applied Calculus, Calculus I, II.

STUDENT ADVISING **Graduate students**

American University

Allison Ragan, Data Science

Winter 2020 - Present

Allison Shafer, Data Science

Winter 2020 - Present

Huong Doan, Computer Science

Winter 2020 - Present

Erik Lovece, Statistics	Spring 2020 - Present
Chace Paulson, Data Science	Spring 2020
Monica Puerto, Data Science	Spring 2020 - Present
Caitlin Moroney, Data Science	Summer 2020 - Present
Dustin Pierce, Data Science	Summer 2020
Dong Ding, Statistics	Spring 2020
Ziyan Wang, Statistics	Spring 2020

Federal University of Ceara (UFC) - Brazil

Lucas Damasceno, Teleinformatics Engineering - DETI	Spring 2020 - Present
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Undergraduate students

American University

Rodanthi Nikopoulou, Chemistry	Winter 2020 - Present
Parker Brotman, Math & Stat	Summer 2020

University of Maryland, Baltimore County

Joshua Slaughter, Computer Engineering	Spring 2020
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University of Maryland, College Park

Chuanmudi Qin, Mathematics	Spring 2019
Rohith Venkatesh, Computer Science	Fall 2018
Austin Kim, Computer Science	Fall 2018

PROFESSIONAL
SERVICE

Ph.D. committee member and dissertation reader

Qunfang Long	UMBC, Dept. of CSEE	Summer 2020
Data-driven Techniques for the Study of Brain Dynamics and Identification of Subgroups: Application to Multi-subject Resting-state fMRI Data		

Suchita Bhinge	UMBC, Dept. of CSEE	Fall 2019
Adaptive Constrained Independent Vector Analysis: Application to Large-Scale fMRI Analysis		

Darren K. Emge	UMBC, Dept. of CSEE	Spring 2018
Independent Vector Analysis for Steady State Visually Evoked Potential Data Analysis.		

MS committee member

Ruiqi Sun	AU, Math & Stat	Summer 2020
Estimating Preferential Pairing in Polyploids		

Conferences Special Sessions Organizer

Co-organizer, Latent Variable Methods: Theoretical Advances and Applications in the Age of Machine Learning, EUSIPCO 2020 (January 2021), Virtual conference

Co-organizer, Machine Learning for Knowledge Discovery in the Social Sciences, MLSP 2019 (October 2019), Pittsburgh, PA, US

Journal paper reviewer and conference program committee member

- Journal:

Journal of Neuroscience methods (Elsevier) (**Certificate of Reviewing**)
 Neural Processing Letters (Springer)
 Transactions on Signal Processing (IEEE)
 Journal of Machine Learning Research

Computational and Mathematical Methods in Medicine (Hindawi)
Journal of the Franklin Institute (Elsevier)

- Conference:

IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2016-2021

The Ninth IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM), 2016

Latent Variable Analysis and Signal Separation (LVA/ICA), 2015

IEEE International Workshop on Machine Learning for Signal Processing (MLSP), 2015, 2016, 2018, 2019, 2020

American University service

- Major Program Review Committee, Summary and Future plans
- Graduate Studies Committees, Data Science, (Initial Moderator)
- Website Committee