

David Alvarez-Melis

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RESEARCH INTERESTS

- Themes Geometry in machine learning, dataset matching and correspondence, interpretability.
Methods Optimal transport, convex/submodular optimization, differential equations.
Applications Data alignment, dataset synthesis, unsupervised translation, generative models.

EDUCATION

- 2014 – 2019 **Massachusetts Institute of Technology**, Ph.D in Computer Science.
◦ Area: Machine Learning, minor in Mathematical Optimization.
◦ Thesis: *Optimal Transport in Structured Domains: Algorithms and Applications*
◦ Committee: Tommi Jaakkola (advisor), Stefanie Jegelka, Justin Solomon.
- 2011 – 2013 **Courant Institute, New York University**, M.S. in Mathematics.
◦ Thesis: *The Matrix Multiplicative Weights Algorithm for Domain Adaptation*.
◦ Advisor: Mehryar Mohri.
- 2006 – 2011 **Instituto Tecnológico Autónomo de México**, B.S. in Applied Mathematics.
◦ Thesis: *The Lax-Milgram Theorem, Generalizations and Applications*.
◦ Advisor: Carlos Bosch Giral.
◦ Mención Honorífica (*summa cum laude*), top 1% of class, valedictorian.

RESEARCH AND WORK EXPERIENCE

- 2019 – **Postdoctoral Researcher**, *Microsoft Research*, Cambridge, MA, USA.
◦ Topics: optimal transport for meta-learning, debiasing and adaptation
- 2014 – 2019 **Research Assistant**, *MIT CSAIL*, Cambridge, MA, USA.
◦ Supervisor: Tommi Jaakkola.
◦ Recent Projects: structured optimal transport, robustly interpretable machine learning.
- 05 – 08/2018 **Research Intern**, *Microsoft Research*, New York, NY, USA.
◦ Mentors: Hanna Wallach, Jenn Wortman Vaughan, Hal Daumé III.
◦ Project: Robust and human-like interpretability for machine learning.
- 05 – 08/2016 **Research Intern**, *Microsoft Research*, Redmond, WA, USA.
◦ Mentors: Scott Yih, Ming-Wei Chang, Kristina Toutanova, Chris Meek.
◦ Project: Multi-hop relation prediction for knowledge base question answering.
- 2013 – 2014 **Supplemental Researcher**, *IBM Research*, TJ Watson Center, NY, USA.
◦ Mentors: Michael Picheny & Ken Church (speech recognition group).
◦ Data mining, statistical modeling and machine learning for speech recognition data.
- 2009 – 2010 **Statistical Analyst**, *LasQuinceLetras Solutions*, Mexico City, Mexico.
◦ Designed and carried out statistical learning methods on large survey datasets.

SELECTED PUBLICATIONS

- [1] **D. Alvarez-Melis** and N. Fusi. “Geometric Dataset Distances via Optimal Transport”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2020.
- [2] **D. Alvarez-Melis**, S. Jegelka, and T. S. Jaakkola. “Towards Optimal Transport with Global Invariances”. In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2019.

- [3] **D. Alvarez-Melis** and T. S. Jaakkola. “Towards Robust Interpretability with Self-Explaining Neural Networks”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2018.
- [4] **D. Alvarez-Melis**, T. S. Jaakkola, and S. Jegelka. “Structured Optimal Transport”. In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2018. (**Oral Presentation**).

FELLOWSHIPS AND AWARDS

- 2020 **Outstanding Reviewer Award**, *ICML 2020*.
- 2019 **Harvard Data Science Initiative Postdoctoral Fellowship**, (*declined*).
- 2019 **Best Reviewer Award**, *NeurIPS 2019*, Registration waived.
- 2018 **Facebook Fellowship Finalist**, (30/800 applicants).
- 2018 **Best Reviewer Award**, *NeurIPS 2018*, Registration waived.
- 2018 **Hewlett Packard Graduate Fellowship**, One-term PhD award.
- 2018 **AI2 Key Scientific Challenges program award**, \$10K unrestricted award..
- 2011, 2014 **Fellowship for graduate studies abroad**, *CONACYT*.
- 2012 **Alumni Research Prize**, *ITAM*, Category: Undergraduate Thesis.
- 2011 **Sotero Prieto Prize, Second Place**, *Mexican Mathematical Society*, For the best undergraduate theses in mathematics in the country.
- 2006 – 2009 **Academic Excellence Scholarship**, *ITAM*, For undergraduate studies.

PRESS AND OUTREACH

- 2020 **Microsoft Research Blog**, “[Measuring dataset similarity using optimal transport](#)”.
- 2019 **ZDNet**, “[IBM offers explainable AI toolkit, but it’s open to interpretation](#)”.
- 2018 **MIT News**, “[Model paves way for faster, more efficient translations of more languages](#)”.
- 2018 **VentureBeat**, “[MIT CSAIL is using unsupervised learning for language translations](#)”.
- 2017 **MIT News**, “[How Neural Networks think](#)”.

PROFESSIONAL ACTIVITIES AND SERVICE

- Reviewer **ACL-IJCNLP 2015**, **IJCNLP 2017**, **ACL (2016 – 2019)**, **UAI (2018, 2020)**, **NeurIPS (2018 – 2020)**, **LXAI@NIPS 2018**, **AISTATS (2019 – 2020)**, **ICML (2019 – 2020)**, **ICLR (2020-2021)**, **PLoS ONE**, **JAIR**, **TACL**, **JMLR**, **IMAI**, **TPAMI**, **AIJ**.
- Organizer **RIIAA 2018** (student-run AI conference in Mexico City), riiaa.org.
- Other **MIT EECS Graduate Admissions Committee** (2017, 2019).
- Other **Orientation Co-Chair**, MIT Graduate Student Council.

FULL LIST OF PUBLICATIONS

Most recent publications via [Google Scholar](#).

PREPRINTS

- [5] **D. Alvarez-Melis** and Y. Mroueh. “Gradient Flows via Input Convex Neural Networks”. 2020.
- [6] **D. Alvarez-Melis**, V. Garg, and A. Kalai. “When not to use an Adversarial Approach to Generative Modeling”. 2020.
- [7] **D. Alvarez-Melis** and N. Fusi. “Gradient Flows in Dataset Space”. 2020.

- [8] **D. Alvarez-Melis** and T. Broderick. “A translation of "The characteristic function of a random phenomenon" by Bruno de Finetti”. 2015.

CONFERENCE AND JOURNAL PUBLICATIONS

- [1] **D. Alvarez-Melis** and N. Fusi. “Geometric Dataset Distances via Optimal Transport”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2020.
- [9] **D. Alvarez-Melis**, Y. Mroueh, and T. S. Jaakkola. “Unsupervised Hierarchy Matching with Optimal Transport over Hyperbolic spaces”. In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2020.
- [10] C. Bunne, **D. Alvarez-Melis**, S. Jegelka, and A. Krause. “Learning Generative Models Across Incomparable Spaces”. In: *International Conference on Machine Learning (ICML)*. 2019.
- [11] G.-H. Lee, W. Jin, **D. Alvarez-Melis**, and T. S. Jaakkola. “Functional Transparency for Structured Data: a Game-Theoretic Approach”. In: *International Conference on Machine Learning (ICML)*. 2019.
- [12] G.-H. Lee, **D. Alvarez-Melis**, and T. S. Jaakkola. “Towards Robust, Locally Linear Deep Networks”. In: *International Conference on Learning Representations (ICLR)*. 2019.
- [2] **D. Alvarez-Melis**, S. Jegelka, and T. S. Jaakkola. “Towards Optimal Transport with Global Invariances”. In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2019.
- [3] **D. Alvarez-Melis** and T. S. Jaakkola. “Towards Robust Interpretability with Self-Explaining Neural Networks”. In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2018.
- [13] **D. Alvarez-Melis** and T. S. Jaakkola. “Gromov-Wasserstein Alignment of Word Embedding Spaces”. In: *Conference on Empirical Methods in Natural Language Processing (EMNLP)*. 2018. (**Oral Presentation**).
- [4] **D. Alvarez-Melis**, T. S. Jaakkola, and S. Jegelka. “Structured Optimal Transport”. In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2018. (**Oral Presentation**).
- [14] **D. Alvarez-Melis** and T. S. Jaakkola. “A causal framework for explaining the predictions of black-box sequence-to-sequence models”. In: *Conference on Empirical Methods in Natural Language Processing (EMNLP)*. 2017.
- [15] **D. Alvarez-Melis** and T. S. Jaakkola. “Tree-structured decoding with doubly-recurrent neural networks”. In: *International Conference on Learning Representations (ICLR)*. 2017.
- [16] **D. Alvarez-Melis** and M. Saveski. “Topic Modeling in Twitter: Aggregating Tweets by Conversations”. In: *International AAAI Conference on Web and Social Media (ICWSM)*. 2016.
- [17] T. B. Hashimoto, **D. Alvarez-Melis**, and T. S. Jaakkola. “Word Embeddings as Metric Recovery in Semantic Spaces”. In: *Transactions of the Association for Computational Linguistics (ACL)* 4 (2016). (**Oral Presentation at ACL’16**).
- [18] **D. Alvarez-Melis**, Y. Mroueh, and T. S. Jaakkola. “Unsupervised Hierarchy Matching with Optimal Transport over Hyperbolic spaces”. In: *NeurIPS Workshop on Optimal Transport for Machine Learning*. 2019. (**Spotlight Talk**).

REFEREED WORKSHOP CONTRIBUTIONS

- [19] **D. Alvarez-Melis**, H. Daumé III, J. W. Vaughan, and H. Wallach. “Weight of Evidence as a Basis for Human-Oriented Explanations”. In: *NeurIPS Workshop on Human-Centric Machine Learning*. 2019.
- [20] H. James-Sorenson and **D. Alvarez-Melis**. “Probabilistic Bias Mitigation in Word Embeddings”. In: *NeurIPS Workshop on Human-Centric Machine Learning*. 2019.
- [21] C. Bunne, **D. Alvarez-Melis**, S. Jegelka, and A. Krause. “Learning Generative Models Across Incomparable Spaces”. In: *NeurIPS Workshop on Relational Representation Learning*. 2018. (**Extended Contributed Talk + Best Paper Award**).
- [22] **D. Alvarez-Melis** and T. S. Jaakkola. “On the Robustness of Interpretability Methods”. In: *Proceedings of the 2018 ICML Workshop in Human Interpretability in Machine Learning*. 2018. (**Oral Presentation**).
- [23] G.-H. Lee, **D. Alvarez-Melis**, and T. S. Jaakkola. “Game-theoretic Interpretability for Temporal Modeling”. In: *Fairness, Accountability and Transparency in Machine Learning*. 2018.
- [24] **D. Alvarez-Melis** and J. Amores. “The Emotional GAN: Priming Adversarial Generation of Art with Emotion”. In: *NIPS Workshop on Machine Learning for Creativity and Design*. 2017.
- [25] **D. Alvarez-Melis**, T. S. Jaakkola, and S. Jegelka. “Structured Optimal Transport”. In: *NIPS Workshop on Optimal Transport for Machine Learning*. 2017. (**Extended Oral Presentation**).
- [26] T. B. Hashimoto, **D. Alvarez-Melis**, and T. S. Jaakkola. “Word, graph and manifold embedding from Markov processes”. In: *NIPS Workshop on Nonparametric Methods for Large Scale Representation Learning*. 2015.
- [27] C. Li, **D. Alvarez-Melis**, K. Xu, S. Jegelka, and S. Sra. “Distributional Adversarial Networks”. In: *International Conference on Learning Representations (ICLR), Workshop Track*. 2017.

THESES

- [28] **D. Alvarez-Melis**. “Optimal Transport in Structured Domains: Algorithms and Applications”. Ph.D. Thesis. Massachusetts Institute of Technology, 2019.
- [29] **D. Alvarez-Melis**. “The Matrix Multiplicative Weights Algorithm for Domain Adaptation”. M.S. Thesis. New York University, 2013.
- [30] **D. Alvarez-Melis**. “El Teorema de Lax Milgram, Generalizaciones y Aplicaciones”. B.Sc. Thesis. Instituto Tecnológico Autónomo de México, 2011.

TALKS

- ‘AUTOMATING DATASET COMPARISON AND MANIPULATION VIA OPTIMAL TRANSPORT’
 - Directions in Machine Learning, Microsoft, November 2020
- ‘GEOMETRIC DATASET DISTANCES VIA OPTIMAL TRANSPORT’
 - NeurIPS, (remote), December 2020
 - AutoML Workshop @ ICML, (remote), July 2020
- ‘UNSUPERVISED HIERARCHY MATCHING VIA OPTIMAL TRANSPORT’
 - AISTATS, (remote), June 2020

- ‘INTERPRETATION, REPRESENTATION AND CORRESPONDENCE IN STRUCTURED DOMAINS’
 - Facebook Artificial Intelligence Research (FAIR), NYC, February 2019
 - ASAPP, NYC, February 2019
 - Google, Cambridge MA, February 2019
 - Microsoft Research, Cambridge MA, February 2019
 - IBM Research, Cambridge MA, February 2019
 - DeepMind, London, January 2019
 - Microsoft Research, NYC, January 2019
- ‘STRUCTURED OPTIMAL TRANSPORT’
 - Harvard University, November 2018
 - Phillipe Rigollet’s Group, MIT, November 2018
 - AISTATS, Lanzarote, April 2018
 - Optimal Transport in ML Workshop @ NIPS 2017, Long Beach, December 2017
- ‘GROMOV-WASSERSTEIN ALIGNMENT OF WORD EMBEDDING SPACES’
 - Jim Glass’s Group, MIT, November 2018
 - EMNLP, Brussels, November 2018
- ‘WORD EMBEDDINGS AND NEURAL NETWORKS FOR NATURAL LANGUAGE PROCESSING’
 - RIIAA 2018, Mexico City, August 2018
 - DeepLearn Seminar, MIT, October 2015
- ‘ON THE ROBUSTNESS OF INTERPRETABILITY METHODS’
 - Workshop on Human Interpretability in Machine Learning (WHI) @ ICML 2018, Stockholm, July 2018
- ‘INTERPRETABILITY IN NATURAL LANGUAGE PROCESSING’
 - Guest Lecture at CMU ECE-739 (remote), April 2018
- ‘LEARNING WITH STRUCTURED DATA: INTERPRETABILITY AND OPTIMAL TRANSPORT’
 - OpenAI, San Francisco, January 2018
- ‘INTERPRETABILITY FOR COMPLEX MODELS NATURAL LANGUAGE PROCESSING’
 - Systems That Learn, MIT, December 2017
 - CompLang Seminar, MIT, November 2017

TEACHING AND MENTORING

- 2018 **Co-Supervisor, MSc Thesis**, Charlotte Bunne (MIT/ETH), Thesis award (ETH).
- 2017-2019 **Advisor**, Undergraduate Research Opportunities Program (5 students), MIT.
- Spring 2015 **Teaching Assistant**, *6.036: Introduction to Machine Learning*, MIT.
- Spring 2013 **Adjunct Instructor (TA)**, *MATH-UA.121: Calculus I*, NYU.
- Fall 2012 **Adjunct Instructor (TA)**, *MATH-UA.9: Algebra and Calculus*, NYU.
- Spring 2012 **Grader**, *MATH-UA.326: Analysis II*, NYU.
- 2010 – 2011 **Teaching Assistant**, *Calculus I*, ITAM.
- Spring 08/09 **Teaching Assistant**, *Economics III (Intermediate Microeconomics)*, ITAM.

PROFESSIONAL TRAINING

- June 2017 **Machine Learning Summer School**, *Max-Planck-Institut*, Tübingen, Germany.
- July 2014 **Regularization methods for Machine Learning**, *Univ. of Genova*, Italy.

COMPUTER SKILLS

Languages Python, Bash, Java, R, C++, Lua Libraries PyTorch, Torch, Theano, Scikit

LANGUAGES

Spanish	Native	
English	Fluent	<i>TOEFL (iBT) 113/120, IELTS 8.5/9, FCE, CAE both with Grade A.</i>
Italian	Advanced	<i>CILS-Tre Certificate.</i>
French	Conversational	<i>Mother's language, studied also at Alliance Française Bordeaux.</i>
German	Basic	<i>Completed levels A1 - A2 at Goethe Institut Mexiko.</i>
Dutch, Greek	Beginner	

PROFESSIONAL MEMBERSHIPS

AMS (2012–), SIAM (2013–), ACL (2016–), AAAS (2017–)

OTHER INTERESTS

Languages, architecture, classical guitar (Albéniz, Sor), Italian cinema, soccer.