David Alvarez-Melis

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RESEARCH INTERESTS

Themes	Structured learning, statistical divergences, interpretability, unsupervised learning.
Methods	Optimal transport, convex/submodular optimization, semi-definite programming.
Applications	Low-resource machine translation, word embeddings, generative models.

EDUCATION

2014 – 2019   **Massachusetts Institute of Technology**, Ph.D in Computer Science.
- Area: Machine Learning, minor in Mathematical Optimization.
- Advisor: Tommi S. Jaakkola.
- Thesis: *Optimal Transport in Structured Domains: Algorithms and Applications*
- Thesis Committee: Tommi Jaakkola, 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: Dr. Mehryar Mohri.

2006 – 2011   **Instituto Tecnologico Autonomo de Mexico**, B.S. in Applied Mathematics.
- Thesis: *The Lax-Milgram Theorem, Generalizations and Applications.*
- Advisor: Dr. 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.

TEACHING AND ADVISING EXPERIENCE

2018	**Co-Supervisor, MSc Thesis**, Charlotte Bunne (MIT/ETH).
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. |

Fellowships and Awards

2018	**Facebook Fellowship Finalist**, (30/800 applicants).
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*.
March 2012	**Alumni Research Prize, Second Place**, *ITAM*, Category: Undergrad Thesis.
2012 – 2013	**Award for Graduate Studies Abroad**, *Mexican Ministry of Education*.
October 2011	**Sotero Prieto Prize, Second Place**, *Mexican Mathematical Society*, Yearly award for the best undergraduate theses in mathematics in the country.
2006 – 2009	**Academic Excellence Scholarship**, *ITAM*, For undergraduate studies.

Publications

Most recent publications via Google Scholar.

Preprints

[1] **D. Alvarez-Melis**, Y. Mroueh, and T. S. Jaakkola. "Unsupervised Hierarchy Matching with Optimal Transport over Hyperbolic spaces". 2019.

[2] **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

[3] C. Bunne, **D. Alvarez-Melis**, S. Jegelka, and A. Krause. "Learning Generative Models Across Incomparable Spaces". In: *International Conference on Machine Learning (ICML)*. 2019.

[4] 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.

[5] G.-H. Lee, **D. Alvarez-Melis**, and T. S. Jaakkola. "Towards Robust, Locally Linear Deep Networks". In: *International Conference on Learning Representations (ICLR)*. 2019.

[6] **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.

[7] **D. Alvarez-Melis** and T. S. Jaakkola. "Towards Robust Interpretability with Self-Explaining Neural Networks". In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2018.

[8] **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).**

[9] **D. Alvarez-Melis**, T. S. Jaakkola, and S. Jegelka. "Structured Optimal Transport". In: *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2018. **(Oral Presentation)**.

[10] **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.

[11] **D. Alvarez-Melis** and T. S. Jaakkola. "Tree-structured decoding with doubly-recurrent neural networks". In: *International Conference on Learning Representations (ICLR)*. 2017.

[12] **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.

[13] 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 (TACL)* 4 (2016). **(Oral Presentation at ACL'16)**.

Refereed Workshop Contributions

[14] **D. Alvarez-Melis**, H. Daumé III, J. W. Vaugan, and H. Wallach. "Weight of Evidence as a Basis for Human-Oriented Explanations". In: NeurIPS Workshop on Human-Centric Machine Learning. 2019.

[15] H. James-Sorenson and **D. Alvarez-Melis**. "Probabilistic Bias Mitigation in Word Embeddings". In: NeurIPS Workshop on Human-Centric Machine Learning. 2019.

[16] 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).**

[17] **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).**

[18] 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.

[19] **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.

[20] **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).**

[21] 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.

[22] 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

[23] **D. Alvarez-Melis**. "Optimal Transport in Structured Domains: Algorithms and Applications". Ph.D. Thesis. Massachusetts Institute of Technology, 2019.

[24] **D. Alvarez-Melis**. "The Matrix Multiplicative Weights Algorithm for Domain Adaptation". M.S. Thesis. New York University, 2013.

[25] **D. Alvarez-Melis**. "El Teorema de Lax Milgram, Generalizaciones y Aplicaciones". B.Sc. Thesis. Instituto Tecnologico Autonomo de Mexico, 2011.

Professional Activities and Service

Reviewer ACL-IJCNLP 2015 (outstanding reviewer), IJCNLP 2017, ACL (2016 – 2019), TACL, UAI 2018, NeurIPS (2018 – 2019) (reviewer award, registration waived both times), PLoS ONE, LXAI@NIPS 2018, AISTATS (2019 – 2020), ICML 2019, JAIR 2019.

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.

Talks

⟶ 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, Januray 2018

⟶ Interpretability for Complex Models Natural Language Processing.
  ○ Systems That Learn, MIT, December 2017
  ○ CompLang Seminar, MIT, November 2017

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

Professional Memberships

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

Other Interests

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