

Kevin S. Bello Medina (Kevin Bello)

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RESEARCH INTERESTS

I am broadly interested in Artificial Intelligence and Machine Learning. My research focuses on developing algorithms that are computationally and statistically efficient for various machine learning problems. *Specific Topics of Interest:* Combinatorial problems in machine learning, causal discovery, structured prediction, (non)convex optimization, high-dimensional statistics, fundamental limits, latent variable modeling.

ACADEMIC POSITIONS

Joint Postdoctoral Fellow Sept. 2021 - present
University of Chicago (Booth School of Business) and
Carnegie Mellon University (Machine Learning Department)
Mentors: Bryon Aragam (UChicago) and Pradeep Ravikumar (CMU)

EDUCATION

Ph.D. in Computer Science Aug. 2016 - Aug. 2021
Purdue University, Indiana, USA
Thesis: "Structured Prediction: Statistical and Computational Guarantees in Learning and Inference"
Advisor: Jean Honorio

B.Sc. in Mechatronics Engineering (Robotics) Aug. 2009 - Dec. 2014
Universidad Nacional de Ingenieria, Lima, Peru
Summa Cum Laude

HONORS AND AWARDS

- **DAAD AI-net Fellowship** 2023
DAAD's support of an individual one-week networking visit to German institutions, and membership in the DAAD AI-net Fellows and Alumni Network.
- **NeurIPS Scholar Award** 2022
- **NSF Computing Innovation Fellowship** 2021
Prestigious award given by the Computing Research Association and Computing Community Consortium to support two-year postdoctoral positions
- **Bilsland Dissertation Fellowship** 2021
Competitive award given to the most outstanding students at Purdue University
- **NeurIPS Travel Award** 2018, 2019
- **Grant to participate in the Machine Learning Summer School, Kyoto University** 2015
- **Highest accumulated GPA of my class, Universidad Nacional de Ingenieria** 2014
- **Peruvian Council of Science and Technology (Concytec) research grant** 2013
- **Presidente Manuel Pardo y Lavalle Prize** 2012
Highest honor given to undergraduates at Universidad Nacional de Ingenieria
- **Grant to participate in the 1st Latin American Theoretical Informatics School, University of Chile** 2012

PUBLICATIONS

PREPRINTS / UNDER REVIEW

- [1] "[Direct Learning with Guarantees of the Difference DAG Between Structural Equation Models](#)".
A. Ghoshal, **K. Bello** and J. Honorio.
Under review, 2023.

PEER-REVIEWED CONFERENCES

- [2] “NOTEARS²: Optimizing NOTEARS Objectives via Topological Swaps.”.
C. Deng, **K. Bello**, B. Aragam and P. Ravikumar.
International Conference on Machine Learning (ICML), USA, 2023.
- [3] “[DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization](#)”.
K. Bello, B. Aragam and P. Ravikumar.
Neural Information Processing Systems (NeurIPS), USA, 2022.
- [4] “[On the Fundamental Limits of Exact Inference in Structured Prediction](#)”.
H. Lee, **K. Bello**, and J. Honorio.
IEEE International Symposium on Information Theory (ISIT), Finland, 2022.
- [5] “[A Thorough View of Exact Inference in Graphs from the Degree-4 Sum-of-Squares Hierarchy](#)”.
K. Bello, C. Ke, and J. Honorio.
International Conference on Artificial Intelligence and Statistics (AISTATS), Spain, 2022.
- [6] “[Inverse Reinforcement Learning in the Continuous Setting with Formal Guarantees](#)”.
G. Dexter, **K. Bello**, and J. Honorio.
Neural Information Processing Systems (NeurIPS), Canada, 2021.
- [7] “[A Le Cam Type Bound for Adversarial Learning and Applications](#)”.
K. Bello^{*}, Q. Xu^{*}, and J. Honorio.
IEEE International Symposium on Information Theory (ISIT), Australia, 2021.
- [8] “[Fairness Constraints can Help Exact Inference in Structured Prediction](#)”.
K. Bello and J. Honorio.
Neural Information Processing Systems (NeurIPS), Canada, 2020.
- [9] “[Minimax Bounds for Structured Prediction Based on Factor Graphs](#)”.
K. Bello, A. Ghoshal and J. Honorio.
International Conference on Artificial Intelligence and Statistics (AISTATS), Italy, 2020.
- [10] “[Exact Inference in Structured Prediction](#)”.
K. Bello and J. Honorio.
Neural Information Processing Systems (NeurIPS), Canada, 2019.
- [11] “[Learning Latent Variable Structured Prediction Models with Gaussian Perturbations](#)”.
K. Bello and J. Honorio.
Neural Information Processing Systems (NeurIPS), Canada, 2018.
- [12] “[Computationally and Statistically Efficient Learning of Bayes Nets Using Path Queries](#)”.
K. Bello and J. Honorio.
Neural Information Processing Systems (NeurIPS), Canada, 2018.
- [13] “[Improving Topic Coherence Using Entity Extraction Denoising](#)”.
R. Cardenas, **K. Bello**, A. Coronado and E. Villota.
The Prague Bulletin of Mathematical Linguistics, Czech Republic, 2018.
- [14] “[Panorama of the Market Demand for Mechanical Engineers in South American Countries](#)”.
R. Cardenas, **K. Bello**, A. Valle, E. Villota and A. Coronado.
ASME-IMECE, USA, 2015.

CONFERENCE PRESENTATIONS AND INVITED TALKS

- [1] “DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization”
Neural Information Processing Systems (NeurIPS). New Orleans, December 2022.
- [2] “DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization”
Bay Area Machine Learning Symposium (BayLearn). San Francisco, October 2022.

- [3] “Exact Inference in Structured Prediction”
Research Experience for Peruvian Undergraduates CS Seminar. Virtual, July 2021.
- [4] “Bayesian Network Learning with Path Queries”
IEEE EMBS, Universidad Nacional de Ingenieria. Virtual, June 2021.
- [5] “Exact Inference in Graphs and its Structural Properties”
Carnegie Mellon University (Pradeep Ravikumar’s Lab). Virtual, April 2021.
- [6] “Exact Inference in Graphs and its Structural Properties”
Massachusetts Institute of Technology CSAIL (David Sontag’s Lab). Virtual, April 2021.
- [7] “Exact Inference in Graphs and its Structural Properties”
Massachusetts Institute of Technology CBMM (Tomaso Poggio’s Lab). Virtual, April 2021..
- [8] “Exact Inference in Graphs”
Peru’s 3rd Symposium of Deep Learning. Virtual, January 2021.
- [9] “Fairness Constraints can Help Exact Inference in Structured Prediction”
Neural Information Processing Systems (NeurIPS). Virtual, December 2020.
- [10] “Ph.D. Research Experience”
TECHSUYO Accelerating digital transformation in Peru. Virtual, October 2020.
- [11] “Minimax Bounds for Structured Prediction Based on Factor Graphs”
Artificial Intelligence and Statistics (AISTATS). Virtual, August 2020.
- [12] “Exact Inference in Structured Prediction”
Neural Information Processing Systems (NeurIPS). Vancouver, December 2019.
- [13] “Learning Latent Variable Structured Prediction Models with Gaussian Perturbations”
Neural Information Processing Systems (NeurIPS). Montreal, December 2018.
- [14] “Computationally and Statistically Efficient Learning of Bayes Nets Using Path Queries”
Neural Information Processing Systems (NeurIPS). Montreal, December 2018.
- [15] “Labor Market Demand Analysis for Engineering Majors in Peru Using Topic Modeling”
Machine Learning Summer School (MLSS). Kyoto, August 2015.

PROFESSIONAL SERVICE

- Chair of the [LXAI Workshop](#) at ICML 2020.
- **Reviewer:**
Conferences: NeurIPS 2023, ICML 2023, ICLR 2023, NeurIPS 2022, ICML 2022, ICLR 2022, AAAI 2022, NeurIPS 2021, ICML 2021, AISTATS 2021, ICLR 2021, NeurIPS 2020, IJCAI 2020, NeurIPS 2019.
Journals: Journal of Machine Learning Research (JMLR), IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), Transactions on Machine Learning Research (TMLR), Journal of Computational and Graphical Statistics (JCGS).

RESEARCH EXPERIENCE

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|---|---|
| Research Assistant
<i>Department of Computer Science, Purdue University</i> | June 2017 - Aug. 2021
Advisor: <i>Jean Honorio</i> |
|---|---|
- Analyzed the degree-4 sum-of-squares hierarchy for exact inference in graphs.
 - Studied the effect of fairness constraints in exact inference for structured prediction.
 - Analyzed information-theoretic bounds for adversarial learning.
 - Derived lower bounds to characterize learnability of structured prediction models, specifically, factor graph models with unary and pairwise factors.
 - Studied the sufficient conditions to perform exact inference in polynomial time for structured prediction through the use of semidefinite programming relaxations.

- Developed a computationally efficient method for the learning of latent-variable structured prediction models under Gaussian perturbations, and studied its generalization properties by using PAC-Bayes and Rademacher complexity.
- Studied the learning of causal Bayesian networks by using path queries. A poly-time algorithm with polynomial sample complexity was proposed.

PhD Intern

May 2020 - Aug. 2020

Facebook AI

Supervisor: *Maxim Grechkin and Hao Ma*

- Studied backward compatible representations of Facebook content, i.e., explored how to reconstruct an *old* pre-trained embedding given a *new* pre-trained embedding from a more complex model.

PhD Intern

May 2019 - Aug. 2019

Facebook AI

Supervisor: *Yunlong He*

- Proposed domain-based metrics for a feature selection algorithm as part of the Ads Ranking team.

TEACHING EXPERIENCE

Teaching Assistant

Department of Computer Science, Purdue University

- Data Mining and Machine Learning (CS 373)

Spring 2021

- Statistical Machine Learning (CS 578)

Fall 2020

- Data Structures and Algorithms (CS 251)

Fall 2016, Spring 2017

ACADEMIC REFERENCES

Pradeep Ravikumar, Postdoctoral Advisor

Carnegie Mellon University

Professor, Machine Learning Department, School of Computer Science

email: pradeepr@cs.cmu.edu

Bryon Aragam, Postdoctoral Advisor

The University of Chicago

Assistant Professor, Booth School of Business

email: nikhyl.aragam@chicagobooth.edu

Jean Honorio, Doctoral Advisor

Purdue University

Assistant Professor, Computer Science Department

email: jhonorio@purdue.edu