

# Kevin S. Bello Medina (Kevin Bello)

<https://kevinsbello.github.io/>

## RESEARCH INTERESTS

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I am broadly interested in Artificial Intelligence and Machine Learning. My research focuses on developing algorithms that are computationally and statistically efficient for different machine learning problems.

*Specific Topics of Interest:* Combinatorial problems in machine learning, causal discovery, causal representation learning, distribution shifts, structured prediction, (non)convex optimization, high-dimensional statistics, fundamental limits, latent variable modeling.

## ACADEMIC POSITIONS

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### Joint Postdoctoral Fellow

Sept. 2021 - present

Carnegie Mellon University (Machine Learning Department) and  
University of Chicago (Booth School of Business)

*Mentors: Pradeep Ravikumar (CMU) and Bryon Aragam (UChicago)*

## EDUCATION

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### 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

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- **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

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### PREPRINTS / UNDER REVIEW

- [1] "[Bayesian Dynamic DAG Learning: Application in Discovering Dynamic Effective Connectome of Brain](#)".  
A. Bagheri, M. Pasande, **K. Bello**, A. Akhondi-Asl, B. N. Araabi  
Preprint, 2023.

- [2] “[Direct Learning with Guarantees of the Difference DAG Between Structural Equation Models](#)”.  
A. Ghoshal, **K. Bello** and J. Honorio.  
Preprint, 2023.

#### PEER-REVIEWED CONFERENCES

- [3] “[iSCAN: Identifying Causal Mechanism Shifts among Nonlinear Additive Noise Models](#)”.  
T. Chen, **K. Bello**, B. Aragam and P. Ravikumar.  
*Neural Information Processing Systems (NeurIPS)*, USA, 2023.
- [4] “[Global Optimality in Bivariate Gradient-based DAG Learning](#)”.  
C. Deng, **K. Bello**, B. Aragam and P. Ravikumar.  
*Neural Information Processing Systems (NeurIPS)*, USA, 2023.
- [5] “[Optimizing NOTEARS Objectives via Topological Swaps](#)”.  
C. Deng, **K. Bello**, B. Aragam and P. Ravikumar.  
*International Conference on Machine Learning (ICML)*, USA, 2023.
- [6] “[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.
- [7] “[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.
- [8] “[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.
- [9] “[Inverse Reinforcement Learning in the Continuous Setting with Formal Guarantees](#)”.  
G. Dexter, **K. Bello**, and J. Honorio.  
*Neural Information Processing Systems (NeurIPS)*, Canada, 2021.
- [10] “[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.
- [11] “[Fairness Constraints can Help Exact Inference in Structured Prediction](#)”.  
**K. Bello** and J. Honorio.  
*Neural Information Processing Systems (NeurIPS)*, Canada, 2020.
- [12] “[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.
- [13] “[Exact Inference in Structured Prediction](#)”.  
**K. Bello** and J. Honorio.  
*Neural Information Processing Systems (NeurIPS)*, Canada, 2019.
- [14] “[Learning Latent Variable Structured Prediction Models with Gaussian Perturbations](#)”.  
**K. Bello** and J. Honorio.  
*Neural Information Processing Systems (NeurIPS)*, Canada, 2018.
- [15] “[Computationally and Statistically Efficient Learning of Bayes Nets Using Path Queries](#)”.  
**K. Bello** and J. Honorio.  
*Neural Information Processing Systems (NeurIPS)*, Canada, 2018.
- [16] “[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.

- [17] “[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

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- [1] “iSCAN: Identifying Causal Mechanism Shifts among Nonlinear Additive Noise Models” Workshop on Spurious Correlations, Invariance, and Stability at ICML. Hawaii, July 2023.
- [2] “iSCAN: Identifying Causal Mechanism Shifts among Nonlinear Additive Noise Models” Max Planck Institute for Intelligent Systems. Tübingen, July 2023.
- [3] “DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization” Midwest Machine Learning Symposium (MMLS). Chicago, May 2023.
- [4] “DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization” Neural Information Processing Systems (NeurIPS). New Orleans, December 2022.
- [5] “DAGMA: Learning DAGs via M-matrices and a Log-Determinant Acyclicity Characterization” Bay Area Machine Learning Symposium (BayLearn). San Francisco, October 2022.
- [6] “Exact Inference in Structured Prediction” Research Experience for Peruvian Undergraduates CS Seminar. Virtual, July 2021.
- [7] “Bayesian Network Learning with Path Queries” IEEE EMBS, Universidad Nacional de Ingenieria. Virtual, June 2021.
- [8] “Exact Inference in Graphs and its Structural Properties” Carnegie Mellon University (Pradeep Ravikumar’s Lab). Virtual, April 2021.
- [9] “Exact Inference in Graphs and its Structural Properties” Massachusetts Institute of Technology CSAIL (David Sontag’s Lab). Virtual, April 2021.
- [10] “Exact Inference in Graphs and its Structural Properties” Massachusetts Institute of Technology CBMM (Tomaso Poggio’s Lab). Virtual, April 2021..
- [11] “Exact Inference in Graphs” Peru’s 3rd Symposium of Deep Learning. Virtual, January 2021.
- [12] “Fairness Constraints can Help Exact Inference in Structured Prediction” Neural Information Processing Systems (NeurIPS). Virtual, December 2020.
- [13] “Ph.D. Research Experience” TECHSUYO Accelerating digital transformation in Peru. Virtual, October 2020.
- [14] “Minimax Bounds for Structured Prediction Based on Factor Graphs” Artificial Intelligence and Statistics (AISTATS). Virtual, August 2020.
- [15] “Exact Inference in Structured Prediction” Neural Information Processing Systems (NeurIPS). Vancouver, December 2019.
- [16] “Learning Latent Variable Structured Prediction Models with Gaussian Perturbations” Neural Information Processing Systems (NeurIPS). Montreal, December 2018.
- [17] “Computationally and Statistically Efficient Learning of Bayes Nets Using Path Queries” Neural Information Processing Systems (NeurIPS). Montreal, December 2018.
- [18] “Labor Market Demand Analysis for Engineering Majors in Peru Using Topic Modeling” Machine Learning Summer School (MLSS). Kyoto, August 2015.

## PROFESSIONAL SERVICE

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- Chair of the [LXAI Workshop](#) at ICML 2020.

- **Reviewer:**

**Conferences:** ICLR 2024, 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

June 2017 - Aug. 2021

*Department of Computer Science, Purdue University*

Advisor: *Jean Honorio*

- 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

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### Teaching Assistant

*Department of Computer Science, Purdue University*

- Data Mining and Machine Learning (CS 373)
- Statistical Machine Learning (CS 578)
- Data Structures and Algorithms (CS 251)

Spring 2021

Fall 2020

Fall 2016, Spring 2017

## ACADEMIC REFERENCES

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*Pradeep Ravikumar*, Postdoctoral Advisor

Carnegie Mellon University

Professor, Machine Learning Department, School of Computer Science

email: [pradeepr@cs.cmu.edu](mailto:pradeepr@cs.cmu.edu)

*Bryon Aragam*, Postdoctoral Advisor

The University of Chicago

Assistant Professor, Booth School of Business

email: [nikhyl.aragam@chicagobooth.edu](mailto:nikhyl.aragam@chicagobooth.edu)

*Jean Honorio*, Doctoral Advisor

Purdue University

Assistant Professor, Computer Science Department

email: [jhonorio@purdue.edu](mailto:jhonorio@purdue.edu)