KIMBERLY VILLALOBOS CARBALLO

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EDUCATION

Massachusetts Institute of Technology (GPA: 5.0/5.0) *Cambridge, MA, USA*
Ph.D. candidate in Operations Research *2019 - Exp. 2024*
- Advisor: Prof. Dimitris Bertsimas
- Thesis: Integrating Optimization and Machine Learning: Theory, Computation and Applications.

Massachusetts Institute of Technology (GPA: 5.0/5.0) *Cambridge, MA, USA*
Bachelor of Science degree in Mathematics *2015 - 2019*
Bachelor of Science degree in Computer Science
Minor in Statistics and Data Science

RESEARCH INTERESTS

Methodology: Optimization (Robust, Stochastic, Convex and Non-convex, Discrete and Continuous, Multistage), Machine Learning, Data Multimodality.

Applications: Healthcare Analytics, Applications in Medicine.

PAPERS

TabText: A Flexible and Contextual Approach to Tabular Data Representation
Kimberly Villalobos Carballo, Liangyuan Na, Yu Ma, Léonard Boussioux, Cynthia Zeng, Luis R. Soenksen, Dimitris Bertsimas
Submitted to Nature Machine Intelligence

Patient Outcome Predictions Improve Operations at a Large Hospital Network
Liangyuan Na, Kimberly Villalobos Carballo, Jean Pauphilet, Ali Haddad-Sisakht, Daniel Kombert, Melissa Boisjoli-Langlois, Andrew Castiglione, Maram Khalifa, Pooja Hebbal, Barry Stein, Dimitris Bertsimas
Submitted to Manufacturing & Service Operations Management (M&SOM), 2023

Holistic Deep Learning
Dimitris Bertsimas, Kimberly Villalobos Carballo, Léonard Boussioux, Michael Lingzhi Li, Alex Paskov, Ivan Paskov
Minor Revision in Machine Learning (MACH), 2023

Multistage Stochastic Optimization via Kernels
Dimitris Bertsimas, Kimberly Villalobos Carballo
Submitted to Mathematical Programming (MAPR), 2023

Robust Upper Bounds for Adversarial Training
Dimitris Bertsimas, Xavier Boix, Kimberly Villalobos Carballo, Dick den Hertog
Minor Revision in Journal of Machine Learning Research (JMLR), 2023

Integrated multimodal artificial intelligence framework for healthcare applications
Luis R Soenksen, Yu Ma, Cynthia Zeng, Leonard Boussioux, Kimberly Villalobos Carballo, Liangyuan Na, Holly M Wiberg, Michael L Li, Ignacio Fuentes, Dimitris Bertsimas
NPJ Digital Medicine (NPJDIGITALMED), 2022

From predictions to prescriptions: A data-driven response to COVID-19
Dimitris Bertsimas, Leonard Boussioux, Ryan Cory-Wright, Arthur Delarue, Vassilis Digalakis, Alexandre Jacquillat, Driss Lahlou Kitane, Galit Lukin, Michael Li, Luca Mingardi, Omid Nohadani, Agni

Orfanoudaki, Theodore Papalexopoulos, Ivan Paskov, Jean Pauphilet, Omar Skali Lami, Bartolomeo Stellato, Hamza Tazi Bouardi, Kimberly Villalobos Carballo, Holly Wiberg, Cynthia Zeng
Health Care Management Science, 2021

Do neural networks for segmentation understand insideness?
Kimberly Villalobos, Vilim Štih, Amineh Ahmadinejad, Shobhita Sundaram, Jamell Dozier, Andrew Francl, Frederico Azevedo, Tomotake Sasaki, Xavier Boix
Neural Computation, 2021

RESEARCH AND INDUSTRY EXPERIENCE

MIT Operations Research Center *September 2019 - Present*
Doctoral Research Assistant *Cambridge, MA, USA*

Theory and Methodology

- Developed a new algorithm for training robust Neural Networks and provided theoretical guarantees for the nonexistence of adversarial attacks.
- Formulated a novel algorithm to solve multistage stochastic optimization problems via sparsification of universal kernels, and proved asymptotic optimality.
- Developed a new methodology to train neural networks that simultaneously optimize for sparsity, robustness and stability.
- Built a flexible representation framework to extract contextual information from tabular structures.
- Co-designed a novel framework for medical prediction tasks by combining multiple data modalities.

Healthcare Applications

- Improved hospital operations resulting in length of stay reduction via patient outcome predictions at Hartford Healthcare and UMass Memorial Center.
- Co-developed a machine learning model to identify life-threatening events for early dispatch of Rapid Response Teams at Hartford Healthcare.
- Co-designed an optimization algorithm for assignment of elective surgeries at Hartford Healthcare.
- Applied multi-modal machine learning algorithms at Brigham And Women's Hospital for early detection of victims of domestic violence.
- Helped designing analytical tools that support decision makers to combat the COVID-19 pandemic.

MIT Neuroscience Department *June 2017 - June 2019*
Undergraduate Research Assistant *Cambridge, MA, USA*

- Developed a theoretical analysis to find the sample complexity of different types of neural network (NN) architectures in the problem of finding if an object lies inside or outside a closed path.
- Demonstrated mathematically that state-of-the art NNs can implement solutions for this problem.

Microsoft Research *January 2017 - April 2018*
Research Intern *Cambridge, MA, USA*

- Analyzed the conditions under which a set of points on a sphere universally locally minimize total potential energy.
- Formulated a representation of the isometry group for the 24-Cell and decomposed it into irreducible representations.

SPUR - MIT Math Department Summer Program *June 2017 - August 2017*
Undergraduate Researcher *Cambridge, MA*

- Explored connections between theoretical physics and machine learning through random walk models on Ising spin systems.

Singapore University of Technology and Design *June 2017 - August 2017*
Undergraduate Researcher *Changi, SG*

- Developed a 3D virtual map of the SUTD campus to facilitate navigation for students.

TEACHING EXPERIENCE

	Rating
Machine Learning via a Modern Optimization Lens (MIT 15.095) Teaching Assistant - Fall 2022 Academic Level: PhD, MSc, MBAn	6.9/7.0
Robust Modeling, Optimization, and Computation (MIT 15.094) Teaching Assistant - Spring 2022 Academic Level: PhD, MSc, MBAn	6.7/7.0
Analytics Capstone (MIT 15.089) Teaching Assistant - Summer 2022 Academic Level: MBAn	NA
Analytics Software Tools (MIT 15.003) Instructor - Fall 2023, Fall 2022, Fall 2021 Academic Level: MBAn	TBD
The Analytics Edge (MIT 15.727) Teaching Assistant - Spring 2021 Academic Level: Executive MBA	7.0/7.0
The Analytics Edge (MIT 15.727) Teaching Assistant - Fall 2020 Academic Level: NA (online course)	7.0/7.0

TALKS

Robust Upper Bounds for Adversarial Training
- Robust Optimization (MIT 15.094) Invited Speaker 2023
- MIT Operations Research Student Seminar 2022
- INFORMS Annual Meeting 2022
- International Conference on Continuous Optimization (ICCOPT) 2022
- Biological Learning in Silico MIT Meeting Group 2022

Patient Outcome Predictions Improve Operations at a Large Hospital Network
- MIT MIMO Symposium Poster Competition 2023
- AI Cures Conference 2023
- INFORMS Annual Meeting 2022

TabText: A Flexible and Contextual Approach to Tabular Data Representation
- INFORMS Healthcare Conference 2023
- AI Cures Conference 2023
- INFORMS Annual Meeting Workshop: the Future of Analytics and OR 2022

Multistage Stochastic Optimization via Kernels
- Machine Learning Under a Modern Optimization Lens (MIT 15.095) Guest Lecture 2023
- MIT Operations Research Center General Exam Research Presentation 2023

Holistic Deep Learning
- *Upcoming:* INFORMS Annual Meeting 2023

Integrated multimodal artificial intelligence framework for healthcare applications

- INFORMS Annual Meeting 2022
- AI Cures Conference 2022

Do neural networks for segmentation understand insideness?

- Center for Brains, Minds and Machines, EIT Research Presentations 2019

HONORS AND AWARDS

INFORMS' William Pierskalla Best Paper Award - Winner 2020
INFORMS Doing Good with Good OR Student Paper Competition - Finalist 2023
MIT-Pillar AI Collective Prize - Winner 2023
MIT Cognex Poster Competition - Winner 2022
Tau Beta Pi Honor Society 2018
Eta Kappa Nu Honor Society 2018
Young Talent Costa Rican Presidency Award 2014
55th International Mathematical Olympiad - Bronze Medal 2014
54th International Mathematical Olympiad - Honorable Mention 2013
Asian Pacific Mathematics Olympiad - Bronze medal 2013
Iberoamerican Mathematical Olympiad - Bronze medal 2013
Iberoamerican Mathematical Olympiad - Bronze medal 2012

SERVICE AND OUTREACH

INFORMS Annual Meeting Session Chair 2023

INFORMS Healthcare Session Chair 2023

MIT Operations Research Center Seminar Series Coordinator 2023

MIT Operations Research Center IAP Seminar Series Coordinator 2022

Reviewer for INFORMS Journal on Optimization, International Conference on Computer Vision 2020-Present

SKILLS

Programming Languages: Python, Julia, R, Java, JavaScript, HTML, CSS, SQL, C++

Software Tools: TensorFlow, PyTorch, MATLAB, JuMP, Gurobi, MOSEK, IPOPT

OTHERS

Languages: Spanish (native), English (fluent)

Activities: Singing, Dancing, Sports

Citizenship: Costa Rica