Charles C. Margossian

New York, NY
✉ *cmargossian@flatironinstitute.org*
🖥 *charlesm93.github.io*

Education

2017– 2022   **Ph.D. Statistics**, *Columbia University*, New York, NY.
- Thesis: *Modernizing Markov chains Monte Carlo for scientific and Bayesian modeling*
- Advisor: Andrew Gelman
- Dissertation Committee: Aki Vehtari, Matthew Hoffman, Sumit Mukherjee, David Blei

2011–2015   **B.Sci. Physics**, *Yale University*, New Haven, CT.

2009–2011   **Baccalauréat Scientifique**, *Ecole Jeannine Manuel (High school)*, Paris, France, Mention *très bien.*

Research Interest

Markov chains Monte Carlo; Bayesian modeling; Bayesian workflow; Hierarchical models; ODE-based models; Approximate Bayesian computation; Integrated Laplace approximations; Automatic differentiation; Probabilistic programming; Pharmacometrics; Epidemiology; Statistical Physics.

Experience

2022–present   **Research Fellow**, *Flatiron Institute, Center for Computational Mathematics*, Simons Foundation, New York, NY.

Summer 2021   **Research Intern**, *Google Research*, Bayesflow and TensorFlow Probability team, New York, NY.

Summer 2019   **Visiting Doctoral Student**, *Aalto University, Department of Computer Science*, Probabilistic Machine Learning group, Espoo, Finland.

2016–2017   **Visiting Scientist**, *Metrum Research Group LLC*, Cambridge, MA.

2015–2016   **Pharmacometrics Bootcamp**, *Metrum Research Group LLC*, Tariffville, CT.

2013–2015   **Researcher**, *Yale Department of Astronomy*, New Haven, CT.

Summer 2014   **Patent Law, Technical Specialist**, *Leinweber und Zimmermann*, Munich, Germany.

Skills

Progamming: R, Python, C++, Stan, TensorFlow Probability, LaTeX, GitHub
Languages: English, French, German

Preprints

[1] **Charles C Margossian** and Michael Betancourt. Efficient Automatic Differentiation of Implicit Functions. *Preprint. arXiv:2112.14217.*, March 2022.

[2] **Charles C Margossian** and Sumit Mukherjee. Simulating Ising and Potts models at critical and cold temperatures using auxiliary Gaussian variables. *Preprint. arXiv:2110.10801.*, October 2021.

[3] **Charles C Margossian**, Matthew D Hoffman, and Pavel Sountsov. Nested $\hat{R}$: assessing convergence for Markov chains Monte Carlo when using many short chains. *Preprint. arXiv:2110.13017.*, October 2021.

[4] Andrew Gelman, Aki Vehtari, Daniel Simpson, **Charles C Margossian**, Bob Carpenter, Yuling Yao, Lauren Kennedy, Jonah Gabry, Paul-Christian Bürkner, and Martin Modrák. Bayesian Workflow. *Preprint. arXiv:2011.01808*, October 2020.

[5] Michael Betancourt, **Charles C Margossian**, and Vianey Leos-Barajas. The Discrete Adjoint Method: Efficient Derivatives for Functions of Discrete Sequences. *Preprint. arXiv:2002.00326*, February 2020.

Publications

*: Supervised student

[1] **Charles C Margossian**, Yi Zhang, and William R Gillespie. Flexible and efficient Bayesian pharmacometrics modeling using Stan and Torsten, Part I. *CPT: Pharmacometrics & Systems Pharmacology*, 11:1151 – 1169, April 2022.

[2] Philip Greengard, Jeremy Hoskins, **Charles C Margossian**, Andrew Gelman, and Aki Vehtari. Fast methods for posterior inference of two-group normal-normal models. *Bayesian Analysis*, page (to appear), August 2022.

[3] Léo Grinsztajn*, Elizaveta Semenova, **Charles C Margossian**, and Julien Riou. Bayesian workflow for disease transmission modeling in Stan. *Statistics in Medicine*, 40:6209 – 6234, September 2021.

[4] **Charles C Margossian**, Aki Vehtari, Daniel Simpson, and Raj Agrawal. Hamiltonian Monte Carlo using an adjoint-differentiated Laplace approximation: Bayesian inference for latent Gaussian models and beyond. *Advances in Neural Information Processing Systems (NeurIPS)*, 33:9086 – 9097, October 2020.

[5] Anthony Hauser, Michel J Counotte, **Charles C Margossian**, Garyfallos Konstantinoudis, Nicola Low, Christian L Althaus, and Julien Riou. Estimation of SARS-CoV-2 mortality during the early stages of an epidemic: a modeling study in Hubei, China and six regions in Europe. *PLOS Medicine*, 17, July 2020.

[6] **Charles C Margossian**. A Review of automatic differentiation and its efficient implementation. *Wiley interdisciplinary reviews: data mining and knowledge discovery*, 9, March 2019.

[7] Joseph R Schmitt, Eric Agol, Katherine M Deck, Leslie A Rogers, J Zachary Gazak, Debra A Fischer, Ji Wang, Matthew J Holman, Kian J Jek, **Charles Margossian**, Mark R Omohundor, Troy Winarski, John M Brewer, Matthew J Giguere, Chris Lintott, Stuart Lynn, Michael Parrish, Kevin Schawinski, Megan E Schwamb, Robert Simpson, and Arfon M Smith. Planet Hunters. VII. Discovery of a new low-mass, low-density planet (PH3 C) orbiting KEPLER-289 with mass measurements of two additional Planets (PH3 B and D). *Astrophysical Journal*, 795(2), October 2014.

Conference notebooks and posters

*: Supervised student

[1] **Charles C Margossian**, Lu Zhang, Sebastian Weber, and Andrew Gelman. Solving ODEs in a Bayesian context: challenges and opportunities. In *Population Approach Group in Europe (PAGE) 29*, September 2021.

[2] Aurélien Marc, Marion Kerioui, **Charles Margossian**, Julie Bertrand, Pauline Maisonnasse, Yoan Aldon, Rogier W Sanders, Marit Van Gils, Roger Le Grand, and Jérémie Guedj. Developing a model of SARS-CoV-2 viral dynamics under monoclonal antibody treatment. In *Population Approach Group in Europe (PAGE) 29*, September 2021.

[3] Johann D Gaebler* and **Charles C Margossian**. Propagating Derivatives through Implicit Functions in Reverse Mode Autodiff. In *Student Presentation, Stanford Institute for Computational & Mathematical Engineering*, May 2021.

[4] **Charles C Margossian**, Aki Vehtari, Daniel Simpson, and Raj Agrawal. Approximate Bayesian inference for latent Gaussian models in Stan. In *StanCon 2020*, August 2020.

[5] **Charles C Margossian** and Andrew Gelman. Bayesian model of planetary motion: exploring ideas for a modeling workflow when dealing with ordinary differential equations and multimodality. In *Stan Case Studies*, volume 7, October 2020.

[6] **Charles C Margossian**. Computing Steady States with Stan's Nonlinear Algebraic Solver. In *StanCon 2018*, January 2018.

[7] **Charles C Margossian** and William R Gillespie. Gaining Efficiency by Combining Analytical and Numerical Methods to Solve ODEs: Implementation in Stan and Application to Bayesian PK/PD. *Journal of Pharmacokinetics and Pharmacodynamics*, 44, October 2017.

[8] **Charles C Margossian** and William R Gillespie. Differential Equation Based Models in Stan. In *StanCon 2017*, January 2017.

[9] **Charles C Margossian** and William R Gillespie. Stan Functions for Pharmacometrics Modeling. *Journal of Pharmacokinetics and Pharmacodynamics*, 43, October 2016.

Software

Core developer, *Stan: a probabilistic programming language*, mc-stan.org.

Co-creator, *Torsten: an extension of Stan for Bayesian pharmacometrics modeling*, GitHub link.

Contributor, *mrgSolve: Simulation from ODE-Based Population PK/PD and System Pharmacology Models*, GitHub link.

Awards and recognitions

2022   **WIRES Top Article**, For *A Review of Automatic Differentiation and its Efficient Implementation*, which was amongst the top 10 most cited articles in the 2021 Journal Citation Report for *WIRES, Data Mining and Knowledge Discovery*.

2022   **Minghui Yu Teaching Assistant Award**, *Department of Statistics, Columbia University*, Awarded by the Director of Graduated Studies based on student feedback.

2022   **AISTATS Top Reviewer**, The top reviewers were selected based on the feedback received from the Area Chairs and comprise the top-10% of AISTATS reviewers.

2017   **Dean's Fellowship**, *Department of Statistics, Columbia University*, 5 years funding for PhD degree.

2010   **Yale Book Award**, For "character and intellectual promise".

Academic service

Reviewer.
- Computational Statistics (2022)
- Nature (2021)
- AISTATS (2021)
- Methods in ecology (2021)
- Journal of data science (2021)
- NeurIPS (2020)
- Journal of pharmacokinetics and pharmacodynamics (2019)

2019 - 2020   **Student representative**, *PhD program in statistics at Columbia University*.

Supervised research projects

- Johann Gaebler (PhD student), Fall 2020
  Project: *Propagating Derivatives through implicit functions in reverse mode automatic differentiation*

- Léo Grinsztajn (master student), Summer 2020
  Project: *Bayesian Workflow for disease transmission models*

- Hyunjee Moon (undergraduate student), Summer 2020
  Project: *Simulation-based Calibration for the embedded Laplace approximation*

Teaching experience (selected)

2019 – 2022   **Lecturer**, *Probability and Bayes, lecture for PHC 506: Biometry in Pharmaceutics*, University of Buffalo, School of Pharmacy, Buffalo, NY.

2019 – 2022	**Instructor**, *Building, fitting, and criticizing Bayesian PK/PD models*, (one day workshop), University of Buffalo, School of Pharmacy, Buffalo, NY.
2019, 2020	**Instructor**, *Stan for the people: two days introductory workshop on Bayesian modeling*, (two days workshop), McGill University, Montreal, Canada.
August 2019	**Co-instructor**, *Population and ODE-based models using Stan and Torsten*, (two days workshop), Stan Conference 2019, Cambridge, UK.
January 2018	**Instructor**, *How to Develop for the Stan C++ Core Language*, Stan Conference 2018, Pacific Grove, CA.
April 2017	**Invited Lecturer**, *Introduction to Bayesian Data Analysis with Stan*, Harvard University, STAT 220: Bayesian Statistics, Cambridge, MA.
2021, 2022	**Teacher Assistant**, *Applied Statistics II, STAT 6102 (PhD level)*, Columbia University, New York, NY.
2019, 2020	**Teacher Assistant**, *Foundation of Graphical Models, STAT 6701 (PhD level)*, Columbia University, New York, NY.
Spring 2019	**Teacher Assistant**, *Statistical inference*, STAT 5204 (Master level), Columbia University. New York, NY
Fall 2018	**Teacher Assistant**, *Statistical Computing and Introduction to Data Science (Undergrad level)*, STAT 4206, Columbia University. New York, NY
September 2017	**Teacher Assistant**, *Stan for Physics*, Massachusetts Institute of Technology, Cambridge, MA.
June 2017	**Teacher Assistant**, *Getting Started with Bayesian PKPD Modeling using Stan and Torsten*, Population Approach Group in Europe 26, Budapest, Hungary.

Presentations (selected)

July 2022	**Nested $\hat{R}$: Assessing convergence for Markov chains Monte Carlo when running many short chains**, Center for Research in Economics and Statistics (CREST), Institut Polytechnique de Paris.
March 2021	**Bayesian inference for latent Gaussian models: MCMC, approximate methods, and hybrids**, Minghui Yu memorial conference, Columbia University.
November 2020	**Developing a Bayesian modeling workflow for population PBPK**, American Conference on Pharmacomertrics, virtual.
August 2020	**Approximate Bayesian inference for latent Gaussian models in Stan**, Stan Conference 2020, virtual.
June 2020	**Developing a Bayesian workflow to model the Covid-19 outbreak**, 12th Covid-19 symposium, Columbia University, New York, NY.
April 2020	**Laplace approximation for speeding up the computation of multilevel models**, MRP conference, Columbia University, New York, NY.
March 2020	**Building a probabilistic programming language to diagnose our inference**, Special seminar, University of Buffalo, School of Pharmacy.
July 2018	**Understanding automatic differentiation to improve performance**, Stan for Pharmacometrics Day 2018, Université Paris Diderot, School of Medicine, Paris, France.

January 2018	**Computing steady states with Stan's nonlinear algebraic solver**, Stan Conference 2018, Pacific Grove, CA.
June 2017	**L'Avenir de Stan en pharmacométrie**, Université Paris Diderot, School of Medicine, Paris, France.
January 2017	**Differential equations based models in Stan**, *Stan Conference*, Columbia University, New York, NY.
November 2016	**Differential equations based models in Stan**, *Stan Meetup in Boston*, Harvard University, Cambridge, MA.
February 2016	**Practice (and malpractices!) of Bayesian analysis**, *Metrum Journal Minute*, Tariffville, CT.
March 2015	**How stars and planets Interact: testing the effects of close-in giant planets on stellar magnetic activity**, *Davenport Mellon Forum*, Yale University, New Haven, CT.

Modified September 2022