

# MAHDI KOOSHKBAGHI

## Computational & Data Scientist

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### TECHNICAL SKILLS

Machine Learning  
Statistical/Bayesian Inference  
Python    TensorFlow    NumPyro  
MLOps    Cloud Computing  
Kubeflow    VertexAI  
SQL    BigQuery  
Git/GitHub  
Scientific Visualization  
Computational Fluid Dynamics  
Linux    Fortran    LaTeX

### REFERENCES

- **Christopher Curro**  
ccurro@estee.com  
Principal Data Scientist  
The Estée Lauder Companies
- **Eric Higgins**  
ehiggins@estee.com  
Data Science Executive  
The Estée Lauder Companies
- **Prof. Justin. B. Kinney**  
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Cold Spring Harbor Laboratory  
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- **Prof. Yannis Kevrekidis**  
yannisk@jhu.edu  
Johns Hopkins University  
Phone: +1 410 516 2906
- **Dr. Christos E. Frouzakis**  
cfrouzakis@ethz.ch  
ETH Zürich  
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### ABOUT ME

I am a motivated computational and data scientist with focus on software development, with 10+ years of experience in writing production-quality and reproducible codes

- Proficient in mathematical modeling for complex systems and data-driven methodologies, including a range of machine learning techniques like statistical and Bayesian inference, as well as deep neural networks
- Proficient in MLOps and AI orchestration, including expertise with KubeFlow, Google Cloud SDK, as well as tools such as BigQuery, VertexAI, and GCP
- Develop, version control, debug, optimize, validate code for diverse user community
- Expertise in machine learning, computational physics simulations, GNU/Linux
- Highly skilled in data visualization and scientific communication and writing
- +20 publications in high-impact journals

### EXPERIENCE

#### Staff Machine Learning Engineer | The Estée Lauder Companies

- Nov 2022 – present    New York City, NY, USA
- Constructing a comprehensive pipeline to predict Customer Lifetime Value (CLV) through the utilization of Google Cloud SDKs and cutting-edge statistical modeling
  - Creating a Bayesian Inference Pipeline to estimate Average Treatment Effect (ATE) within the realm of A/B testing, employing KubeFlow, VertexAI, and BigQuery
  - Guiding multiple summer internship students in successfully delivering their projects in the field of Data Science and Machine Learning Engineering

#### Computational Postdoc | Cold Spring Harbor Laboratory

- Jan 2020 – present    Cold Spring Harbor, NY, USA
- Utilized analytical and technical expertise to provide insight for grant proposals
  - Developed the TensorFlow-based software to analyze Massively Parallel Reporter Assay (MPSA) data
  - Bayesian inference model fitting and parameter estimation for drugs interactions using CPUs/GPUs
  - Developed computational frameworks to analyze raw biological datasets (data preparation)

#### Research Fellow in Applied Mathematics | Princeton University

- 2017 – 2022    Princeton, NJ, USA
- Collaborated with scientists from Johns Hopkins and Brown universities in DARAP Artificial Intelligence Exploration (AIE) grant for physic-informed machine learning research
  - Developed several manifold learning codes and algorithms to analyze time-dependent datasets
  - Developed machine learning algorithms to discover governing equations from data
  - Mentored several graduate students for developing manifold- and machine-learning software

### EDUCATION

#### Doctor of Sciences | ETH Zürich

- 2012 – 2015    Zürich, Switzerland
- Developed several algorithms for computational fluid dynamics simulations of reactive flows
  - Developed bifurcation analysis tool for high-dimensional ordinary differential equations
  - Awarded full-funded Early Postdoc Mobility grant from Swiss National Science Foundation (SNSF) to join Princeton University

#### Master of Science Mech. Eng | Amirkabir University of Technology

- 2008 – 2011    Tehran, Iran
- Developed a time-accurate algorithm for low-Mach number, variable density flows on curvilinear grids



#### Bachelor of Science Aero. Eng | Amirkabir University of Technology

- 2008 – 2010    Tehran, Iran

#### Bachelor of Science Mech. Eng | Amirkabir University of Technology

- 2004 – 2008    Tehran, Iran
- Ranked 471 out of 500,000 high-school students in public universities entrance exam

### PROJECTS

MAVE-NN: TensorFlow based software for massive biological dataset |  | 

Structural and mechanistic basis of  $\sigma$ -dependent transcriptional pausing |  | 

## Journal Articles

- [1] Yuma Ishigami, Mandy S Wong, Carlos Marti-Gomez, Andalus Ayaz, **Mahdi Kooshkbaghi**, Sonya M Hanson, David M McCandlish, Adrian R Krainer, and Justin B Kinney. "Specificity, synergy, and mechanisms of splice-modifying drugs". In: *Nature Communications* 15.1 (Feb. 2024), p. 1880. DOI: [10.1038/s41467-024-46090-5](https://doi.org/10.1038/s41467-024-46090-5).
- [2] Elham Kiyani, **Mahdi Kooshkbaghi**, Khemraj Shukla, Rahul Babu Koneru, Zhen Li, Luis Bravo, Anindya Ghoshal, George Em Karniadakis, and Mikko Karttunen. "Characterization of partial wetting by CMAS droplets using multiphase many-body dissipative particle dynamics and data-driven discovery based on PINNs". In: *Journal of Fluid Mechanics* 985 (Apr. 2024), A7. DOI: [10.1017/jfm.2024.270](https://doi.org/10.1017/jfm.2024.270).
- [3] Nikolaos Evangelou, Noah J Wichrowski, George A Kevrekidis, Felix Dietrich, **Mahdi Kooshkbaghi**, Sarah McFann, and Ioannis G Kevrekidis. "On the parameter combinations that matter and on those that do not: data-driven studies of parameter (non)identifiability". In: *PNAS Nexus* 1.4 (Sept. 2022). ISSN: 2752-6542. DOI: [10.1093/pnasnexus/pgac154](https://doi.org/10.1093/pnasnexus/pgac154).
- [4] Elham Kiyani, Steven Silber, **Mahdi Kooshkbaghi**, and Mikko Karttunen. "Machine-learning-based data-driven discovery of nonlinear phase-field dynamics". In: *Physical Review E*. 106 (6 Dec. 2022), p. 065303. DOI: [10.1103/PhysRevE.106.065303](https://doi.org/10.1103/PhysRevE.106.065303).
- [5] Chirangini Pukhrambam, Vadim Molodtsov, **Mahdi Kooshkbaghi**, Ammar Tareen, Hoa Vu, Kyle S Skalenko, Min Su, Zhou Yin, Jared T Winkelman, Justin B Kinney, et al. "Structural and mechanistic basis of  $\sigma$ -dependent transcriptional pausing". In: *Proceedings of the National Academy of Sciences* 119.23 (2022), e2201301119. DOI: [10.1073/pnas.2201301119](https://doi.org/10.1073/pnas.2201301119).
- [6] Ammar Tareen, **Mahdi Kooshkbaghi**, Anna Posfai, William T Ireland, David M McCandlish, and Justin B Kinney. "MAVE-NN: learning genotype-phenotype maps from multiplex assays of variant effect". In: *Genome Biology* 23.1 (2022), pp. 1–27. DOI: [10.1186/s13059-022-02661-7](https://doi.org/10.1186/s13059-022-02661-7).
- [7] Carola J Maturana, Jessica L Verpeut, **Mahdi Kooshkbaghi**, and Esteban A Engel. "Novel tool to quantify with single-cell resolution the number of incoming AAV genomes co-expressed in the mouse nervous system". In: *Gene Therapy* (2021), pp. 1–6. DOI: [10.1038/s41434-021-00272-8](https://doi.org/10.1038/s41434-021-00272-8).
- [8] Caroline Moosmüller, Christopher J Tralie, **Mahdi Kooshkbaghi**, Zehor Belkhatir, Maryam Pouryahya, José Reyes, Joseph O Deasy, Allen R Tannenbaum, and Ioannis G Kevrekidis. "Periodicity Scoring of Time Series Encodes Dynamical Behavior of the Tumor Suppressor p53". In: *IFAC-PapersOnLine* 54.9 (2021), pp. 488–495. DOI: [10.1016/j.ifacol.2021.06.106](https://doi.org/10.1016/j.ifacol.2021.06.106).
- [9] Liwei Zhuang, Peter Corkery, Dennis T Lee, Seungjoon Lee, **Mahdi Kooshkbaghi**, Zhen-liang Xu, Gance Dai, Ioannis G Kevrekidis, and Michael Tsapatsis. "Numerical simulation of atomic layer deposition for thin deposit formation in a mesoporous substrate". In: *AIChE Journal* 67.8 (2021), e17305. DOI: [10.1002/aic.17305](https://doi.org/10.1002/aic.17305).
- [10] Felix Dietrich, **Mahdi Kooshkbaghi**, Erik M Bollt, and Ioannis G Kevrekidis. "Manifold learning for organizing unstructured sets of process observations". In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 30.4 (2020), p. 043108. DOI: [10.1063/1.5133725](https://doi.org/10.1063/1.5133725).
- [11] Seungjoon Lee, **Mahdi Kooshkbaghi**, Konstantinos Spiliotis, Constantinos I Siettos, and Ioannis G Kevrekidis. "Coarse-scale PDEs from fine-scale observations via machine learning". In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 30.1 (2020), p. 013141. DOI: [10.1063/1.5126869](https://doi.org/10.1063/1.5126869).
- [12] Thomas N Thiem, **Mahdi Kooshkbaghi**, Tom Bertalan, Carlo R Laing, and Ioannis G Kevrekidis. "Emergent spaces for coupled oscillators". In: *Frontiers in Computational Neuroscience* 14 (2020), p. 36. DOI: [10.3389/fncom.2020.00036](https://doi.org/10.3389/fncom.2020.00036).
- [13] Luigi Acampora, **Mahdi Kooshkbaghi**, Christos E Frouzakis, and Francesco S Marra. "Generalized entropy production analysis for mechanism reduction". In: *Combustion Theory and Modelling* 23.2 (2019), pp. 197–209. DOI: [10.1080/13647830.2018.1504990](https://doi.org/10.1080/13647830.2018.1504990).
- [14] Alexander Holiday, **Mahdi Kooshkbaghi**, Juan M Bello-Rivas, C William Gear, Antonios Zagaris, and Ioannis G Kevrekidis. "Manifold learning for parameter reduction". In: *Journal of Computational Physics* 392 (2019), pp. 419–431. DOI: [10.1016/j.jcp.2019.04.015](https://doi.org/10.1016/j.jcp.2019.04.015).
- [15] **Mahdi Kooshkbaghi**, Christos E Frouzakis, Konstantinos Boulouchos, and Iliya V Karlin. "Spectral quasi-equilibrium manifold for chemical kinetics". In: *The Journal of Physical Chemistry A* 120.20 (2016), pp. 3406–3413. DOI: [10.1021/acs.jpca.6b01709](https://doi.org/10.1021/acs.jpca.6b01709).
- [16] **Mahdi Kooshkbaghi**, Christos E Frouzakis, Konstantinos Boulouchos, and Iliya V Karlin. "n-Heptane/air combustion in perfectly stirred reactors: Dynamics, bifurcations and dominant reactions at critical conditions". In: *Combustion and Flame* 162.9 (2015), pp. 3166–3179. DOI: [10.1016/j.combustflame.2015.05.002](https://doi.org/10.1016/j.combustflame.2015.05.002).
- [17] Ilya V Karlin, Shyam S Chikatamarla, and **Mahdi Kooshkbaghi**. "Non-perturbative hydrodynamic limits: A case study". In: *Physica A: Statistical Mechanics and its Applications* 403 (2014), pp. 189–194. DOI: [10.1016/j.physa.2014.02.018](https://doi.org/10.1016/j.physa.2014.02.018).
- [18] **Mahdi Kooshkbaghi**, Christos E Frouzakis, Konstantinos Boulouchos, and Ilya V Karlin. "Entropy production analysis for mechanism reduction". In: *Combustion and Flame* 161.6 (2014), pp. 1507–1515. DOI: [10.1016/j.combustflame.2013.12.016](https://doi.org/10.1016/j.combustflame.2013.12.016).
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- [20] **Mahdi Kooshkbaghi** and Bamdad Lessani. "A collocated grid, projection method for time-accurate calculation of low-Mach number variable density flows in general curvilinear coordinates". In: *International Journal for Numerical Methods in Fluids* 72.3 (2013), pp. 301–319. DOI: [10.1002/flid.3734](https://doi.org/10.1002/flid.3734).
- [21] Hossein Shokouhmand, M Fakoor Pakdaman, and **Mahdi Kooshkbaghi**. "A similarity solution in order to solve the governing equations of laminar separated fluids with a flat plate". In: *Communications in Nonlinear Science and Numerical Simulation* 15.12 (2010), pp. 3965–3973. DOI: [10.1016/j.cnsns.2010.01.031](https://doi.org/10.1016/j.cnsns.2010.01.031).