

# ASHKAN SHAHBAZI

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| EDUCATION                              | <b>Vanderbilt University</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Nashville, TN                   |
|                                        | <i>Ph.D. Candidate in Computer Science</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2022 – 2027 ( <i>expected</i> ) |
|                                        | <ul style="list-style-type: none"> <li>• <b>Advisor:</b> Prof. Soheil Kolouri [Homepage]</li> <li>• <b>Research Interests:</b> Transformer-based architectures &amp; LLMs; Dataset distillation; Geometric deep learning &amp; Optimal transport</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |
|                                        | <b>Amirkabir University of Technology (Tehran Polytechnic)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Tehran, Iran                    |
|                                        | <i>B.S. in Biomedical Engineering</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2016 – 2020                     |
|                                        | <ul style="list-style-type: none"> <li>• <b>Thesis:</b> ML-Based Cuffless Blood Pressure Estimation from Bio-Signals</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| INDUSTRY<br>EXPERIENCE                 | <b>Instacart</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | San Francisco, CA (Remote)      |
|                                        | <i>ML Ph.D. Intern, Content AI Team</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Fall 2025                       |
|                                        | <ul style="list-style-type: none"> <li>• <b>Supervisor:</b> Dr. Shih-Ting Li</li> <li>• Research and development on large language models (LLMs) with emphasis on uncertainty quantification and its applications in content AI.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |
| PUBLICATIONS<br>(* Equal contribution) | <b>Conference Proceedings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                 |
|                                        | <ol style="list-style-type: none"> <li>1. <b>A. Shahbazi</b>, E. Akbari, D. Salehi, X. Liu, N. Naderializadeh, S. Kolouri, “<i>ESPFormer: Doubly-Stochastic Attention with Expected Sliced Transport Plans</i>,” <b>ICML</b> 2025.</li> <li>2. X. Liu, Y. Bai, R.D. Martín, K. Shi, <b>A. Shahbazi</b>, B.A. Landman, C. Chang, S. Kolouri, “<i>Linear Spherical Sliced Optimal Transport: A Fast Metric for Comparing Spherical Data</i>,” <b>spotlight</b> at <b>ICLR</b> 2025.</li> <li>3. X. Liu, R.D. Martín, Y. Bai, <b>A. Shahbazi</b>, M. Thorpe, A. Aldroubi, S. Kolouri, “<i>Expected Sliced Transport Plans</i>,” <b>ICLR</b> 2025.</li> <li>4. H. Tran*, Y. Bai*, A. Kothapalli*, <b>A. Shahbazi</b>, X. Liu, R.D. Martín, S. Kolouri, “<i>Stereographic Spherical Sliced Wasserstein Distances</i>,” <b>spotlight</b> at <b>ICML</b> 2024.</li> </ol>                                          |                                 |
|                                        | <b>Workshop Papers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                 |
|                                        | <ol style="list-style-type: none"> <li>5. A. Kothapalli, <b>A. Shahbazi</b>, X. Liu, R. Sheng, S. Kolouri, “<i>Equivariant vs. Invariant Layers: A Comparison of Backbone and Pooling for Point Cloud Classification</i>,” presented at the <b>ICML GRaM Workshop</b> 2024.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                 |
|                                        | <b>Under Review</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                 |
|                                        | <ol style="list-style-type: none"> <li>6. <b>A. Shahbazi*</b>, K. Pereira*, J.S. Heiselman, E. Akbari, A.C. Benson, S. Seifi, X. Liu, G.L. Johnston, J.Y. Wu, N. Simaan, M.L. Miga, S. Kolouri, “<i>Neural-Augmented Kelvinlet for Real-Time Soft Tissue Deformation Modeling</i>,” arXiv:2506.08043. (Patent pending)</li> <li>7. H. Tran*, Y. Bai*, <b>A. Shahbazi*</b>, J.R. Hershey, S. Kolouri, “<i>Understanding Learning with Sliced-Wasserstein Requires Rethinking Informative Slices</i>,” arXiv:2411.10651.</li> <li>8. A. Abbasi, <b>A. Shahbazi</b>, H. Pirsiavash, S. Kolouri, “<i>Vector-Quantized Soft Label Compression for Dataset Distillation</i>,” Manuscript under review / available upon request.</li> <li>9. A. Abbasi, <b>A. Shahbazi</b>, H. Pirsiavash, S. Kolouri, “<i>One Category One Prompt: Dataset Distillation Using Diffusion Models</i>,” arXiv:2403.07142.</li> </ol> |                                 |

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| PATENTS                   | Ashkan Shahbazi, Kyvia Pereira, Jon S. Heiselman, Elaheh Akbari, Annie C. Benson, Soheil Kolouri, Michael I. Miga, Nabil Simaan, “ <i>System and Method for Real-Time Soft Tissue Simulation via Hybrid AI-Driven Physics-Informed Modeling</i> ,” U.S. Patent pending (filed January 2025)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| MACHINE LEARNING RESEARCH | <p><b>Attention, Transformers &amp; LLMs.</b> Developed ESPFormer, a Doubly-Stochastic (DS) attention with <math>O(n^2)</math> training and <math>O(n \log n)</math> inference, improving over SinkFormer. Introduced LUNA, achieving SOTA on LRA (61.35% avg.) via task-specific kernels and Reptile-style meta-updates, and LOTFormer, the first linear DS attention, scaling to large models with new SOTA on LRA. Benchmarked KD, SeqKD, SelfInst and VQ-Soft Label Compression on GPT2/LLaMA-7B with consistent R-L gains (+1.1%, +0.4%, +1.2%). (ICML ’25; ICLR ’26 submissions; Under review)</p> <p><b>Sliced Optimal Transport.</b> Contributed to the advancement of (spherical) sliced OT: stereographic S3W for parallelizable transport (ICML ’24 spotlight), linear spherical sliced OT via <math>L^2</math> embedding (ICLR ’25 spotlight), expected sliced transport plans with variance reduction (ICLR ’25), and adaptive selective slicing (under review).</p> <p><b>Neural-Augmented Kelvinlet.</b> Enabled real-time soft-tissue deformation (<math>\approx 1</math> ms/inference) on 10K–20K node meshes by combining analytical Kelvinlet priors with learned residuals. (Under review; patent pending)</p> |
| SELECTED COURSEWORK       | <ul style="list-style-type: none"> <li>• Foundations of Machine Learning (4/4)</li> <li>• Geometric Deep Learning (4/4)</li> <li>• Machine Learning for Dynamical Systems (3.7/4)</li> <li>• Computer Vision (4/4)</li> <li>• Deep Representation Learning (4/4)</li> <li>• Numerical Methods in CS (3.7/4)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| SKILLS                    | <p><b>Programming:</b> Python, C++, MATLAB, JAVA.</p> <p><b>Machine Learning Tools:</b> PyTorch, JAX, Scikit-learn, Numpy, Scipy, OpenCV, Pandas.</p> <p><b>Languages:</b> English, Persian.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| TA EXPERIENCE             | <p>Geometric Deep Learning, Spring 2024, Vanderbilt University</p> <p>Statistics and Probability, Spring 2021, Amirkabir University of Technology</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| ORAL PRESENTATION         | “Geometric Neural Simulators for Modeling Liver Tissue Deformation,” presented at the 13th Annual Symposium on Surgery, Intervention, and Engineering, December 2024, Vanderbilt University, Nashville, TN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| ACADEMIC SERVICES         | <p><b>Reviewers for:</b> AAAI 2026, NeurIPS 2025, ICLR 2025</p> <p><b>Mentorship:</b> Supervised undergraduate student Zhanqi Zhu during the 2023 VISE Summer Fellowship Program.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |