

# NATHAN MANKOVICH

## CURRICULUM VITAE

 [natemankovich.weebly.com/](http://natemankovich.weebly.com/)

 [nathan.mankovich@gmail.com](mailto:nathan.mankovich@gmail.com)

### EDUCATION

---

- Ph.D. in Mathematics**, Colorado State University, Fort Collins, CO *Jan 2019- Mar 2023*  
Advisor: Michael Kirby  
Thesis: “Subspace Averaging for Computer Vision and Bioinformatics”
- M.S. in Mathematics**, Colorado State University, Fort Collins, CO *Aug 2017-Dec 2019*  
Advisor: Michael Kirby  
Thesis: “Methods for Network Generation and Spectral Feature Selection: Especially on Gene Expression Data”
- B.S. in Mathematics**, Colorado College, Colorado Springs, CO *Aug 2013-May 2017*  
Advisor: Michael Penn  
Thesis: “Using Commutative Algebra to Examine a Rogers-Ramanujan Identity”  
Study abroad: Budapest Semesters in Mathematics (Fall 2015)

### WORK EXPERIENCE

---

- Post Doctoral Researcher** *March 2023-present*  
University of Valencia, Valencia, Spain  
A member of the Image and Signal Processing Group (ISP) and diving into the field of earth system science by utilizing geometric and topological characteristics to understand underlying dynamical and causal relations between multimodal earth science data. Specific lines of investigation include Koopman Mode Decomposition, Riemannian manifolds (e.g., flag manifolds), and causality. Under the supervision of Gustau Camps-Valls.
- Graduate Research Assistant** *Jan 2019-March 2023*  
Colorado State University, Fort Collins, CO  
Leveraging subspace learning and network theory in conjunction with supervised classification and unsupervised clustering machine learning methods to analyze multi-omics datasets. Collaborative research with CSU students and faculty in mathematics and computer science for the Defense Advanced Research Projects Agency (DARPA) (2019 to 2020) and ZOETIS (2020 to 2023). Code: Pathway Analysis and Module Refinement. Under the supervision of Michael Kirby.
- PhD Intern** *Summer 2020, Summer 2021*  
Pacific Northwest National Labs, Remote  
Investigations into the geometric properties of the feature space of prototypical networks and few shot models in general. The project continued as a part time position Winter 2020/2021. Building approximate rationally invariant neural networks by learning on Fourier ring descriptors- rotationally invariant feature representations for images. Under the mentorship of Henry Kvinge and Tegan Emerson.
- Probability Researcher** *Summer 2016*  
Colorado College, Colorado Springs, CO  
Demonstrated the utility of APPL (A Probability Programming Language) by using its commands to write a program that generated 400 families of distributions.
- Geospatial Big Data Solutioneer Intern** *Summer 2015*  
Digital Globe, Thorton, CO  
Designed a workflow for large-scale orchard spatial analysis with California almond orchards.

Implemented the system on high-resolution Digital Globe imagery using the Geo Big Data platform to run algorithms for feature identification, extraction, analysis, and visualization at scale. Mentored by Jordan Reed.

**Peer Tutor** 2015-2017  
Colorado College, Colorado Springs, CO

Tutoring students in mathematics courses from pre-calculus and calculus to proof-based courses like abstract algebra and real analysis and even computer science courses.

**Lab Technician** 2013-2017  
Colorado College, Colorado Springs, CO

Introduced the Aerial Mapping Initiative (AMI) which builds and operates unmanned aerial vehicles to create high-resolution digital elevation models and raster data for geological, ecological, and environmental remote sensing projects. Student assistant for classes with labs using GIS (Geographic Information Systems). Monitoring and maintaining computer labs on campus.

**Lab Technician** Summer 2013  
National Institute of Standards and Technology, Boulder, CO

Built a circuit board, designed using Altium. Organized LabVIEW programs that operate various terahertz lab equipment. Acquired Machining Shop Certification at CU Boulder. Updated lab computers to Windows 7 and reinstalled scientific programs.

**Summer High School Internship Program (SHIP)** Summer 2012  
National Institute of Standards and Technology, Boulder, CO

Student intern collecting data for jet fuel density measurements using a vibrating tube densimeter. Introduced to programming with LabVIEW and the thermodynamic properties database, REFPROP.

## PUBLICATIONS AND PREPRINTS

---

1. Homer Durand, Gherardo Varando, **Nathan Mankovich** and Gustau Camps-Valls. Improving generalisation via anchor multivariate analysis. *arXiv preprint*, 2024.
2. **Nathan Mankovich** and Tolga Birdal. Fun with flags: Robust principal directions via flag manifolds. *Proceedings of CVPR*, 2024.
3. David Aristoff, Jeremy Copperman, **Nathan Mankovich**, and Alexander Davies. Featurizing Koopman mode decomposition. *arXiv preprint*, 2023.
4. **Nathan Mankovich** and Tolga Birdal. Chordal averaging on flag manifolds and its applications. *Proceedings of ICCV*, 2023.
5. **Nathan Mankovich**, Helene Andrews-Polymenis, David Threadgill, and Michael Kirby. Module representatives for refining gene co-expression modules. *Physical Biology*, 2023.
6. **Nathan Mankovich**, Eric Kehoe, Amy Peterson, and Michael Kirby. Pathway expression analysis. *Scientific Reports*, 2022.
7. **Nathan Mankovich**, Emily King, Chris Peterson, and Michael Kirby. The flag median and FlagIRLS. *Proceedings of CVPR*, 2022.
8. Benjamin Jarman, **Nathan Mankovich**, and Jacob Moorman. Randomized extended Kaczmarz is a limit point of sketch-and-project. *arXiv:2110.05605*, 2021.
9. Melissa Jay, **Nathan Mankovich**, and Elanore Campbell. Searching for a lost plane: A neighborhood-based probabilistic model. *UMAP Journal*, 2015.

## RESEARCH PRESENTATIONS

---

<b>Fun With Flags: Robust Averages and Principal Directions</b> Universidad de Cantabria, Santander	2024 <i>Presentation</i>
<b>Averaging and Dimensionality Reduction using Flag Manifolds</b> Joint Mathematics Meetings, San Francisco	2024 <i>Presentation</i>
<b>Graph-Based Dimensionality Reduction and Clustering for Earth and Life Sciences</b> Learning on Graphs Meetup, Madrid	2023 <i>Presentation</i>
<b>Chordal Averaging on Flag Manifolds and Its Applications</b> ICCV, Paris	2023 <i>Presentation</i>
<b>Recovering Latent Confounders from High-dimensional Proxy Variables</b> First the Friday Talk, University of Valencia	2023 <i>Presentation</i>
<b>Chordal Distance Averages on the Grassmann and Flag Manifolds</b> Invited Talk, Imperial College of London	2023 <i>Presentation</i>
<b>Grassmannian Averages of Synthetic Datasets</b> The 24th Midrasha Mathematicae, Israel Institute for Advanced Studies	2023 <i>Poster presentation</i>
<b>The Applications of Chordal Flag Averages</b> First The Friday Talk, University of Valencia	2023 <i>Presentation</i>
<b>Chordal Distance Averaging on Flag Manifolds and its Applications</b> Topology Seminar, CSU	2023 <i>Presentation</i>
<b>Central Prototypes on Manifolds of Subspaces and Feature Analysis Using Graphs</b> Greenslopes Seminar, CSU	2022 <i>Presentation</i>
<b>Subspace Averaging for Computer Vision and Bioinformatics</b> Michael Penn Patreon Seminar	2022 <i>Virtual presentation</i>
<b>The Flag Median and FlagIRLS</b> CVPR, New Orleans	2022 <i>Poster presentation</i>
<b>Pathway Expression Analysis</b> q-bio, CSU	2022 <i>Poster presentation</i>
<b>FRD-NNs and Lessons Learned at PNNL</b> Greenslopes Seminar, CSU	2021 <i>Virtual presentation</i>
<b>Geometric Median of Subspaces</b> Front Range Applied Math Student Conference, University of Colorado	2020 <i>Presentation</i>
<b>Detecting Biomarkers for Influenza</b> Rocky Mountain Virology Club Meeting, CSU	2019 <i>Poster presentation</i>

## EXPOSITORY PRESENTATIONS

---

<b>Python Workshop</b> SIAM Meeting, CSU	2023 <i>Presentation</i>
<b>An Introduction to Graph Neural Networks</b> Data Science Seminar, CSU	2022 <i>Presentation</i>
<b>Geodesic Regression on the Grassmannian</b> Greenslopes Seminar, CSU	2019 <i>Presentation</i>

## TEACHING EXPERIENCE

---

Dimensionality Reduction	Fall 2023
Math 161 - Calculus II (Online)	Spring 2020
Math 340 - Ordinary Differential Equations (Online)	Fall 2020
Math 160 - Calculus I	Fall 2017, Spring 2018, Fall 2018, Fall 2019

## HONORS & AWARDS

---

ELLIS Society Member	present
Colorado College Sophie Germain Award	2017
INFORMS Award in the Mathematical Contest in Modeling	2015

## SERVICE

---

<b>Society of Industrial and Applied Mathematics Webmaster</b> Colorado State University	Aug 2022-May 2023
<b>Society of Industrial and Applied Mathematics Liaison</b> Colorado State University	Aug 2021-May 2022

## SKILLS

---

<b>Programming</b>	Python, Matlab, R
<b>Languages</b>	English (Native), Spanish (Fluent)
<b>Typesetting</b>	Latex, Word
<b>Misc</b>	GitHub, Linux, VSCode, Slurm, VIM