Matthew Piekenbrock

Curriculum Vitae

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Education

GPA: 3.8 Overall, 4.0 In-Major

Wright State University — **Dayton, OH**
Masters of Science in Computer Science (In Progress) — *Spring, 2018*

Wright State University — **Dayton, OH**
Bachelor of Science in Computer Science, Minor in Statistics — *Fall, 2015*

Relevant Courses Taken

- Network Science
- Applied Stochastic Processes
- Computational Tools and Techniques for Data Analysis
- Machine Learning
- Applied Statistics I & II
- Theoretical Statistics
- Information Theory
- Algorithm Design and Analysis
- Foundations of Artificial Intelligence

Experience

Graduate Research Assistant — **2015 - 2017**
Wright State University — *Web and Complex Systems Lab*

I'm currently pursuing a M.S. in Computer Science as a Graduate Research Assistant. My research interests are in the development of novel approaches to understand data that lie at the intersection of statistical learning theory and practical machine learning techniques. The topic areas I've focused on include:

- Density-based clustering techniques and theory
- Dynamic or Temporal Network Models
- Trajectory mining and modeling

My research is supported by the Center for Surveillance Research, a National Science Foundation I/UCRC.

Student Participant — **Summer 2017**
Google Summer of Code 2017 — *R Project for Statistical Computing / Google*

I submitted a successful funding proposal under the Google Summer of Code (GSOC) Initiative to the R Project for Statistical Computing to explore, develop, and unify recent developments related the theory of density-based clustering. For more details, see the project page[1].

Student Research Associate — **2017**
Air Force Research Laboratory — *Oakland Ridge Institute for Science and Education*

In a collaborative effort to foster new research frontiers in the area of Topology Data Analysis (TDA) between WSU and AFRL, I worked in a research group studying how to combine techniques from the field of topology and machine learning for the purpose of both supervised and unsupervised analysis. Primarily, I researched theoretical extensions to the *Mapper* framework, an often used modality for performing TDA. My work lead to the development of a closed-form solution to compute all distinct simplicial complexes, under certain conditions, usable within the *Mapper* framework. A journal article demonstrating the utility of this solution is currently in development [4].

[1] `https://summerofcode.withgoogle.com/archive/2017/projects/5919718795902976/`

Undergraduate Research Assistant **2014 - 2016**

Air Force Institute of Technology *Oakland Ridge Institute for Science and Education*

I worked closely on the development of a new Iterative Closest Point algorithm amenable to massive parallelization, implemented in C++/CUDA, for the purposes of enabling real-time tracking of aircraft in the context of Autonomous Aerial Refueling. The effort lead to a few publications, see either of [2, 3]. Although my efforts in other projects were either not published or publicly available, I also worked on:

- Parallelizing existing atmospheric absorption routines with OpenCL through MATLABs MEX interface
- A model for predicting web navigation patterns using Hierarchical Markov Models
- A prototypical UI to to enhance searching and viewing of 3D models using ThreeJS

Undergraduate Research Assistant **2013 - 2014**

Air Force Institute of Technology *Southwestern Ohio Council for Higher Education*

As my first part-time position in academia, I worked as an undergraduate research assistant on a diverse set of projects, often assisting graduate or doctoral students working in the research area with primarily programmatic or educational tasks. This involved:

- Codifying a novel nonlinear optimization algorithm in ANSI-C
- Implementing an unsplittable flow approximation algorithm in C++ and Python
- Building prototypical UI to to enhance searching and viewing of 3D models using ThreeJS
- Creating a conversion tool that allowed for converting back and forth between Oracle's Abstract Data Type specification to its equivalent representation as an XMLType

Publications

Journals and Full Research Papers

(Under Review) Michael Hahsler, **Piekenbrock, Matt**, and Derek Doran. dbscan: Fast density-based clustering with R. *Journal of Statistical Software*.

Piekenbrock, Matt, Jace Robinson, Lee Burchett, Scott Nykl, Brian Woolley, and Andrew Terzuoli. Automated aerial refueling: Parallelized 3d iterative closest point: Subject area: Guidance and control. In *Aerospace and Electronics Conference (NAECON) and Ohio Innovation Summit (OIS), 2016 IEEE National*, pages 188–192. IEEE, 2016.

Jace Robinson, **Piekenbrock, Matt**, Lee Burchett, Scott Nykl, Brian Woolley, and Andrew Terzuoli. Parallelized iterative closest point for autonomous aerial refueling. In *International Symposium on Visual Computing*, pages 593–602. Springer International Publishing, 2016.

(In Development): **Piekenbrock, Matt** and Doran, Derek. Cover parameterization and simplicial complex generation for mapper. *SIAM Journal on Applied Algebra and Geometry*.

(In Development): **Piekenbrock, Matt** and Doran, Derek. Intrinsic point of interest discovery from trajectory data. *TBD*.

Abstracts, Workshop Papers, and Posters

Derek Doran and **Piekenbrock, Matt**. Exploring information-optimal network discretization for dynamic network analysis. *Sunbelt Social Networks Conference of the International Network for Social Network Analysis*, page 262, 2016.

Matthew Maurice, **Piekenbrock, Matt**, and Derek Doran. Waminet: An open source library for dynamic geospace analysis using wami. In *Multimedia (ISM), 2015 IEEE International Symposium on*, pages 445–448. IEEE, 2015.

Extra Curricular

Regional Model United Nations Annual Conference: Served in Volunteer Staff (2016 - 2017)
Outstanding Position Paper Award: National Model United Nations Annual Conference (2014)
Outstanding Delegation Award: National Model United Nations Annual Conference (2013)