

Jesse M. Lingeman

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Education

- 2008–present **MS, Computer Science (expected Fall 2011)**, *Courant Institute of Mathematical Sciences at New York University, New York, NY.*
- 2005–2008 **BA, Political Science**, *Western Michigan University, Kalamazoo, MI.*

Master's thesis

- title *Network Inference in Molecular Biology - a hands-on framework*
- supervisors Prof. Dennis Shasha, Prof. Richard Bonneau
- published To be published by *Springer* in January, 2012
- description This monograph covers the theoretical and practical intuitions behind many popular algorithms in the literature on gene regulatory network inference allowing beginning bioinformaticians to quickly understand why algorithms work the way they do and what assumptions are being made about the data. Algorithms are then combined to form “pipelines” to take advantage of the information that different theoretical approaches provide. The idea is that algorithms with different theoretical approaches pick up on different features of the data. By combining the results from different approaches, networks can be inferred more accurately than any single approach would allow.
- The monograph also includes software for experimenting with gene network inference. It provides an easy-to-use, standardized, extensible interface for running experiments using a wide array of algorithms. It also makes it simple to create ensemble networks and to pipe the output of one algorithm into another as a prior. Parameter selection can be done automatically with a computing cluster using several different optimization algorithms. By keeping track of every data manipulation, this software makes it easy to repeat experiments, tweak parameters, and report results.

Research Experience

- 2010-Current **Developer**, *OpenSHAPA/OpenSHARE Dev Team.*
- OpenSHAPA is a tool for behavioral researchers to annotate, score, visualize, and explore data streams in video, audio, physiological measures, and motion analysis. OpenSHARE is a complementary tool for sharing video, OpenSHAPA spreadsheets, and metadata. As part of the development team for this open source project, I designed the Ruby scripting interface and wrote a library of annotated scripts to perform common tasks across databases. I implemented several improvements to the graphical user interface. I am currently developing a link between OpenSHAPA and the MongoDB. I also have served as the primary technical support staff for over 200 users.
 - Supervised by Clinton Freeman, lead developer on the project.

2009-Current **Research Scientist, Infant Action Lab at NYU.**

- Research includes studies of motor learning, development, and motor control: dynamic reaching in human and rhesus macaque infants, periodic crawling and walking gaits in human infants, natural locomotion in a cluttered environment, and brachiation—a new form of locomotion—in children and adults. I have presented my work at several venues (ISDP, SRCD, IGP) including the Dynamic Walking 2011 Conference in Jena, Germany (LINK), and am co-author on the resulting manuscripts.

- To advance the work, I have written several data collection, analysis, and visualization tools. In conjunction with the Ascension motion tracker in studies of reaching and locomotion, I designed tools to capture the real-time coordinates of magnetic markers and provide verification of the data quality and run PCA to compare various gait strategies. In conjunction with the GaitRite pressure-sensitive gait carpet, I built a tool to visualize and calculate spatial and temporal parameters of walking. For use with video recordings, my raster plot program allows visualization of the temporal distribution of crawling and walking bouts during natural walking and my grid program locates infants' crawling and walking paths through the natural cluttered environment. My brachiation program provides a means to digitize video for inferring spatial and temporal gait parameters during human brachiation and an analysis tool for calculating statistics.

- I've also supervised undergraduate students and trained other researchers on various technologies, including the Ruby programming language. Teaching has focused on providing the necessary scaffolding to allow others to technologies like a programming language themselves.

- Supervised by Prof. Karen E. Adolph

2010-2011 **Volunteer Researcher, Plant Genomics Lab at NYU.**

- Developed genetic algorithms that use high performance cluster computing to find optimal hyper-parameters for gene regulatory network inference algorithms. This work has been adapted to search for optimal parameters for protein folding algorithms. Contributed conceptionally to the development of the Virtual Plant genomics software.

- Supervised by Prof. Dennis Shasha and Dr. Arthur Goldberg

2009-2010 **Independent Study, Columbia University College of Physicians and Surgeons.**

- Using Support Vector Machines and Hidden Markov Models, I created evaluation software to calculate flight path deviation for use when training surgeons on the DaVinci Laparoscopic Surgical Robot. This work has been presented at The Society of American Gastrointestinal and Endoscopic Surgeons.

- Supervised by Prof. Yann LeCun and Dr. Scott Belsley

Workshops

2011 **Data Coding, Analysis, Archiving, and Sharing for Open Collaboration: From OpenSHAPA to Open Data Sharing, NSF Workshop,**

As part of the OpenSHAPA/OpenSHARE development team (Clinton Freeman and Prof. Penelope Sanderson, UQ, and Prof. Karen Adolph, NYU), led a two-day NSF-sponsored workshop to delineate the conceptual, technical, professional, and management issues that would allow researchers to openly share behavioral data so as to improve the quality of behavioral science. Participants included 22 senior researchers, representing developmental science, computer science, cognitive science, human factors, and eResearch, 12 junior researchers, and agency personnel from the NSF, NIH, and IES. My role was to facilitate discussion among behavioral researchers and computer scientists, discern the needs and concerns of OpenSHAPA/SHARE users, and help to chart a plan for growing a self-sustaining user community in the open source model.

Manuscripts

Jesse M. Lingeman and Dennis Shasha. *Network Inference in Molecular Biology - a hands-on framework.* Springer, 2012.

Karen E. Adolph, Whitney G. Cole, Meghana Komati, Jessie S. Garciaguirre, Daryaneh Badaly, **Jesse M. Lingeman**, Gladys Chan, and Rachel B. Sotsky. How do you learn to walk? Thousands of steps and dozens of falls per day. *Under review.*

Whitney G Cole, **Jesse M. Lingeman**, Meghana Komati, and Karen E Adolph. Go naked: Effects of diapers

on infant walking. *Under review.*

Jesse M. Lingeman, Kasey C Soska, Karen E Adolph, Kirsten Rosander, Klaus VonHofsten, and Lynne Kiorpes. Visually guided reaching: Parallels between human and non-human primates. *In preparation.*

Talks Presented

Jesse M. Lingeman and Karen E Adolph. Learning to walk. *Talk given at Dynamic Walking, Jena, Germany, 2011.* Video available at: <http://tinyurl.com/dynwk-talk>.

Lynne Kiorpes, Gardiner von Trapp, Amelie Pham, **Jesse M. Lingeman**, Kasey Soska, Karen Adolph, Claes von Hofsten, and Kerstin Rosander. Developmental studies of visual-motor integration: A comparative approach. *Talk given at Vision Science Society, Naples, Florida, 2010.*

Posters Presented

Whitney G. Cole, **Jesse M. Lingeman**, and Karen E Adolph. Effects of diapers on infant walking. *To be presented at the meeting of The International Society for Posture and Gait, 2012.*

Whitney G. Cole, **Jesse M. Lingeman**, Gladys Chan, Danielle Bendicksen, Beatrix Vereijken, and Karen E Adolph. Bimanual gait: The development of human brachiation. *To be presented at the meeting of The International Society for Posture and Gait, 2012.*

Whitney G Cole, Meghana Komati, Megan McGwier, **Jesse M. Lingeman**, and Karen Adolph. Walking skill but not walking experience predicts spontaneous walking in infants. *Poster presented at the meeting of The Society for Research in Child Development, April 2011.*

Whitney G Cole, **Jesse M. Lingeman**, Gladys Chan, Elizabeth Quon, Danielle Bendicksen, Beatrix Vereijken, and Karen Adolph. Monkeying around: Development of human brachiation. *Poster presented at the meeting of The Society for Research in Child Development, April 2011.*

Meghana Komati, Samira Iravani, Megan McGwier, **Jesse M. Lingeman**, Whitney G Cole, and Karen Adolph. Walk this way: Developmental changes in spontaneous walking. *Poster presented at the meeting of The Society for Research in Child Development, April 2011.*

Whitney G Cole, **Jesse M. Lingeman**, Meghana Komati, and Karen Adolph. Go naked: Effects of diapers on infant walking. *Poster presented at the meeting of The International Society of Developmental Psychobiology, November 2010.*

Meghana Komati, Samira Iravani, Megan McGwier, **Jesse M. Lingeman**, Whitney G Cole, and Karen Adolph. Step by step: Development changes in spontaneous walking. *Poster presented at the meeting of The International Society of Developmental Psychobiology, November 2010.*

Jesse M. Lingeman, Amelie Pham, Kasey Soska, Karen Adolph, Kerstin Rosander, Claes von Hofsten, and Lynne Kiorpes. Visually guided reaching: Parallels between human and non-human primates. *Poster presented at the meeting of The International Society of Developmental Psychobiology, November 2010.*

Avinash Burra, **Jesse M. Lingeman**, Kuri Gill, and Scott Belsley. Hidden markov models and identification of surgical flight-path deviation with the davinci robot. *Poster presented at the meeting of The Society of American Gastrointestinal and Endoscopic Surgeons, 2009.*

Awards

Sackler Institute and Wiley Travel Award, 2010.

Software Developed

2011 **Gene Network Inference Engine**, *Collection of algorithms for inferring and analyzing gene regulatory networks.*

- Software for inferring gene regulatory networks as part of masters thesis. It provides an easy to use, extensible interface for running experiments with each many popular algorithms. It also makes it simple to pipeline algorithms, and to compare each algorithm's output by providing a standardized framework for exploring gene regulatory networks. Parameter selection can be done automatically with a computing cluster, using several different optimization algorithms. By keeping track of every data manipulation, this software makes it easy to repeat, tweak, and report experiments.

- 2011 **Ascension Motion Tracking Software**, *Software to collect and analyze motion data.*
- Software package to collect and analyze motion data. Visualizations are provided to data collectors to provide real time feedback from the tracking system, such as quality of sensor readings and relative positions. PCA and other statistical analyses are provided to help analyze the data. Integrated with Matlab and OpenSHAPA.
- 2011 **Monkey Bar 3D Digitizing Software**, *Inferring 3D points from 2D video data.*
- Tool for inferring approximate 3D positions of a brachiating subject based on 2D video data and known locations in the field of view.
- 2010 **Distributed Parameter Finder**, *Bioinformatics hyper-parameter finding software.*
- Software developed with Dennis Shasha in the Virtual Plant Lab at NYU. Some bioinformatics algorithms are highly dependent on correct selection of many hyper-parameters, that are specific to a certain dataset. This software packages automates the process of finding good values for these parameters by launching instances of the algorithm on a computing cluster with a spread of parameters, analyzing the results, and fine tuning its parameter estimation.
- 2010 **Movement Grid Visualizer**, *Data visualization tool.*
- This is a tool for generating visualizations of movement of a subject walking through a room that is broken into grid squares. The grid square that the subject is in at any given time is coded from video, and then this tool creates a visualization to help analyze the path that the subject took.
- 2010 **OpenSHAPA Scripting API**, *Data interaction software.*
- OpenSHAPA (<http://openshapa.org>) is an open-source tool for coding behavior in video data. The OpenSHAPA Ruby scripting API had the requirement of being an API for non-programmers, so the API completely abstracts away all of the internal database structures in favor of easier to work with Ruby objects. The Ruby objects generate their methods at runtime so each database object is customized to the user's data. The many helper functions automatically handle common tasks when video coding, such as creating a coding pass for inter-rater reliability, are handled automatically. Cycling through multiple database files and editing many files from within a single script are also supported.
- 2010 **GaitCrunch**, *Data analysis tool.*
- GaitCrunch is software that was written to solve some of the limitations of the software that is included with the popular GaitRite walking measurement carpet. GaitCrunch stores all objects in an internal database, calculates walking parameters more accurately than the original software, and offers a variety of exporting formats.
- 2010 **MonkeyCrunch**, *Data analysis tool.*
- MonkeyCrunch was written to take in manually coded video data of humans brachiating on monkey bars and automatically calculate parameters such as the strategy used for each hand that contacted a bar, timing measures, and cumulative measures such as total number of contacts per strategy.
- 2010 **Roomba Vision Software**, *Robotics platform.*
- Using the open source library OpenCV, I developed software for use with an iRobot Roomba that has two webcams mounted on top of it. The software will track objects in the view and cause the robot to interact with the objects based on an inferred object type. Using the two webcams to compute a stereo image, depth markers are also estimated so the robot can automatically find a path through a room.

Service

- 2010 **Courant Splash**, *A day of activities to raise interest of computer science in high school students..*
- Talk and live demonstration to high school students about the history and current state of robotics, with an interactive demonstration of programming and controlling an iRobot Roomba with OpenCV and Python.

References

Prof. Karen E. Adolph, *Dept. of Psychology, New York University.*
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Prof. Dennis Shasha, *Dept. of Computer Science, New York University.*

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