

# Dr. Michael Barnathan

## CURRICULUM VITAE

Phone: 732-328-8268

[michael@barnathan.name](mailto:michael@barnathan.name)

<http://michael.barnathan.name>

### OBJECTIVE:

To utilize and refine my unique combination of interests, talents, and vision to perform significant purpose-driven work which changes the world for the better. (With particular emphasis on improving education and advancing medicine).

### AREAS OF INTEREST:

STEM Education, Data Mining/Machine Learning, Computer Aided Diagnosis, Oncology, Neurology, Education, Data Structures, Software Development, and Artificial Creativity.

### EDUCATION:

#### Temple University

GPA: **3.92**

#### Advisor:

Vasileios Megalooikonomou

*Ph. D. in Computer and Information Sciences*

Aug. 2006 – May 2010

**Dissertation Topic:** Mining Complex High-Order Datasets.

*M.S. in Computer and Information Sciences*

Aug. 2006 – Aug. 2007

**Master's Project:** The Medical Image Data Mining System, published in Proc. ISBI 2008.

#### Monmouth University

GPA: **3.96**

*B.S. in Computer Science, Math Minor (Summa Cum Laude)*

Sep. 2002 – May 2006

**\$5000 Award for Highest GPA in Class of 2006.**

$n = 1,050$  students

### SCIENTIFIC EXPERIENCE:

**Senior Software Engineer**

June 2012 – Present

**Software Engineer**

Sep. 2010 – June 2012

*Google*

Developed software in Java, C++, Shell, Python, and Protobuf with some of the world's most talented developers. Committed ~20,000 peer-reviewed lines/year of large, complex changes in C++ and Java across three projects, literally without introducing a single bug during my first year. Formulated a personal set of extreme software quality practices which I hope to implement across an entire organization in the future.

### **Extra performance bonuses:**

- Nov. 2010: Saved one of our releases.
- Feb. 2011: For very high code quality on a complex and critical change.
- Jul. 2011: Enabled another team to meet a major quarterly objective.
- Sep. 2011: A batch -> realtime change which sped two teams up by 5x.
- Dec. 2011: Led a major three team effort to success despite huge pushback.
- Feb. 2012: For a massively parallel release tool, reducing release time from 5h to 5m.
- Mar. 2012: When that tool saved our release!
- Mar. 2012: For a well-received public tech talk.

### **Chief Software Developer**

*Wixity*

June 2010 – Sep. 2010

Led both frontend and backend development of Wixity's event recommendation platform, including design and implementation of machine learning algorithms, using Java, Tomcat, Struts, JSP, Hibernate, Spring, Tiles, MySQL, HTML, CSS, and Javascript, including addition of new functionality and improvement of the entire existing codebase.

### **Data Scientist**

*Media6Degrees*

Dec. 2009 – July 2010

Applied machine learning, graph theory, and statistics to analyze and improve the company's predictive click-through and conversion models, directly improving the advertiser's ability to accurately match users with relevant content. Designed and implemented machine learning algorithms using Java, Spring, Maven, Hadoop, Perl, and MySQL, serving as the link between data science and software development in the company.

### **Adjunct Professor**

*Monmouth University*

Sep. 2008 – May 2009

Taught CS305 and CS503, Monmouth University's undergraduate and graduate courses in data structures and algorithms in Java, during the Fall 2008 and Spring 2009 semesters.

### **Research Assistant and System Administrator**

*Data Engineering Laboratory (DEnLab), Temple University*

Aug. 2006 – May 2010

Responsible for conducting formal research to advance the fields of data mining and bioinformatics, especially computer-aided diagnosis in mammography, MRI, and fMRI. Designed a novel CAD system capable of diagnosing breast cancer with 94% accuracy and brain tumors with 89% accuracy, created the first high-order medical image classification, clustering, and feature extraction algorithms, and developed from scratch the first publicly available implementation of WaveCluster. System administrator of the lab's Linux workstations and

servers.

**Mathematics Tutor**

*Math Learning Center, Monmouth University*

Sep. 2004 – May 2006

**Peer Tutor** (Computer Science, Mathematics, History)

*Peer Tutoring Center, Monmouth University*

Sep. 2004 – May 2006

Tutored undergraduate and graduate students in computer science, mathematics, and history as part of a university-sponsored peer tutoring service. Also tutored students in college and graduate-level mathematics for the university's mathematics learning center.

**Researcher/Software Developer**

*Computer Science Department, Monmouth University*

Sep. 2003 – May 2005

Developed a software platform capable of aggregating, classifying, and acting upon data through interactions with agents as part of a grant project led by Dr. Richard Scherl and funded by the Department of Defense. This work resulted in a conference publication.

**AWARDS AND HONORS:**

- Cloudera Certified Hadoop Developer.
- \$5,000 Alumni Association Academic Achievement Award for Highest GPA in the Monmouth University Class of 2006.
- Undergraduate Computer Science Award, Monmouth University, 2006.
- Temple University Graduate Fellowship, 2006-2010 (2006-2008 unconditional).
- Temple University Dean's Scholarship, 2006-2008.
- Temple University Summer Research Assistantship (Summer I & II 2009).
- Temple University Tuition Scholarship, Summer II 2007.
- Temple University Travel Grant to attend CARS 2008.
- Two-time recipient of the Dr. Harold Jacobs Scholarship for Excellence in Science, Technology, or Engineering, Fall 2005 and Spring 2006.
- \$6,000/year Monmouth University Scholarship, 2002-2006.
- Member of the Phi Eta Sigma, Kappa Mu Epsilon, Lambda Sigma Tau, Omicron Delta Kappa, and Golden Key Honor Societies.
- Member of the National Dean's List (twice: once at Monmouth, once at Temple).

**DISSERTATION:**

- **Mining Complex High-Order Datasets:** By Michael Barnathan. My doctoral dissertation. Presents frameworks for performing common data mining and pattern discovery operations on higher-order data utilizing high-order analogues of singular value decomposition (SVD), with a

particular emphasis on fMRI, medical imaging, and computer-assisted diagnosis. Includes several novel classification, clustering, texture-extraction, concept discovery, feature extraction, compression, wavelet transformation, manifold learning, and texture learning algorithms on both low and high-order data.

**Successfully Defended April 23, 2010.**

#### **PUBLISHED JOURNAL PAPERS:**

- **Mammographic Segmentation Using WaveCluster.** By Michael Barnathan. Accepted for publication in the “Machine Learning in Medical Imaging 2012” special edition of Algorithms.
- **TWave: High-Order Analysis of Functional MRI.** By Michael Barnathan, et al. Published in *NeuroImage*, Vol. 58, Issue 2, 2011, pp. 537-548.
- **A Representation and Classification Scheme for Tree-like Structures in Medical Images: Analyzing the Branching Pattern of Ductal Trees in X-ray Galactograms:** By Vasileios Megalooikonomou, Michael Barnathan, Despina Kontos, Predrag Bakic, and Andrew D.A. Maidment. Published in Vol. 28, Issue 4 of *IEEE Transactions on Medical Imaging*, pp. 487-493. Journal paper extending our methodology for topological analysis of tree-like structures.

#### **PUBLISHED CONFERENCE PROCEEDINGS:**

- **A Wearable Accelerometer Sensor System for Unobtrusive Real-Time Monitoring of Parkinson’s Disease Motor Symptoms:** By Michael Barnathan, et al. Published in *Movement Disorders*, Vol. 27, Issue 4, April 2012.
- **TWave: High-Order Analysis of Spatiotemporal Data:** By Michael Barnathan, et al. Published in *Proceedings of the Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD) 2010*, Hyderabad, India, June 2010.
- **High-Order Concept Discovery in Functional Brain Imaging:** By Michael Barnathan, et al. Published in *Proceedings of ISBI 2010*, Rotterdam, April 2010.
- **Probabilistic Branching Node Detection Using AdaBoost and Hybrid Local Features:** By Tatyana Nuzhnaya, et al. (2<sup>nd</sup> author). Published in *Proceedings of ISBI 2010*.
- **Spatial Feature Extraction Techniques for the Analysis of Ductal Tree Structures:** By Aggeliki Skoura, Michael Barnathan, and Vasileios Megalooikonomou. Published in *Proceedings of EMBC 2009*, Minneapolis, Minnesota, September 2 – 6, 2009.
- **Probabilistic Branching Node Detection Using Hybrid Local Features:** By Haibin Ling, Michael Barnathan, Vasileios Megalooikonomou, Predrag Bakic, and Andrew D.A. Maidment. Published in *Proceedings of ISBI 2009*, Boston, Massachusetts, June 28 – July 1, 2009.
- **Classification of Ductal Tree Structures in Galactograms:** By Aggeliki Skoura, Michael Barnathan, and Vasileios Megalooikonomou. Published in *Proceedings of ISBI 2009*, Boston, Massachusetts, June 28 – July 1, 2009.

- **A Texture based Methodology for Quantification of CNS tumors in Spontaneous Transgenic Mouse Medulloblastoma Model:** By Michael Barnathan, et al. Presented at the 2008 World Molecular Imaging Congress in Nice, France on September 12, 2008. (With special thanks to Feroze Mohamed).
- **Analyzing Tree-Like Structures in Biomedical Images Based on Texture and Branching: An Application to Breast Imaging:** By Michael Barnathan, Jingjing Zhang, Despina Kontos, Predrag Bakic, Andrew Maidment, and Vasileios Megalooikonomou. Published in Proceedings of the International Workshop on Digital Mammography (IWDM) 2008, Tucson, Arizona, July 20 – 23, 2008. Presents two novel methods for automated detection of radiographic abnormalities through texture and topological analysis of the lactiferous ductal tree and compares the resulting texture descriptors in mammography and galactography.
- **Wavelet Analysis of 4D Motor Task fMRI Data:** By Michael Barnathan, Rui Li, Vasileios Megalooikonomou, Feroze Mohamed, and Scott Faro. Published in Proceedings of Computer Assisted Radiology and Surgery (CARS) 2008, Barcelona, Spain, June 25 – 28, 2008. Demonstrates a methodology for spatiotemporal wavelet classification and clustering on fMRI motor task datasets, with cluster signals exhibiting patterns such as motor learning.
- **A Texture-Based Methodology for Identifying Tissue Type in Magnetic Resonance Images:** By Michael Barnathan, et al. Published in Proceedings of the International Symposium on Biomedical Imaging 2008, Paris, France, May 14 – 17, 2008. A novel methodology for classifying normal and pathological tissue types in brain MRIs based on the texture of ROIs.
- **A Web-Accessible Framework for Automated Storage and Analysis of Biomedical Images:** By Michael Barnathan, Jingjing Zhang, and Vasileios Megalooikonomou. Published in Proceedings of the International Symposium on Biomedical Imaging 2008, Paris, France, May 14 – 17, 2008. Presents the Medical Image Data Mining System, my Master's Project.
- **Using Data Mining Techniques for Analyzing Human Brain Image Data:** By Despina Kontos, et al. Presented at the 36<sup>th</sup> Annual Meeting of the Society for Neuroscience on October 16, 2006.
- **A High-Level Language for Homeland Security Response Plans:** By Richard Scherl and Michael Barnathan. Presented at the 2005 AAAI Spring Symposium on March 22, 2005. Published in proceedings. Introduces GOLOG and its applications to homeland security.

#### UNPUBLISHED RESEARCH:

- **BACH: An Automated Classifier of Musical Harmony:** By Michael Barnathan. 75% classification accuracy between works of Bach and Beethoven. Completed May 6, 2007.
- **Construction of an Automated Metasquares Opponent Using the MTD(f) Algorithm:** By Michael Barnathan. Completed January 27, 2007.
- **Properties and Applications of the Divisor Function:** By Michael Barnathan. Presented at the 5<sup>th</sup> annual STE research convention at Monmouth University on April 12, 2006. New result:  $\sigma_k(pn) = p^k * \sigma_k(n) + \sigma_k(n / p^a)$ . Later generalized:  $\sigma(p^k n) = p^k * \sigma(n) + (p^k - 1) / (p - 1) * \sigma(n / p^a)$ .

- **The Quantile Tree: A Tree Structure That Uses Statistical Analysis to Proactively Maintain Balance:** By Michael Barnathan. Presented at the 4<sup>th</sup> annual STE research convention at Monmouth University on April 27, 2005.
- **A Testbed for Knowledge-Based Programming:** By Michael Barnathan and Richard Scherl. Presented at the 4<sup>th</sup> annual STE research convention at Monmouth University on April 27, 2005.

## LEADERSHIP AND SERVICE:

- Volunteer at Google's NYC Tech Talks and at CS4HS 2012.
- Offered a series of [free lectures and courses](#) to the community for the [Polymath Foundation](#), an educational non-profit organization which he founded. Raised nearly 1000 supporters and students and recruited over 50 prospective instructors.
- Member of the Temple University CIS Faculty Selection Committee.
- Member of the Monmouth University School of Science, Technology, and Engineering Advisory Council (2004-Present).
- Helped organize the November 6, 2005 meeting of the Mathematics Association of America (New Jersey Section) at Monmouth University.
- President (2005-2006), Vice President (2004-2005), and Webmaster (2004-2006) for the Monmouth University ACM Chapter.
- Officer (2005-2006) and Webmaster (2005-2006) of the Monmouth University Lambda Sigma Tau honor society.
- Organized community service events, such as the Coastal Habitat for Humanity Walk-a-thon and Salvation Army Angel Tree, for the Lambda Sigma Tau honor society.

## TALKS:

- *"Recognizing and Nurturing Technical Intuition"*: By Michael Barnathan. Given June 27, 2012 at Kean University to an audience of high school teachers. Presents a radically different approach to STEM education, founded on intuition of technical presentation and a hands-on curriculum starting as early as age 8. Successfully taught the nontechnical audience pigeonhole sort and maximum variance unfolding as examples of this approach.
- *"Building Software at Google Scale"*: By Michael Barnathan, Greg Estren, and Pepper Lebeck-Jobe. Given at Google NYC, February 2012. A public Tech Talk to an audience of 300 on how Google creates a wildly fast and scalable build system.
- *"Replacing the Radiologist: How AI is Transforming Medicine"*: By Michael Barnathan. Discusses the societal implications of advances in machine learning technology, using medicine as a microcosm of the changes we can expect to see in the near future through society at large. I also demonstrated the construction of a very simple mammographic classifier which can nevertheless detect breast cancer with roughly 80% accuracy. Given at a North Jersey Coast ACM Chapter meeting on April 28, 2011.
- *"How to Learn Everything: Learning Skills for Becoming a 21<sup>st</sup> Century Renaissance Thinker"*: By Michael Barnathan. A talk on creativity, interdisciplinary reasoning, time management, the

psychology of giftedness, and historical polymathy. Offered for the Polymath Foundation since May 15, 2009.

- “*How to Create Your Own Website*”: By Michael Barnathan. A 10-lecture weekly course on web design using HTML and CSS, offered for the Polymath Foundation. April 4 – June 6, 2009.
- “*Sword and Shield: A New Approach to Programming*”: By Michael Barnathan and Michael Edwards (\*both speakers contributed equally). Given at Monmouth University on March 24, 2006.

## OTHER EMPLOYMENT:

### **SCEP (Supply Systems Analyst)**

*C4ISR Logistics and Readiness Center, Ft. Monmouth*

Sep. 2005 – June 2006

### **Lead Web Developer, System Administrator**

*Kaller Historical Documents, Inc.*

May 2001 – Feb. 2003

### **Freelance Web and Software Development**

*RDA International, R.I.C.K. Foundation, BE Marketing, others.*

As-needed.

## SOFTWARE DEVELOPMENT SKILLS:

*Developing software since 1992 (Age 8), websites since 1994.*

- **Programming Languages:** Java, C++, Visual Basic, Perl, Matlab, Python, PHP, R, Protobuf.
- **Web Development:** (X)HTML, CSS, JavaScript, SQL, Flash, XML, AJAX, JSP, Struts, jQuery.
- **Development Tools:** Eclipse, Visual Studio, Spring, Maven, Hadoop, NetBeans, vi, svn, cvs.
- **Database Systems:** MySQL, Hive, SQLite, Microsoft Access.
- **System Administration:** “LAMP”: Linux, Apache (>50 vhosts), MySQL, Perl, BIND, SSH, Postfix, Dovecot, amavisd, iptables, cron, syslogd, logrotate, Nagios, Cacti, etc.
- **Operating Systems:** Windows (beta tester), Linux (Gentoo, Fedora, Ubuntu), Mac OS X, DOS. Very experienced in Linux administration.
- **Productivity Software:** MS Office, Dreamweaver, Photoshop, OpenOffice.
- **Scientific Software:** Maple, Matlab, Maxima, LyX, LaTeX, BibTeX.
- **Modeling Techniques:** UML, E-R modeling, flowcharts, grammars/FSAs.

**PlanetSourceCode Superior Coding Contest Winner** (of ~50,900 coders) – Jan. 2000, Age 15.

**RentACoder Top Coder** (customer satisfaction record in top 2% of over 170,000 coders)

## RECENT SOFTOGRAPHY:

### **Digital Mammographer**

Breast cancer image classifier.

Business Project

~25,000 LOC, Matlab.

October 2011 – Present

[livingdiscoveries.com](http://livingdiscoveries.com)

### **Photography Sale System**

Personal system for selling my photography via Paypal.  
Independent Project, links to my Behance profile  
~5,000 LOC, PHP.

June 2012  
[bit.ly/M1AYI8](http://bit.ly/M1AYI8)

### **NJDelay**

Uses nagios and NLP to track NJ Transit delays.  
Independent Project  
~1,500 LOC, Perl.

December 2011  
[nidelay.com](http://nidelay.com)

### **OpenWaveCluster**

First publicly accessible WaveCluster implementation.  
Opensource Project, part of my dissertation.  
~2,000 LOC, Matlab.

April 2010  
[svn.barnathan.name/papers/  
WaveCluster.zip](http://svn.barnathan.name/papers/WaveCluster.zip)

### **Quantile**

A stock analysis and trend prediction tool.  
Freelance Project (v1.0), Independent Project (v2.0).  
~20,000 LOC; C#, C++, Matlab (v2.0), advanced statistics,  
and utter disregard for the Efficient Market Hypothesis.

April 2008 – June 2008  
October 2009 – Present

### **LanceRates**

Provides freelance market rates and analysis.  
Independent Project, uses machine learning.  
~4,000 LOC, Perl, MySQL, XHTML, CSS, and Javascript.

June 2008  
<http://www.lancerates.com>

### **Project Polymath**

My ongoing attempt to start a university.  
Incorporated 501(c)(3) non-profit.  
Made with XHTML, CSS, Javascript, and a big vision.

Dec. 2007 – Present  
<http://www.projectpolymath.org>

### **Metasquarer**

Online puzzle game with thousands of users  
Award Winning Independent Project  
Version 7.0.73, 27,596 LOC, Visual Basic.

Sep. 1997 – Present  
(First released at age 12)  
<http://www.metasquared.com>

### **Ethereal Lamentations**

A website showcasing my musical compositions.  
Independent Project.  
~1,000 LOC, HTML, CSS, Javascript, and Flash.

July 2008  
<http://ethereallamentations.com>

### **Freelance Mining**

Integration of data mining and software development.  
Offering my services on a freelance basis.  
Made with XHTML, CSS, and Javascript.

Feb. 2008 – June 2008  
[www.freelancemining.com](http://www.freelancemining.com)



### **Medical Image Data Mining System (MIDMS)**

Allows users to submit and analyze medical images.  
Master's Project  
Version 1.1, 1,579 LOC; Perl and Matlab

July 26 – July 31, 2007  
<http://denlab.temple.edu/midms>

### **BACH (Basic Algorithmic Classifier of Harmony)**

Musical classifier with 75% accuracy.  
Independent AI Project  
Version 1.0, ~1000 LOC; Matlab

May 6, 2007  
[michael.barnathan.name/  
papers/BACH.zip](http://michael.barnathan.name/papers/BACH.zip)

### **HireGeeks**

Auction site for skilled freelance services.  
Registered Small Business  
16,257 LOC; Perl, MySQL, CSS, XHTML, RSS

Aug. 2006 – June 2008  
<http://www.hiregeeks.com>

### **Ecossaise**

Lightweight yet Robust IRC Client  
Independent Project  
Version 0.6 Beta, 7,419 LOC; C++

July 2006  
<http://www.ecossaise.com>

### **My Affiliate Marketing Manager**

Freelance work for Steve Schneiderman  
Version 1.0.1.8, ~8,000 LOC; Visual Basic

July 2006 – Aug. 2006  
[myaffiliatemarketingmanager.com](http://myaffiliatemarketingmanager.com)

### **Forum Marketing Manager**

Freelance work for Steve Schneiderman  
Version 1.5, ~5,000 LOC; Visual Basic

March 2006 – June 2006  
[forummarketingmanager.com](http://forummarketingmanager.com)

### **Table Genie**

Freelance work for Steve Schneiderman  
Version 2.8, ~10,000 LOC; Visual Basic

March 2002 – Feb. 2006  
<http://www.tablegenie.com>

### **Generalized Networking and Sockets Library (GNSL)**

A Complete Object-Oriented Networking Library  
Independent Opensource Project  
Version 1.0, ~9,000 LOC; C++

Dec. 2004 – Oct. 2005  
[michael.barnathan.name/gnsl](http://michael.barnathan.name/gnsl)

### **OpenAL OO Wrapper Library (ALWrapper)**

A Complete Object-Oriented Sound Library  
Independent Opensource Project  
Version 0.9, ~6,500 LOC; C++, Java

Dec. 2004 – Jan. 2005  
[michael.barnathan.name/alwrapper](http://michael.barnathan.name/alwrapper)

### **Rumble Pop**

Freelance work for Steve Schneiderman  
Version 1.2, ~4000 LOC; Visual Basic

April 2005 – June 2005  
<http://www.rumblepop.com>

**KCPUMonitor**

CPU Frequency and Temperature Monitor (KDE)  
Independent Opensource Project  
Version 0.5, ~3,000 LOC; C++

May 2004 – June 2004  
<http://kcpumonitor.sf.net>

**Secure Password Generator**

Secure Password Generator (Qt)  
Opensource Project led by Jonathan Weinraub  
Version 1.0, ~1,000 LOC; C++

May 2004 – June 2004  
<http://spassgen.sf.net>

**OTHER SKILLS:**

- Trained in formal logic (propositional, predicate, situation calculus, fuzzy, probabilistic)
- Experience performing interdisciplinary biomedical research, including research collaborations with physicians, biologists, and radiologists. Burning desire to make a significant contribution to medicine.
- Created diverse electronic devices including a solar powered GPS, an automatic plant watering device, and a Wi-Fi and machine learning enabled color changing orb.
- Proficient as a pianist and composer (experience playing at festivals and concerts).
- Experience in photography, poetry, writing, philosophy, and game design.
- Broad, interdisciplinary, and creative approach to problem solving.
- Extremely independent and self-motivated.

Complete portfolio and résumé available at <http://michael.barnathan.name>.