

Dr. Michael Barnathan

CURRICULUM VITAE

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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:

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:

Chief Software Developer

June 2010 – Present

Wixity

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*Media Six Degrees*

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 of biomedical images. Also responsible for administration of the lab's Linux workstations and servers after rapidly recognized for Linux competence. Voluntary position due to fellowship until September 2008, paid thereafter.

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:

- **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:

- **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. (2nd 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 36th 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.

IN PROGRESS / UNDERGOING REVIEW:

- **Analysis of fMRI Brain Activation Patterns of Working Memory Tasks:** By Jingjing Zhang, Michael Barnathan, and Vasileios Megalooikonomou. Analyzes spatiotemporal activation patterns of verbal and spatial working memory tasks at various stages of task performance (instruction, storage, processing/distraction, recall, fixation). Discovers a high degree of spatial activation during processing task in areas associated with nociception in the brain, suggesting that *difficult working memory processing tasks may actually result in pain and avoidance*.

Status: Submitted to AI In Medicine.

- **A Multidimensional Wavelet Transform for Higher-Order Structures:** By Michael Barnathan. Presents a tensor-based multidimensional wavelet decomposition algorithm developed in the course of my work on my TWave methodology.

Status: Performing further analysis to demonstrate additional properties of the algorithm.

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 5th 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 4th 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 4th annual STE research convention at Monmouth University on April 27, 2005.

LEADERSHIP AND SERVICE:

- 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:

- “How to Learn Everything: Learning Skills for Becoming a 21st 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.

PROFESSIONAL AFFILIATIONS:

Member of the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE).

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, R, C#, Prolog, GOLOG.
- **Web Development:** (X)HTML, CSS, JavaScript, SQL, Flash, XML, AJAX, JSP, Struts, jQuery.
- **Development Tools:** Visual Studio 2010, Eclipse, Spring, Maven, Hadoop, NetBeans, vi, svn, cvs.
- **Database Systems:** MySQL, Hive, SQLite, Microsoft Access.
- **Operating Systems:** Windows (Windows 7 beta tester), Linux (Gentoo, RedHat/Fedora, Debian, 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:

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

July 2008

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

<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

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

Forum Marketing Manager

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

March 2006 – June 2006
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

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

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.
- 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>.