

Curriculum Vitae

Eric P. Nichols
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Education

Indiana University — Bloomington

Joint Ph.D. in Computer Science and Cognitive Science,
Certificate in Cognitive Modeling, Ph.D. Minor in Music
Thesis advisor: Dr. Douglas R. Hofstadter

May 2006 – December 2012

M.S., Computer Science

January 2004 – April 2006

Montana State University — Bozeman

B.S., Mathematics and Applied Mathematics with High Honors,
Minor in Computer Science

September 1995 – May 2000

Institut National des Sciences Appliquées — Lyon, France

Undergraduate Exchange in Computer Science and Mathematics

January 1997 – May 1997

Research Experience

Center for Research on Concepts and Cognition (CRCC)

January 2004 – present

Developed a computer model of music perception and cognition in Western tonal music. Organized monthly meetings of the Fluid Analogies Research Group (FARG) at CRCC.

National Science Foundation CreativeIT Grant (IIS-0738384)

September 2007 – February 2010

Wrote a successful NSF grant proposal to fund my research in modeling musical expectation. The grant paid for my tuition and travel and also allowed me to purchase more equipment and hire and train part-time help to run experiments in music cognition.

Music Informatics | Indiana University

September 2005 – present

Designed and implemented novel algorithms for several music informatics problems with Dr. Christopher Raphael, including:

- Cost function optimization in a trellis graph (with applications in automatic harmonic analysis and piano fingering) (using C# and Java)
- Polyphonic audio transcription (using C)
- Audio segmentation (using C)
- Automatic melody and rhythm generation (using Python and C#)

Industry Experience

Software Engineering Intern | Google Research June 2011 – August 2011

Improved automatic ranking of YouTube Slam music videos by 0.5% by developing new music-specific features for audio analysis—these features estimate singing quality, including how well a person is singing in-tune. Added the intonation feature to the upcoming Golden Set 5.0 release, so it will be computed for all uploaded YouTube videos. Developed a classifier to estimate singer age and demonstrated a heuristic for identifying talented young artists. Wrote a paper on this work intended for presentation at the ISMIR 2012 conference.

Research Intern | Microsoft Research, Theory and Computational User Experiences (CUE) June 2008 – August 2008

Solved difficult problems in automatic genre-specific harmonization of sung melodies, using probabilistic graphical models and a novel clustering method. Brought together researchers from the Theory, CUE, and Natural Languages groups to overcome modeling obstacles and prototyped new features for the Songsmith project inspired by these discussions. Ran user studies to test our new algorithms and interface, and presented the results at a conference on Intelligent User Interfaces.

President/Owner | AiMusic, LLC January 2007 – present

Created and self-funded a startup specializing in creativity support tools for musicians. Developed multiple unique and profitable iPhone apps, including the first rhyming dictionary for iPhone, “Perfect Rhyme” (<http://tinyurl.com/perfectrhyme>).

Consultant | Retronyms, LLC September 2007 – present

Designed and coded the server software for the award-winning GPS-based iPhone game “Seek ‘n Spell” (www.seeknspell.com). Developed a Windows Media Player plug-in (C++) to apply virtual surround-sound effects to an audio stream. Helped design a novel social website using Django.

Software Engineer | IntelliChem Inc. May 2001 – December 2003

Second engineer hired by the founders in a successful, fast paced startup designing software for top-ten pharmaceutical companies; IntelliChem was acquired shortly after our successful 4.0 release. The company grew to comprise over 40 people (fifteen software engineers) by the time I left to start graduate school.

- Designed and implemented client applications (VB 6), web services (C#), and control software for robotic liquid handlers (C#).
- Managed and mentored offshore software engineers and summer interns working on my team to develop machine learning algorithms for chemical property prediction; I reported directly to our CEO for this mission-critical project.
- Developed custom software extensions, working directly with clients at Bristol-Myers Squibb, Merck, and Pfizer, owning the project all the way from the detailed requirements-gathering phase through testing and final delivery.

Lead Technical Writer | Cylant Technology August 2000 – April 2001

Wrote both technical and user documentation for prototype software engineering and security tools in a demanding startup environment. Managed information-gathering sessions and served as the liaison between the technical team and the documentation and public relations teams. Provided mathematical and algorithmic guidance to the development team. Designed the company website.

Awards

- First Place in the Indiana University School of Informatics poster competition, for "Lyric-Based Rhythm Suggestion", 2009
- Seek 'n Spell game for iPhone: Best Use of Technology award, Come Out & Play Festival, New York City, 2009
- NSF SGER Grant for: "Musical: a computational model of creativity in a musical domain," under the direction of Douglas R. Hofstadter, 2007-2009
- Summer Research Fellowship in Cognitive Science, Indiana University, 2004-2006
- NSF Graduate Research Fellowship Honorable Mention, 2003-2004
- Barry Goldwater Fellowship, 1998-1999
- Presidential Scholar, Montana State University, 1995-2000

Teaching at Indiana University

- Instructor for the graduate seminar Introduction to Music Informatics January 2011 – May 2011
- Instructor for an undergraduate artificial intelligence course September 2008 – December 2008
One of my former students recently asked my permission to make Othello tournament engine I developed for the course was recently refactored and open-sourced by a former student:
<http://tinyurl.com/GitHubOthello>

Skills / Other

- C# and .NET, Python, C, C++, Objective-C and iOS, Java, Django, Visual Basic 6, Scheme, Lisp, PERL, Ada, Pascal, and Assembly
- Keyboardist, bass guitarist, vocalist, and songwriter with the folk-rock band Angerhard Eclectic
- Composer of several modern classical music pieces
- Studied artificial intelligence and mathematics in Lyon, France for one semester; competent in the French language
- Studied the Portuguese language; derived some interesting heuristics about Portuguese noun gender using machine learning
- Selected by my advisor, Doug Hofstadter, to join him on his sabbatical in Paris (January – June 2010) while working on my research
- World traveler with a network of international friends – spent time in many different countries: France, The Netherlands, Sweden, Finland, Japan, Morocco, England, Canada, Germany, Italy, Switzerland, and Austria.
- Active dancer (salsa, swing, and contradance), cyclist, runner, racquetball player, and yoga student

Publications

Hughes, J., Lohman, B., Deckert, G., Nichols, E., Settles, M., Abdo, Z., and Top, E., "The role of clonal interference in the evolutionary dynamics of plasmid-host adaptation," *mBio* 3(4):e00077-12. doi:10.1128/mBio.00077-12. 2012.

Raphael, C., and Nichols, E., "Linear Dynamic Programming and the Training of Sequence Estimators," in *Operations Research and Cyber-Infrastructure*, eds. Chinneck, J., Kristjansson, B., and Saltzman, M. Springer: New York, NY, 2009, pp. 219–231.

Nagoski, E., Janssen, E, Lohrmann, D, and Nichols, E. "Risk, Individual Differences, and Environment: An Agent-Based Modeling Approach to Sexual Risk-Taking." Accepted for publication in Archives of Sexual Behavior.

Nichols, E., "Dynamic Melodic Expectation in the Creative Microdomain SeekWell." 2007. Available (from Center for Research on Concepts and Cognition; 510 North Fess; Bloomington IN 47408) as CRCC Technical Report #138.

Jordan, R., Nichols, E., and Cunningham, A. (1999). "The role of (bio)surfactant sorption in promoting the bioavailability of nutrients localized at the solid-water interface." *Wat. Sci. Technol.* 39(7), p. 91.

Conference Papers/Presentations

Nichols, E., DuHadway, C., Aradhye, H.,, and Lyon, R. "Automatically Discovering Talented Musicians with Acoustic Analysis of YouTube Videos," *IEEE International Conference on Data Mining (ICDM)*. December 2012, Brussels, Belgium.

Knopke, I. and Nichols, E. "Melodic Search and Pattern Discovery for Symbolic Music Information Retrieval", Tutorial at the International Society for Music Information Retrieval Conference (ISMIR). August 2010, Utrecht, The Netherlands.

Nichols, E. "Cantonese Melody-Composition Assistant," IPSJ Special Interest Group on MUSic and computer (SIGMUS), November 2009, Tokyo, Japan.

Nichols, E., Morris, D., Basu, S., and Raphael, C. "Relationships Between Lyrics and Melody in Popular Music," in International Society for Music Information Retrieval Conference (ISMIR), pp. 471–476, October 2009, Kobe, Japan.

Nichols, E. and Byrd, D. "The Future of Music IR: How Do You Know When a Problem is Solved?" in International Society for Music Information Retrieval Conference (ISMIR), October 2009, Kobe, Japan.

Nichols, E. "Lyric-Based Rhythm Suggestion," in International Computer Music Conference (ICMC), August 2009, Montreal, Canada.

Nichols, E. and Joe, E. "Modeling Meter and Key Implication," in Society of Music Perception and Cognition Conference (SMPC), August 2009, Indianapolis, Indiana, USA.

Nichols, E. "Lyric-Based Rhythm Suggestion," School of Informatics Grad Poster Session, April 17, 2009, Bloomington, Indiana, USA.

Nichols, E. "Musicat: a Computer Model of Music Cognition," New Voices in Academia Conference, March 27, 2009, Bloomington, Indiana, USA.

Nichols, E., Morris, D., and Basu, S. "Data-Driven Exploration of Musical Chord Sequences," in 13th International Conference on Intelligent User Interfaces (IUI), February 2009, pp. 227–236, Sanibel Island, Florida, USA.

Nichols, E. and Hofstadter, D.R. "Musicat: A Computational Model of Creativity in a Musical Domain," NSF CreativeIT Workshop, January 2009, Arlington, Virginia, USA.

Raphael, C., and Nichols, E., "Linear Dynamic Programming and the Training of Sequence Estimators," INFORMS Computing Society (ICS), 2009, Charleston, South Carolina, USA.

- Linhares, A. and Nichols, E., "Automated Scientific Discovery and Hofstadter's Fluid Concepts Model," AAAI 2008 Fall Symposium on Automated Scientific Discovery, 2008, Arlington, Virginia, USA.
- Nichols, E. and Linhares, A., "Creativity veRsus Classical Computation," North American Conference on Computing and Philosophy, 2008, Bloomington, USA.
- Raphael, C. and Nichols, E., "Training Music Sequence Recognizers with Linear Dynamic Programming," in MML 2008 International Workshop on Machine Learning and Music, 2008, pp. 19–20, Helsinki, Finland.
- Knopke, I. and Nichols, E., "Constrained Automatic Chord Alignment and Detection of Musical Structure," CIM 2008 Fourth Conf. on Interdisciplinary Musicology Proc., 2008, Thessaloniki, Greece.
- Nichols, E. and Raphael, C., "Automatic Transcription of Music Audio Through Continuous Parameter Tracking," in ISMIR 2007 Eighth Int. Conf. on Music Inf. Retr. Proc., 2007, pp. 387–392, Vienna, Austria.
- Kasimi, A., Nichols, E., and Raphael, C., "A Simple Algorithm for Automatic Generation of Polyphonic Piano Fingerings," in ISMIR 2007 Eighth Int. Conf. on Music Inf. Retr. Proc., 2007, pp. 355–356, Vienna, Austria.
- Nichols, E. and Knopke, I., "Musical Attractors: A New Method for Audio Synthesis," in AES 31st Int. Conf. Proc., June 25–27, 2007, London, UK.
- Nichols, E. and Raphael, C., "Globally Optimal Audio Partitioning," in ISMIR 2006 Seventh Int. Conf. on Music Inf. Retr. Proc., 2006, pp. 202–205, Victoria, Canada.