

EDUCATION

Harvard University, Cambridge, MA USA*Ph.D., Computer Science*

began Fall 2011

- Advisor: Krzysztof Gajos, Intelligent Interactive Systems group
- Research: High-dimensional visualization; tools for supporting visual interface design
- Courses: Advanced Machine Learning, Probability, Statistical Inference, Research in HCI, Random Processes and Algorithms

Massachusetts Institute of Technology, Cambridge, MA USA*S.M., Media Arts and Sciences (MIT Media Lab)*

February 2010

- Research: *Reusing Code by Reasoning About its Purpose* (thesis); natural-language commonsense reasoning, human-computer interaction
- Advisor: Henry Lieberman, Software Agents Group, MIT Media Lab
- Courses: Technologies for Creative Learning, Common Sense Reasoning for Interactive Applications, Natural Language, The Society of Mind (Prof. Marvin Minsky), Human Intelligence Enterprise (Prof. Patrick Winston) (GPA: 4.9 out of 5.0)

Cornell University, Ithaca, NY USA*B.S., Electrical and Computer Engineering*

June 2007

- GPA: 3.99 out of 4.0 (*magna cum laude*)
- Cornell Presidential Research Scholars program
- Coursework in electronics, communications systems, nonlinear dynamics, sound and image signal processing, natural language processing, and others

PUBLICATIONS

Arnold, K.C. and H. Lieberman. **Managing Ambiguity in Programming by Finding Unambiguous Examples**. *Proceedings of Onward!* 2010.

Arnold, K.C. and H. Lieberman. **Embracing Ambiguity**. *FSE/SDP Workshop on the Future of Software Engineering Research*, November 2010.

Arnold, K.C. and H. Lieberman. **Scruffy Cross-Domain Inference**. *AAAI Fall Symposium on Common Sense Knowledge*, November 2010.

Alonso, J.B., K.C. Arnold, and C. Havasi. **Envisioning a Robust, Scalable Metacognitive Architecture Built on Dimensionality Reduction**. In *AAAI-10 Workshop on Metacognition for Robust Social Systems*, July 2010.

Havasi, C., R. Speer, K.C. Arnold, H. Lieberman, J. Alonso, J. Moeller. **Open Mind Common Sense: Crowd-sourcing for Common Sense**. In *AAAI-10 Workshop on Collaboratively-Built Knowledge Sources and Artificial Intelligence*, July 2010.

Gold, K., C. Havasi, M. Anderson, and K.C. Arnold. **Comparing Matrix Decomposition Methods for Meta-analysis and Reconstruction of Cognitive Neuroscience Results**, *FLAIRS*, May 2011.

Arnold, K.C. **Reusing Code by Reasoning About its Purpose**. Master's thesis, MIT, February 2010.

Speer, R., J. Krishnamurthy, C. Havasi, D. Smith, H. Lieberman, K.C. Arnold. **An interface for targeted collection of common sense knowledge using a mixture model**. *Proceedings of the 13th International Conference on Intelligent User Interfaces (IUI)*, February 2009.

Smith, D. and K.C. Arnold. **Learning hierarchical plans by reading simple English narratives**. *Presented at the Commonsense Workshop at the ACM International Conference on Intelligent User Interfaces (IUI)*, February 2009.

Huang, Norden. E, Zhaohua Wu, Steven R. Long, Kenneth C. Arnold, Xianyao Chen, Karin Blank. **On Instantaneous Frequency**. *Advances in Adaptive Data Analysis*, vol. 1, Dec. 2009, pp. 177-229.

PATENTS

The following patents came out of my work with IBM Extreme Blue. All are granted to IBM and list the following inventors: Jacob C Albertson, Kenneth C Arnold, Steven D Goldman, Michael A Paolini, Anthony J Sessa.

Controlling resource access based on user gesturing in a 3D captured image stream of the user. (US7971156 issued Jun, 28 2011).

Informing a user of gestures made by others out of the user's line of sight. (US7725547 issued May, 25 2010).

Tracking a range of body movement based on 3D captured image streams of a user. (US7840031 issued Nov, 23 2010).

Warning a vehicle operator of unsafe operation behavior based on a 3D captured image stream. (US7792328 issued Sep, 7 2010).

Controlling a document based on user behavioral signals detected from a 3d captured image stream. (US7877706 issued Jan 25, 2011).

Controlling a system based on user behavioral signals detected from a 3D captured image stream. (US7801332 issued Sep, 21 2010).

Warning a user about adverse behaviors of others within an environment based on a 3D captured image stream. (US8269834 issued Sep 18, 2012).

Adjusting a consumer experience based on a 3D captured image stream of a consumer response. (US8295542 issued Oct 23, 2012).

EXPERIENCE

Luminoso, LLC, Cambridge, MA USA

Co-founder, Researcher, Developer

2011–present

Our unique analytics engine, based on my group's research at the Media Lab, combines associations it finds in documents with crowdsourced "common sense" relationships in order to elucidate insights from surveys or statuses, route trouble tickets to the right people, and suggest who should talk with whom about what. As a full-time student my day-to-day involvement has naturally diminished, but I try to deploy some of my research results within the company.

MIT Media Lab, Cambridge, MA USA

Research Assistant

August 2007–August 2011

- Developed, maintained, and supported widely-used research software, including:
 - **ConceptNet** and **Divisi**: Python libraries for common-sense reasoning, natural language processing, and machine learning, used in academic institutions around the world and at several Media Lab sponsor companies
 - **Open Mind Common Sense**: Website for acquiring, rating, and browsing common-sense knowledge
 - **Luminoso**: an analysis and visualization tool for exploring semantic spaces of free-text data
- Investigated various topics in common-sense reasoning, including:

- Mathematical analysis of Blending, a flexible technique for reasoning jointly over multiple types of knowledge (see “Scruffy Cross-Domain Inference” paper)
- Combining flexible reasoning elements for broad pattern recognition and planning (see “Scalable Metacognitive Architecture” paper)
- Applied these common-sense reasoning techniques to various applications, including goal-oriented website design and goal-oriented programming by code search and reuse (see Master’s thesis work)
- Extensive Linux and Mac OS X system administration for our group’s several complex public websites, streaming computation platforms, and development environments.
 - Deployed, maintained, and scaled database-backed Python web applications
 - Implemented a virtualized server platform based on KVM and libvirt, including configuration management (Puppet), private networking, NFS, etc.
- Presented research to many Media Lab sponsor companies
- Mentored ~15 undergraduate students in a variety of projects

IBM, Austin, TX USA

Extreme Blue Intern

Summer 2006

Our team of four took two webcams and a Cell processor and made a full software stack for interacting with a computer by hand gestures. We built a SIMD-optimized stereo object tracking system on the Cell processor, a networked video processing pipeline, and applications for drawing, presentation, and map navigation. Our team was granted eight patents for gesture recognition applications.

Cornell University, Ithaca, NY USA

Head Consultant for Computer Organization Course

January–May 2006

I designed and implemented an entirely new system for students to simulate hardware implementations using Cadence ASIC design tools, developed the reference MIPS processor implementation and Verilog verification testbenches, and wrote and taught section notes on Verilog. Additionally, I assisted students during the semester as a lab consultant.

Johns Hopkins Center for Talented Youth, St. Mary’s City, MD USA

Computer Science Teaching Assistant

Summer 2005

I assisted in teaching two sessions of an intensive Fundamentals of Computer Science course to middle and high-school students. For the second session, I became a co-instructor and took primary responsibility for the units on computer architecture and graphics using Java Swing. We wrote instructional materials as needed, including an online code submission system and a framework upon which students built five functional video games.

NASA Goddard Space Flight Center, Greenbelt, MD USA

Nonlinear Signal Analysis Research Programmer

Summer 2003 and 2004

I worked with the inventor of the Hilbert-Huang Transform (HHT) technique on implementation and applications. I wrote optimized numerical algorithms in MATLAB and C/C++ that improved accuracy over existing methods. I also developed a tool to visualize the signal analysis process.

Boston Project, Boston, MA USA

Summer Missions Program Staff

Summer 2007

We hosted five week-long service missions trips for groups of up to fifty middle- and high-school students. We led them in serving in the Dorchester, MA community (painting, yard work, etc.) and the greater Boston area (food preparation at homeless shelters, sorting donations for children, etc.), and in reflecting on their experiences.