Tyler Streeter

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Research Focus

My long term goal is to develop a practical general-purpose learning system, implement it in software, and apply it to real-time control problems in robotics and video games. My current approach is based on the mammalian brain architecture. Each of the brain's large-scale structures provides a unique computational benefit which can also benefit AI systems.

Practically, this means gathering the best existing machine learning algorithms (or inventing new ones) and using them to engineer software-based modules similar to the major brain regions. I am currently developing modules based on the sensory and motor cortices, prefrontal cortex, basal ganglia, hippocampus, and cerebellum. Each one is tested both independently and within a fully-integrated architecture. Finally, the entire system must be tested using a developmental approach based on real experience, including sensory data, external reinforcement, and internal curiosity rewards.

Education

Pursuing a PhD in Human Computer Interaction
Iowa State University, ETA: May 2010, GPA: 3.85/4.0
Thesis: An A.I. Architecture for High-Dimensional Reinforcement Learning

MS in Human Computer Interaction
Iowa State University, 2005, GPA: 3.92/4.0
Thesis: Design and Implementation of General Purpose Reinforcement Learning Agents

BS in Computer Engineering, Minor in Music
Iowa State University, 2004, GPA: 3.83/4.0

Experience

Founded Brainpower Labs LLC October 2008 to Present
www.brainpowerlabs.com
Goal: To provide an entrepreneurial outlet for advanced artificial intelligence software based on my PhD research. Currently focused on raising funds by developing iPhone/iPod applications. Our first product (iBonsai) was downloaded over 40,000 times within the first 2 weeks.

PhD Research August 2006 to Present
HCI Graduate Program, Virtual Reality Applications Center
Iowa State University, Ames, IA 50011
Advisor: Dr. James Oliver
Research topic: Brain-inspired artificial general intelligence.

Research Intern May to August 2006
IBM TJ Watson Research Center, Yorktown Heights, NY 10598
Biometaphorical Computing Research Group
Mentor/Manager: Dr. Charles Peck
Tasks: Implemented and tested a novel systems-level computational model of the cerebellum.

Teaching Assistant January to May 2006
Computational Perception course
Iowa State University, Ames, IA 50011
Course Instructor: Dr. Alex Stoytchev
Topics: Machine perception techniques that augment human computer interaction.

Master's Research October 2003 to December 2005
HCI Graduate Program, Virtual Reality Applications Center
Iowa State University, Ames, IA 50011
Advisor: Dr. Adrian Sannier
Thesis: Design and Implementation of General Purpose Reinforcement Learning Agents.

Research Assistant May 2003 to December 2005
Virtual Reality Applications Center, Ames, IA 50011
Principal Investigators: Dr. Adrian Sannier and Dr. James Oliver
Tasks: Developed VR software for various applications, especially military visualizations.

Research Assistant June 2002 to December 2003
Center for Nondestructive Evaluation, Ames, IA 50011
Principal Investigator: Mike Garton
Tasks: Assisted design and implementation of 3D software for ultrasonic probe simulations used for testing jet and shuttle parts.

Projects

I have worked on a large variety of software-based research projects involving neural networks, genetic algorithms, artificial curiosity, brain modeling, cellular automata-based physics, video game development, kernel mixture modeling, topographic map formation, rigid body dynamics simulations (including embodied intelligence experiments), ray traced 3D graphics, cave-based virtual reality, branching system simulations, fish schooling behavior, and multi-touch input devices. For more details (pictures, videos, and executable demos), see the Projects section at www.tylerstreeter.net.

Publications

Peck, C., Streeter, T., & Kozloski, J. 2007. An Integrated Cerebro-Cerebellar Model Demonstrating Associative Learning and Motor Control. In Proceedings of the 10th Tamagawa-Riken Dynamic Brain Forum.

Streeter, T., Oliver, J., & Sannier, A. 2006. Verve: A General Purpose Open Source Reinforcement Learning Toolkit. In Proceedings of the ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference.

Streeter, T. 2006. Curiosity-Driven Exploration with Planning Trajectories. In Proceedings of the Twenty-First National Conference on Artificial Intelligence.

Streeter, T. 2005. Design and Implementation of General Purpose Reinforcement Learning Agents. Unpublished Master's Thesis, Iowa State University, Ames, IA.

Presentations

A Hierarchical Empirical Bayesian Model of Cerebral Cortex
Poster/demo presentation, The 2nd Conference on Artificial General Intelligence, Arlington, VA, Spring 2009.

Verve: A General Purpose Open Source Reinforcement Learning Toolkit
Technical paper presentation, ASME IDETC & CIE, Philadelphia, PA, Fall 2006.

A Model of Motor Task Offloading in the Cerebellum
Poster presentation, IBM TJ Watson Research Center, Yorktown Heights, NY, Summer 2006.

MS Thesis Research Overview
Presented to the IBM Biometaphorical Computing Research Group, Yorktown Heights, NY, Summer 2006.

Curiosity-Driven Exploration with Planning Trajectories
Poster presentation, AAAI 2006 Conference, Boston, MA, Summer 2006.

General Research Presentations at ISU
HCI Forum/Emerging Tech Conference, Spring 2004-2008
ISU HCI Research Experience for Undergraduates, Summer 2007
ISU Robotics Club, Spring 2005, Spring 2006, Fall 2006, Fall 2008
HCI Student Organization, Fall 2005, Fall 2006
MS Thesis defense, Fall 2005
ISU Game Developer's Club, Fall 2003, Spring 2005

Open Source Software Development

Verve - verve-agents.sourceforge.net
A C++ software library for reinforcement learning in robotics and 3D applications.
Sole author, started Sep '04, approx. download count (Feb '10): 600

Voce - voce.sourceforge.net
A simple, cross-platform speech synthesis and recognition library for C++ and Java.
Sole author, started Mar '05, approx. download count (Feb '10): 3,100

OPAL: Open Physics Abstraction Layer - opal.sourceforge.net
A C++ software library which simplifies physics simulation in real-time 3D applications.
Principal author, started Sep '04, approx. download count (Feb '10): 12,700

QuickTest, **QuickProf**, & **QuickMP** - quicktest.sf.net, quickprof.sf.net, quickmp.sf.net
A set of simple C++ header files for unit testing, performance profiling, and multi-processing.
Sole author, started Jul '05, Feb '06, and Apr '08, approx. download count (Feb '10): 1,600

Software Development Skills

Programming Languages
C/C++, Python, Java

Operating Systems
Windows, Linux, Mac OS X, iPhone/iPod touch

C++ Library APIs
OpenCV (image processing/computer vision), Open Dynamics Engine (real-time collision detection and rigid-body dynamics), OpenGL (standard graphics API), Audiere (audio input/output), Corona (image input/output), Ogre3D (real-time 3D rendering), SDL (OpenGL window/event/media handling), TinyXML (XML parsing), VR Juggler (VR development platform), wxWidgets (cross-platform native UI framework)

Python Modules
SciPy (Matlab equivalent), Matplotlib (plotting tools), PyGame (OpenGL window/event/media handling), Pyglet (OpenGL window/event/media handling)

Relevant Coursework

General
Calculus I, II, & III, Classical Physics I & II, Differential Equations, Discrete Math, General Chemistry, Linear Algebra, Statistics, Vehicle Dynamics, Electric Circuits, Electronic Devices

Computer Software
Algorithm Design and Analysis, C/C++ Programming, Data Structures, High Performance Computing, Computer Architecture, Microcontrollers/Assembly, Networking, Operating Systems, Software Engineering

Computer Graphics
Computer Animation and Modeling, Computer Graphics, Advanced Computer Graphics, Game Design and Development, Virtual Reality

Artificial Intelligence
Principles of Artificial Intelligence, Evolutionary Computation, Complex Adaptive Systems Seminar, Computational Perception, Developmental Robotics

Human Computer Interaction
Cognitive Psychology of HCI, Interaction Techniques, Topics in HCI Seminar

Neuroscience
Brain and Behavior, Neural Basis of Human Movement, Neurobiology

Honors

Marvin and Hilda Robbins Graduate Scholarship Recipient
National Merit Finalist (full scholarship for 4-year undergraduate degree)
Multiple ISU Engineering College Scholarships
Undergraduate Research Assistantship
Finalist in 2004 Independent Games Festival Student Competition
1st Place in Software Engineering Class Project Competition (3D game Ricochet)
2nd Place in Developmental Robotics Class Project Competition (embodied artificial curiosity)

Volunteer Experience

Mentor, ISU HCI Research Experience for Undergraduates, Summer 2007
Conference Associate, Game Developers Conference, 2005-2008
Technical judge, First Lego League Iowa Competition, 2005
Volunteer, Ames Lab Regional Science Bowl, 2005, 2008

Interests

Reading (Ray Kurzweil, Arthur C. Clarke, Richard Dawkins, Aldous Huxley, Ray Bradbury), developing and playing video games, blogging about interesting ideas, playing the piano, playing jazz on the tenor sax (led a jazz quartet in 2003-2004), drawing

References

Dr. James Oliver
Director, Virtual Reality Applications Center
Director, Human Computer Interaction Graduate Program
Professor, Mechanical Engineering
Iowa State University, Ames, IA 50011
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http://www.vrac.iastate.edu/~oliver

Dr. Charles Peck
Manager/Researcher, Biometaphorical Computing Research Group
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Dr. Adrian Sannier
University Technology Officer
Professor of Practice
Arizona State University, Tempe, AZ 85287
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