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Summary

I am a researcher and software engineer with a long-standing interest in creating artificial general intelligence. Having spent years studying a wide range of machine learning models and methods, I now focus on deriving new learning algorithms from simple, elegant principles.

I enjoy writing clean code and simple APIs, designing data visualizations to gain intuition about new domains, simulating physical processes with unexpected emergent behavior, building tangible objects from humble materials, and capturing big ideas with small math. My ideal project is one that lets me be a scientist, artist, and engineer.

Highlights

- **Machine Learning Researcher, Engineer, Founder** at [Brainpower Labs](#) since 2008
- **PhD** Machine Learning (2021), **MS** Reinforcement Learning, **BS** Computer Engineering
- **Expertise:**
 - C/C++, Python, 3D simulation, visualization, parallelization, open source
 - machine learning, graphical models, neural networks, optimization, MCMC, reinforcement learning, information theory, Bayesian methods, brain-inspired AI
- **Research projects:**
 - **Theory** and learning algorithms for binary log-linear models with objective priors.
 - **Brain-inspired architecture** for artificial general intelligence.
 - **Infomax mixture models** with hierarchy and **topographic constraints**.
 - **Cerebellum** computational model at IBM Research.
 - **Reinforcement learning** with various state spaces, planning, and **artificial curiosity**.
 - **Evolution of motor control** in 3D simulated humanoids.
- **Software projects:**
 - **Sample Lab**: visualization tool for graph-based Monte Carlo algorithms in C.
 - **Sapience**: AGI library in C++ and Python, debugger, and test environments.
 - **Verve**: general purpose reinforcement learning in C++ and Python.
 - **OPAL**: Open Physics Abstraction Layer, simple 3D physics simulation in C++.
 - **Voce**: tiny API for speech synthesis and recognition in C++ and Java.
 - **QuickMP**: simple loop parallelization macros in a single C++ header file.
 - **QuickProf**: simple performance profiling in a single C++ header file.
 - **QuickTest**: simple unit testing in a single C++ header file.
 - **iBonsai**: meditative interactive 3D tree simulation in C++ for iOS.

Education

PhD in Machine Learning expected 2021

Computer Engineering Dept, Iowa State University

- Thesis: Multivariate Binary Data Prediction with Log-Linear Models, Bayesian Inference, and Information Theoretic Priors.
- GPA 3.85/4.0

MS in Reinforcement Learning

Mechanical Engineering Dept, Iowa State University

- Thesis: Design and Implementation of General Purpose Reinforcement Learning Agents.
- GPA 3.92/4.0

BS in Computer Engineering

Computer Engineering Dept, Iowa State University

- Minor in Music (Jazz Performance)
- GPA 3.83/4.0

Experience

Machine Learning Researcher, Engineer, Founder (Oct 2008 - Present)

Brainpower Labs LLC, Ames IA

- Manage company, perform AI and machine learning research, and develop software.
- Derive math results and design new learning algorithms involving probabilistic graphical models, Bayesian methods, and information theory.
- Build internal software tools in C/C++ and Python to aid research, including a range of interactive visualizations for machine learning methods, especially optimization and Monte Carlo sampling algorithms.
- Designed a novel brain-inspired architecture for artificial general intelligence, and implemented it in in C++ and Python with interactive debugger and test environments.
- Develop commercial software to fund research agenda, including iBonsai, a meditative interactive 3D tree simulation in C++ for iOS (40,000 downloads in first 2 weeks).

Graduate Student Researcher (Aug 2006 - Dec 2009)

VR Applications Center, Iowa State University, Ames IA

- Performed independent research on topographic maps, maximum entropy learning algorithms, Bayesian networks, reinforcement learning, and systems neuroscience.
- Developed open source C++ libraries for unit testing, profiling, and parallel programming.

Research Intern (May 2006 - Aug 2006)

IBM Research, Biometaphorical Computing Group, Yorktown Heights NY

- Implemented a novel computational model of the cerebellum.
- Demonstrated motor learning and transfer of complex reaching behaviors with a simulated 6-muscle arm.
- Participated in discussions of global brain modeling and information theoretic learning rules.

Teaching Assistant (Jan 2006 - May 2006)

Computational Perception, Iowa State University, Ames IA

- Assisted teaching machine perception techniques, computer vision, image processing, and software tools (e.g. OpenCV).
- Managed wiki for student code submissions.

Graduate Student Researcher (May 2003 - Dec 2005)

VR Applications Center, Iowa State University, Ames IA

- Performed independent research for MS thesis on reinforcement learning, artificial curiosity, planning, 3D physics simulation, and interactive real-time visualization.
- Developed virtual reality software tools and applications for several funded research projects.

Research Assistant (Aug 2002 - Dec 2003)

Center for Nondestructive Evaluation, Iowa State University, Ames IA

- Assisted design and implementation of 3D software for ultrasonic probe simulations used for testing e.g. jet engine and space shuttle parts.
- Integrated STL file importer and octree space partitioning.

Research Assistant (Jun 2002 - Aug 2002)

Ames Laboratory, Scalable Computing Lab, Ames IA

- Developed general message logging software for computational chemistry and other applications on high performance computing clusters.

Open Source Software

QuickMP: Simple loop parallelization macros in a single C++ header file. 500 downloads. Sole developer, began in 2008. [[link](#)]

QuickProf: Simple performance profiling in a single C++ header file. 1900 downloads. Sole developer, began in 2006. [[link](#)]

QuickTest: Simple unit testing in a single C++ header file. 1200 downloads. Sole developer, began in 2005. [[link](#)]

Voce: Tiny API for speech synthesis and recognition in C++ and Java. 39700 downloads. Sole developer, began in 2005. [[link](#)]

Verve: General purpose reinforcement learning in C++ and Python. 1200 downloads. Sole developer, began in 2004. [[link](#)]

OPAL: Open Physics Abstraction Layer, simple 3D physics simulation in C++. 16700 downloads. Principal developer, began in 2004. [[link](#)]

Commercial Software

iBonsai: Meditative interactive 3D tree simulation in C++ for iOS. Sole developer, began in 2008. [[link](#)]

Proprietary Software

SOM Lab: Interactive visualization tool for topographic map learning algorithms in C. Sole developer, began in 2013.

Anvil: C utility library for machine learning, linear algebra, parallelization, visualization, etc. Sole developer, began in 2013.

Sample Lab: Interactive visualization tool for graph-based Monte Carlo algorithms in C. Sole developer, began in 2012. [[link](#)]

Sapience: Brain-inspired AGI implementation in C++ and Python, debugger, and test environments. Sole developer, began in 2006. [[link](#)]

Publications & Written Work

Streeter. 2019. **Multivariate Binary Data Prediction with Log-Linear Models, Bayesian Inference, and Information Theoretic Priors.** Iowa State University. Research proposal. (Not yet public.) [[link](#)]

Streeter & Oliver. 2009. **A Brain-Inspired Cognitive Architecture for Autonomous Development.** 9th International Conference on Epigenetic Robotics: Modeling Cognitive Development in Robotic Systems. (Withdrawn due to schedule conflict.) [[pdf](#), [link](#)]

Streeter & Oliver. 2009. **A Brain-Inspired Cognitive Architecture for Reinforcement Learning.** Biologically Inspired Cognitive Architectures 2009. (Withdrawn due to schedule conflict.) [[pdf](#), [link](#)]

Streeter. 2009. **Sapience: A Brain-Inspired Cognitive Architecture.** Iowa State University. Research proposal. [[pdf](#), [link](#)]

Peck, Streeter, & Kozloski. 2007. **An Integrated Cerebro-Cerebellar Model Demonstrating Associative Learning and Motor Control.** 10th Tamagawa-Riken Dynamic Brain Forum. [[pdf](#), [link](#)]

Streeter, Oliver, & Sannier. 2006. **Verve: A General Purpose Open Source Reinforcement Learning Toolkit.** ASME IDETC & CIE. [[pdf](#), [link](#)]

Streeter. 2006. **Curiosity-Driven Exploration with Planning Trajectories.** Twenty-First National Conference on Artificial Intelligence. [[pdf](#), [link](#)]

Streeter. 2005. **Design and Implementation of General Purpose Reinforcement Learning Agents.** Iowa State University. MS thesis. [[pdf](#), [link](#)]

Streeter. 2005. **Open Source Speech Interaction with the Voce Library.** Iowa State University. Technical report. [[pdf](#), [link](#)]

Streeter. 2004-2011. **The Verve Project.** Online blog. [[link](#)]

Presentations

Oct 2019. **Multivariate Binary Data Prediction with Log-Linear Models, Bayesian Inference, and Information Theoretic Priors**. Iowa State University, Ames IA. Proposal presentation. (Not yet public.) [[link](#)]

Jul 2009. **Artificial Evolution**. NSF Research Experience for Undergraduates at ISU. Presentation and demo. (Python demo of 2D catapult simulation and parameter evolution.) [[pdf](#), [link](#)]

Jun 2009. **Sapience: A Brain-Inspired Cognitive Architecture**. Iowa State University, Ames IA. Proposal presentation. [[pdf](#), [link](#)]

Mar 2009. **A Hierarchical Empirical Bayesian Model of Cerebral Cortex**. The 2nd Conference on Artificial General Intelligence, Arlington VA. Poster and demo. (Presented again in Mar 2009 at Emerging Technologies Conference, Ames IA.) [[jpg](#), [link](#)]

Nov 2008. **Artificial Evolution of Catapults and Neuroevolution**. ISU Robotics Club, Ames IA. Presentation and demos. (Python demos of 2D catapult simulation and parameter evolution and 2D mobile robot neuroevolution with collision-based mating.) [[link](#)]

Jun 2008. **Artificial Evolution and Neuroevolution**. NSF Research Experience for Undergraduates at ISU. Presentation and demo. (Python demo of 2D mobile robot neuroevolution with collision-based mating.) [[link](#)]

Apr 2008. **Brain-Inspired Artificial General Intelligence**. Emerging Technologies Conference, Ames IA. Poster. [[jpg](#), [link](#)]

Nov 2006. **Neuroevolution, Reinforcement Learning, Artificial Curiosity, and Self-Organizing Maps**. ISU Robotics Club, Ames IA. Research presentation. (Presented again in Dec 2006 to the ISU HCI Club.) [[link](#), [link](#), [link](#), [link](#)]

Oct 2006. **An Integrated Cerebellum Model Explaining Associative Learning, Timing Prediction, and Motor Control**. Society for Neuroscience Annual Meeting, Atlanta, GA. Poster and abstract. (Did not attend.) [[jpg](#), [pdf](#), [link](#)]

Sep 2006. **Verve: A General Purpose Open Source Reinforcement Learning Toolkit**. ASME IDETC & CIE, Philadelphia PA. Paper presentation. [[pdf](#), [link](#)]

Aug 2006. **A Model of Motor Task Offloading in the Cerebellum**. IBM TJ Watson Research Center, Yorktown Heights NY. Poster. [[jpg](#), [link](#)]

Jul 2006. **Design and Implementation of General Purpose Reinforcement Learning Agents**. IBM TJ Watson Research Center, Yorktown Heights NY. MS thesis presentation. (Given to the Biometaphorical Computing Group.) [[link](#)]

Jul 2006. **Curiosity-Driven Exploration with Planning Trajectories**. Twenty-First National Conference on Artificial Intelligence, Boston MA. Poster. [[pdf](#), [link](#)]

Apr 2006. **Artificial Curiosity**. HCI Forum, Ames IA. Research presentation. [[pdf](#), [link](#)]

Apr 2006. **Artificial Curiosity**. HCI Forum, Ames IA. Poster and demo. [[jpg](#), [link](#)]

Mar 2006. **Design and Implementation of General Purpose Reinforcement Learning Agents**. ISU Robotics Club, Ames IA. MS thesis presentation. [[link](#)]

Nov 2005. **Design and Implementation of General Purpose Reinforcement Learning Agents**. Iowa State University, Ames IA. MS thesis defense. [[pdf](#), [link](#)]

Apr 2005. **Motor Learning for Simulated Creatures**. HCI Forum, Ames IA. Poster. [[jpg](#), [link](#)]

Apr 2005. **OPAL: Open Physics Abstraction Layer**. HCI Forum, Ames IA. Poster and demo. [[jpg](#), [link](#)]

Feb 2005. **Neuroevolution and Reinforcement Learning for Physically Realistic Motor Control in Video Games**. ISU Game Developers Club, Ames IA. Research presentation. [[link](#), [link](#)]

Jan 2005. **Verve Research Overview**. ISU Robotics Club, Ames IA. Research presentation. [[pdf](#), [link](#)]

Apr 2004. **Autonomous Virtual Humans**. HCI Forum and 8th International Immersive Projection Technology Workshop, Ames IA. Research presentation. [[pdf](#), [link](#)]

Nov 2003. **Open Dynamics Engine and Simulated Humans with Neural Network Motor Controllers**. ISU Game Developers Club, Ames IA. Tutorial and demos. (C++ demos of simulated humans with neural network motor controllers.) [[pdf](#), [link](#)]

Honors

- Robbins Graduate Scholarship
- National Merit Finalist
- ISU College of Engineering Scholarships
- Dean's List Every Semester
- Undergraduate Research Assistantship
- Student Finalist (highest award), Independent Games Festival
- Lead Tenor Saxophone, ISU Jazz Ensemble

Volunteer Experience

- Conference Associate (4 years), Game Developers Conference
- Question Reviewer/Scorekeeper (2 years), US DOE Science Bowl
- Mentor, NSF Research Experience for Undergraduates
- Technical Judge, FIRST Lego League Iowa
- Fundraiser/Laborer, humanitarian trips to six countries

Software Development Expertise

- **languages:** C/C++, Python, LaTeX, Mathematica, HTML
- **libraries:** SDL, ODE, NumPy, SciPy, Matplotlib
- **OS targets:** macOS, Linux, Windows, iOS
- **programs:** Vim, CMake, GIMP, Inkscape, Blender, Audacity
- **parallelization:** multithreading, SIMD, OpenMP, MPI
- **visualization:** 2D and 3D graphics, OpenGL, ray tracing, VR
- **simulation:** collision detection, rigid body dynamics, embodied AI simulations (humanoids/bipeds, arms/hands, wheeled robots)
- **miscellaneous:** clean code, good documentation, open source, cross platform development, AI/ML visualization tool development, video game architectures, cellular automata, cell-based physics models, speech recognition, speech synthesis, web development

Machine Learning Expertise

- **undirected graphical models:** Boltzmann machines, Markov random fields, Ising models, spin glasses, Hopfield networks, energy-based models, log-linear models
- **directed graphical models:** feedforward neural networks, Bayesian networks, logistic belief networks
- **other models:** self-organizing maps, generative models, kernel mixture models
- **optimization algorithms:** gradient descent, coordinate descent, 2nd-order methods, natural gradient, simulated annealing, genetic and evolutionary algorithms, deep learning
- **MCMC sampling algorithms:** Gibbs, Metropolis, exact/perfect sampling, partition function/free energy estimation
- **learning objectives:** supervised learning, unsupervised learning, reinforcement learning, clustering, lossless data compression, text/sequence prediction
- **general principles:** information theory, Bayesian methods, objective priors, maximum entropy, minimum description length (MDL), Fisher information, computational neuroscience, brain-inspired AI, artificial curiosity

Favorite Textbooks

- MacKay. Information Theory, Inference, and Learning Algorithms.
- Sutton & Barto. Reinforcement Learning: An Introduction.
- Russell & Norvig. Artificial Intelligence: A Modern Approach.
- Koller & Friedman. Probabilistic Graphical Models.
- Haykin. Neural Networks and Learning Machines.

Relevant Coursework

- **general:** Calculus, Differential Equations, Linear Algebra & Matrices, Discrete Math, Classical Physics, General Chemistry, Electric Circuits, Electronic Devices, Vehicle Dynamics
- **computer software:** C Programming, C++ Programming, Data Structures, Algorithm Design and Analysis, Software Engineering, Operating Systems, Networking, Microcontrollers & Assembly Languages, High Performance Computing, Computer Architecture
- **computer graphics:** Computer Animation and Modeling, Computer Graphics, Advanced Computer Graphics, Game Design and Development, Virtual Reality
- **AI & machine learning:** Artificial Intelligence, Statistics, Advanced Bayesian Methods, Probabilistic Graphical Models, Computational Perception, Developmental Robotics, Complex Adaptive Systems, Evolutionary Computation, iCub Summer School
- **neuroscience:** Brain and Behavior, Neural Basis of Movement, Neurobiology
- **human computer interaction:** Cognitive Psychology of HCI, Topics in HCI, Interaction Techniques

Other Interests

- **general:** running, drawing, cooking, piano, saxophone, video games (especially NES, SNES, DOS), making things from scratch
- **tangible:** bookbinding, woodworking, prototyping, paper electronics, cardboard robotics, artificial muscles, computer keyboards from scratch, molding & casting techniques, adhesives/coatings/binders, making everyday things from common materials
- **mental:** mathematics, physics, computer science, unix, handwritten notes, hand-drawn diagrams, old textbooks, math typesetting, finding better ways to represent & organize ideas (both paper & digital), brainstorming new projects & startups, thinking big, minimizing description lengths, discretizing continua, getting to the bottom of things