Samraat Pawar

Contact

Postdoctoral Scholar

Department of Ecology & Evolution

Computation Institute University of Chicago Zoology 403, 1101 E 57th St Chicago, IL 60637 USA

Telephone: +1-323-208-1639E-mail: samraat@uchicago.edu

www: samraat.bol.ucla.edu

Research

Systems biology; Physiology and metabolic scaling; Biomechanics; Ecoinformatics; Population dynamical and evolutionary consequences of species interactions; Interaction network and community dynamics; Biological effects of climatic fluctuations; Recovery and conservation of ecosystem function

EDUCATION

The Ohio State University, Columbus, OH

Ph.D., Electrical and Computer Engineering, August 2010

- Thesis Topic: Design and Analysis of Optimal Task-Processing Agents
- Candidacy: Research Problems in Distributed Control for Energy Systems
- Adviser: Professor Kevin M. Passino
- Area of Study: Control Engineering

M.S., Electrical and Computer Engineering, August 2007

- Thesis Topic: Optimal Foraging Theory Revisited
- Adviser: Professor Kevin M. Passino
- Area of Study: Control Engineering

B.S., Electrical and Computer Engineering, June 2004

- Magna cum Laude, With Honors in Engineering
- Electrical specialization (emphasis on electromagnetics and digital computers)
- Minor in Computer and Information Systems (programming and algorithms)

ACADEMIC APPOINTMENTS

Postdoctoral Scholar

July 2012 to present

School of Life Sciences, Arizona State University

- Supervisor: Professor Stephen C. Pratt
- Focus: Behavioral bio-mimicry of animals with emphasis on social insects
- Affiliations:
 - Complex Adaptive Systems Initiative
 - Center for Social Dynamics and Complexity

Postdoctoral Researcher

September 2010 to June 2012

Department of Computer Science and Engineering, The Ohio State University

- National Science Foundation Cyber-Physical Systems (ENG, ECCS)
 - "Autonomous Driving in Mixed-Traffic Urban Environments" (grant #0931669)
 - Supervisor (co-PI): Professor Paolo A. G. Sivilotti
 - PI: Professor Ümit Özgüner

Submitted Journal Publications [1] Pavlic, T.P., and K.M. Passino. Cooperative task processing. *IEEE Transactions on Systems, Man*, and Cybernetics. 2012. Submitted.

Refereed Journal Publications

- [2] Pavlic, T.P., and K.M. Passino. Generalizing foraging theory for analysis and design. The International Journal of Robotics Research [Special Issue on Stochasticity in Robotics and Bio-Systems Part 1]. $30(5):505-523.\ 2011.$ doi:10.1177/0278364910396551
- [3] Pavlic, T.P., and K.M. Passino. The sunk-cost effect as an optimal rate-maximizing behavior. Acta Biotheoretica, 59(1):53-66. 2011. doi:10.1007/s10441-010-9107-8
- [4] Pavlic, T.P., and K.M. Passino. When rate maximization is impulsive. Behavioral Ecology and Sociobiology, 64(8):1255–1265. August 2010. doi:10.1007/s00265-010-0940-1
- [5] Pavlic, T.P., and K.M. Passino. Foraging theory for autonomous vehicle speed choice. *Engineering* Applications of Artificial Intelligence, 22(3):482–489, April 2009. doi:10.1016/j.engappai.2008.10.017

SUBMITTED CONFERENCE PUBLICATIONS

- [6] Kumar, G.P., T.P. Pavlic, S.M. Berman, A. Buffin, and S.C. Pratt. A pSHS Model of Collective Transport in A. cockerelli. In: Proceedings of the 15th International Conference on Hybrid Systems: Communication and Control (HSCC 2013), April 8–11, 2013. In preparation.
- [7] Pavlic, T.P. Stigmergic memory for real-time primal-space distributed optimization under constraints. In: *Proceedings of the 4th International Conference on Cyber-Physical Systems (ICCPS 2013)*, April 8–11, 2013. In preparation.

Conference Publications

- [8] Pavlic, T.P., and K.M. Passino. Cooperative task-processing networks. In: Proceedings of the Second International Workshop on Networks of Cooperating Objects (CONET 2011), April 11, 2011.
- [9] Freuler, R.J., M.J. Hoffmann, T.P. Pavlic, J.M. Beams, J.P. Radigan, P.K. Dutta, J.T. Demel, and E.D. Justen. Experiences with a Comprehensive Freshman Hands-On Course Designing, Building, and Testing Small Autonomous Robots. In: *Proceedings of the 2003 American Society for Engineering Education Annual Conference & Exposition*, 2003.

Conference Talks

[10] Pavlic, T.P., and S.C. Pratt. Sequential-sampling models of quorum detection in house-hunting ants. In: 2012 IUSSI-NAS Meeting, October 5–7, 2012.

Conference Posters

- [11] Pavlic, T.P., P.A.G. Sivilotti, A.D. Weide, and B.W. Weide. Verification of Smooth and Close Collision-Free Cruise Control. In: *Proceedings of the 2011 Symposium on Control and Modeling Cyber-Physical Systems*, October 20–21, 2011. Poster abstract.
- [12] Özgüner, Ü., A. Krishnamurthy, F. Özgüner, K. Redmill, P. Sivilotti, B. Weide, and T. Pavlic. CPS: Autonomous driving in urban environments. In: *Proceedings of the 2011 NSF CPS PI Meeting*, August 1–2, 2011. Poster abstract.
- [13] Pavlic, T.P., and K.M. Passino. Cooperative task processing. In: *Proceedings of the ICAM 2009 Symposium: Emergence in Physical, Biological, and Social Systems IV*, November 13, 2009. Poster abstract.

OTHER PUBLICATIONS

- [14] Pavlic, T.P., P.A.G. Sivilotti, A.D. Weide, and B.W. Weide. Comments on 'Adaptive Cruise Control: Hybrid, Distributed, and Now Formally Verified'. Tech. report OSU-CISRC-7/11-TR22, The Ohio State University, 2011.
- [15] Pavlic, T.P., and K.M. Passino. Cooperative Task-processing Networks: Parallel Computation of Non-trivial Volunteering Equilibria. Tech. report OSU-CISRC-3/11-TR05, The Ohio State University, 2011.
- [16] Pavlic, T.P. Design and Analysis of Optimal Task-Processing Agents. PhD thesis, The Ohio State University, Columbus, OH, 2010.
- [17] Pavlic, T.P. Optimal Foraging Theory Revisited. Master's thesis, The Ohio State University, Columbus, OH, 2007.

BOOKS IN PREPARATION PAPERS IN PREPARATION

- [18] Pavlic, T.P., B.W. Andrews, K.M. Passino, and T.A. Waite. Foraging Theory for Engineering.
- [19] Pavlic, T.P., K.M. Passino. Distributed optimization under constraints: Pareto-optimal intelligent lighting.
- [20] Pavlic, T.P. The ideal free distribution as degenerate form of nutrient-constrained optimization.

Grants

- Senior staff, "Autonomous Driving in Mixed-Traffic Urban Environments", NSF, ECCS-0931669, \$1,499,833, September 1, 2009 to August 31, 2012.
- Senior staff, "Cooperative LED Arrays for Preference-Adaptive Lighting in Smart Buildings", NSF, EFRI-SEED preliminary proposal, 2009.

STUDENT ADVISING

Ganesh P. Kumar.

Graduate student in Computer Science, Arizona State University. Modeling of the collective carrying behaviors of *Aphaenogaster cockerelli* ants for purposes of bio-mimetic robot design. 2012.

Christal Johnson.

Undergraduate student in Biology, Arizona State University. Modeling and analysis of quorum detection during emigration behavior in *Temnothorax rugatulus* ants. Honors thesis. 2012.

Cory Henderson, James O'Donnell, Ian Neack, and Patrick Whewell.

Undergraduate students in Electrical and Computer Engineering. Group design project on retrofittable vehicle-to-vehicle communications system for adaptive-cruise-control in mixed-traffic environments. 2012.

Manas Agrawal. Graduate student in Computer Science and Engineering. Software verification and model checking applied to railroad safety problems. 2012.

Sai Prathyusha Peddi. Graduate student in Computer Science and Engineering. Software verification applied to adaptive cruise control and instrumented intersection signal timing. 2011–2012.

Jaeyong Park. Graduate student in Electrical and Computer Engineering. Provably correct on-line control synthesis for autonomous vehicles with hybrid dynamics. 2011–2012.

TEACHING EXPERIENCE

The Ohio State University, Columbus, OH

Instructor

March 2012 to August 2012

- Instructor for ECE 683: Undergraduate Design Project
 - Students designed retrofitable vehicle-to-vehicle communications system to aid in the development of verifiably safe adaptive cruise control.
 - Design project folded into larger research project on autonomous vehicles in mixed-traffic urban environments.

Teaching Assistant

September 2007 to August 2009

(sample graded material and student evaluations available upon request)

- Instructor for ECE 327: Electronic Devices and Circuits Laboratory I
 - Autumn 2007, Winter (2) and Spring 2008 (2), Winter (2) and Summer 2009
 - Responsible for 1-hour lecture and supervision of 3-hour laboratory. Students design and implement infrared modem and 8-ohm speaker driver.
 - Authored hundreds of pages of course material archived at http://www.tedpavlic.com/teaching/osu/ece327.
- Grader for ECE 481 Ethics in Electrical and Computer Engineering
 - Autumn 2007 and Autumn 2008
- Instructor for ECE 209: Circuits and Electronics Laboratory
 - Autumn 2008
 - Responsible for lecture and supervision of basic electronics laboratory.
 - Authored material at http://www.tedpavlic.com/teaching/osu/ece209.
- Instructor for ECE 557: Control, Signals, and Systems Laboratory
 - Summer 2008 (2 sections) and Summer 2009
 - Responsible for lecture and supervision of laboratory. Students used Simulink and dSPACE RTI1104 units for linear system control design.
 - Authored material at http://www.tedpavlic.com/teaching/osu/ece557.
- Lab Instructor for ECE 758: Control Systems Implementation Laboratory
 - Spring 2009 (2 sections)
 - Responsible for lecture and supervision of laboratory. Graduate and senior undergraduate students used Simulink, with dSPACE RTI1104 units for analysis of and advanced control implementation for linear and non-linear systems.
 - Authored material at http://www.tedpavlic.com/teaching/osu/ece758.

National Science Foundation GK-12 Fellow

September 2006 to October 2007

Developed, implemented, and evaluated daily inquiry-based fourth-grade science lessons for a local inner-city public school class.

Instructor

March 2002 to June 2004

- Member of Fundamentals of Engineering for Honors instructional team.
- Special graduate teaching appointment as undergraduate.
- Lectured weekly engineering laboratory for ENG H191, H192, and H193.
- Trained in-class undergraduate teaching assistants in laboratory procedure.
- Graded weekly lab reports and provided laboratory exams.

Teaching Assistant

- Assisted Fundamentals of Engineering for Honors instructional team.
- Provided support to first-year engineering students (ENG H191, H192, and H193).
- Graded daily assignments on programming and drafting.
- Developed on-line journal system for Physics Education Research Group (PERG).

Undergraduate Researcher

September 2000 to March 2002

- Participated in the Europa Undergraduate Research Forum, a part of the Reusable Software Research Group.
- Studied component-based software engineering undergraduate pedagogy.
- Researched changes to RESOLVE/C++ implementation for ANSI compliance.

Grader

September 2001 to December 2001

• Graded daily electromagnetics assignments (ECE 311).

Professional Service

Referee Service

- 49th Annual Conference on Decision and Control
- Bioinspiration & Biomimetics
- Behavioral Ecology
- IEEE Transactions on Signal Processing
- The International Journal of Robotics Research
- Swarm and Evolutionary Computation
- IEEE Transactions on Control Systems Technology
- International Journal of Control

Conference Service

• Organizer/Associate Editor for invited session: "Correctness by Verification and Design", 14th IEEE Conference on Intelligent Transportation Systems (ITSC 2011), Washington, DC, October 5–7, 2011.

Professional Experience

Arizona State University, Tempe, AZ

Postdoctoral Scholar

July 2012 to present

- Supervisor: Professor Stephen C. Pratt
- Novel application of sophisticated quantitative analysis and modeling techniques to animals, with social insects as a particular focus.
- Develop new algorithms for robotics and other autonomous systems based on animal behavior, with focus on distributed decision making.
- Supervise graduate and undergraduate students in engineering, computer science, and biology in tasks related to biological analysis and modeling as well as technological bio-mimetic design.

The Ohio State University, Columbus, OH

Postdoctoral Researcher

September 2010 to June 2012

- Funding: National Science Foundation Cyber-Physical Systems (ENG, ECCS)
 - "Autonomous Driving in Mixed-Traffic Urban Environments" (grant #0931669)
 - Supervisor (co-PI): Professor Paolo A. G. Sivilotti
 - PI: Professor Ümit Özgüner
- Developed new approaches to software verification in the context of hybrid-state and hybrid-time dynamical systems.
- Supervised student design project for novel vehicle-to-vehicle communications systems to assist in adaptive cruise control.

National Instruments, Austin, TX

Hardware R&D Intern for Multifunction DAQ

June 2003 to September 2003

- Designed final verification test fixture for use with STC2 MIO products.
- Designed and executed study of the effect of varying burn-in time on long-term drift of common industry voltage references.

Hardware R&D Intern for Multifunction DAQ

June 2002 to September 2002

- Designed and performed validation tests for 16-bit 800 kHz NI-6120 SMIO DAQ.
- Designed high-quality source to use with NI-5411 arbitrary function generator.

IBM Network Storage, Research Triangle Park, NC

Core Systems Software Developer for FlexNAS

June 2001 to September 2001

- Designed and implemented highly available multihop communications subsystem.
- Participated in software development of various vital box services.

CallTech Communications, Columbus, OH

Information Technology Systems Engineer

June 1997 to May 2001

- Responsible for the acquisition, setup, and administration of all hardware and software systems supporting NetWalk Internet service and web presence provider.
- Designed and implemented state-of-the-art open-source highly available load-balancing system supporting thousands of virtual servers.
- Developed call-center software for clients such as CompuServe, AOL, and Priceline.

MegaLinx Communications, Dublin, OH

Web Developer and Support Representative

June 1995 to May 1997

- Produced web content for commercial clients.
- Assisted in administration of UltraSPARC, x86, 680x0, and PowerPC systems.
- Developed multi-platform open-source file-sharing solution.
- Provided technical support for Internet and web presence customers.

Professional Memberships

Institute for Electrical and Electronics Engineers (IEEE), Member, 2002–present

- IEEE Control Systems Society (2004–present)
- IEEE Communications Society (2012–present)
- IEEE Computer Society (2009–present)
- IEEE Intelligent Transportation Systems Society (2011–present)
- IEEE Systems, Man, and Cybernetics Society (2011–present)
- IEEE Robotics and Automation Society (2011–present)

Animal Behavior Society, Member, 2011-present

International Union for the Study of Social Insects, Member, 2012-present

• North American Section (2012–present)

Society for Mathematical Biology, Member, 2012–present

SERVICE

Recent contributor to several open-source software projects, including:

- Vim-LaTeX suite
- Vimperator and Pentadactyl Firefox extensions
- Git distributed version control system
- Mercurial distributed version control system
- Personal projects archived at http://hg.tedpavlic.com/

Frequent contributor to Wikipedia

• Significant contributions to articles on control theory, electronics, and signals and systems.

Contributor to Quora

• Contributions to articles on thermodynamics, chaos theory, electronics, and evolutionary biology.

OSU FIRST Robotics Team, The Ohio State University, 2000–2004

- Introduced middle school and high school students to science and technology by participating with them in national robotics competitions.
- Led 2002 team to regional silver medal Engineering Inspiration Award.
- Lead Team Mentor, 2002–2004
- Component Design Team Lead Mentor, 2001–2002

Director of Computers, Engineers' Council, The Ohio State University, 2002

Linux Virtual Server Project, 1999–2000

• Early member of the team that formed the open-source project that is now an important load balancing solution for the Linux software platform.

Greater Columbus Free-Net, 1995–1997

Provided technical support services.

CompuTeen Bulletin Board System, 1993–1995

- Administrated dial-up bulletin board system.
- Founded and administrated TeenLiNK, an international electronic mail network that spread through the United States, Canada, and Australia and delivered mail over a series of electronic dial-up drop offs.

APPLICATION Areas

Autonomous and Unmanned Vehicles, Flexible Manufacturing Systems, Distributed Power Generation, Intelligent Lighting, Power Demand Response, Microgrids, Smart Grids

HARDWARE AND

Analog and Digital Electronics:

- Software Skills Bipolar and FET implementations of continuous and switched amplifiers, modulators, converters, and
 - Computer-Aided Design Tools: Cadence OrCAD, NI Multisim, SPICE, pst-circ

Embedded and Real-time Systems:

• Software and hardware development with several MCU and DSP platforms (e.g., Motorola MCU's, Texas Instruments DSP's, Atmel ATmega MCU's, Microchip PIC MCU's, and others)

Instrumentation, Control, Data Acquisition, Test, and Measurement:

• dSPACE hardware (e.g., RTI1104) and Control Desk software, Simulink, LabVIEW and other National Instruments control and data acquisition hardware and software (e.g., MIO, SMIO, DSA, DMM, and others), Hewlett-Packard and Agilent bench-top equipment

Computer Programming:

• C, C++, Java, JavaScript, NetLogo, Pascal, Perl, PHP, Lisp, UNIX shell scripting (including POSIX.2), GNU make, AppleScript, SQL, MySQL, MATLAB, Maple, Mathematica, and others

Version Control and Software Configuration Management:

• DVCS (Mercurial/MQ, Git/StGit), VCS (RCS, CVS, SVN, SCCS), and others

Matlab skill set:

- Linear algebra, Fourier transforms, Monte Carlo analysis, nonlinear numerical methods, polynomials, statistics, N-dimensional filters, visualization
- Toolboxes: communications, control system, filter design, genetic algorithm and direct search, signal processing, system identification

Software Verification:

• KeY, PRISM, KeYmaera

Information/Internet Technology:

 Networking (UDP, TCP, ARP, DNS, Dynamic routing), Services (Apache, SQL, MediaWiki, POP, IMAP, SMTP, application-specific daemon design)

Productivity Applications:

• TeX (IATeX, BibTeX, PSTricks), Vim, most common productivity packages (for Windows, OS X, and Linux platforms)

Operating Systems:

• Microsoft Windows family, Apple OS X, IBM OS/2, Linux, BSD, IRIX, AIX, Solaris, and other UNIX variants

EXPERTISE

Mathematics:

 Applied Mathematics, Real and Complex Analysis, Measure Theory, Differential Geometry, Game Theory, Graph Theory, Combinatorics

Control Theory and Engineering:

 Linear and Nonlinear Systems Theory, Feedback, Variable Structure Systems and Sliding Modes, Distributed and Intelligent Control, Dynamic Optimization, Biomimicry, Bioinspiration, Hybrid and CyberPhysical Systems

Communications and Signal Processing:

Probability, Random Variables, Stochastic Processes, Information Theory, Estimation, Networks

Computer Science and Engineering:

 Model Checking (automated, distributed, hybrid, probabilistic), Hybrid Automata, Software Verification, Component-Based Reusable Software

Natural Sciences (Biology, Neuroscience, Psychology, Anthropology):

• Behavioral Ecology, Foraging Theory, Altruism, Impulsiveness, Evolution

AWARDS

National Science Foundation

- GK-12 Fellowship, 2006–2007
- Graduate Research Fellowship Honorable Mention, 2005

The Ohio State University

- Dean's Distinguished University Fellowship, 2004–2010
- Electrical and Computer Engineering Bradshaw Scholarship, 2002–2004
- Electrical and Computer Engineering Shafstall Scholarship, 2001–2003
- University Scholarship, 1999–2003

SECURITY CLEARANCE

Department of Defense Top Secret SCI with polygraph (expired: 2002)

REFERENCES AVAILABLE TO CONTACT

Dr. Stephen C. Pratt (e-mail: stephen.pratt@asu.edu; phone: +1-480-727-9425)

- Associate Professor, School of Life Sciences, Arizona State University
- ♦ School of Life Sciences, PO Box 874501, Tempe, AZ 85287-4501
- * Dr. Pratt is my current postdoctoral supervisor.

Dr. Spring M. Berman (e-mail: Spring.Berman@asu.edu; phone: +1-480-965-4431)

- Assistant Professor, Mechanical and Aerospace Engineering, Arizona State University
- School for Engineering of Matter, Transport, and Energy, PO Box 876106, Tempe, AZ 85287-6106
- * Dr. Berman is collaborator on my bio-mimicry work.

Dr. Kevin M. Passino (e-mail: passino.1@osu.edu; phone: +1-614-312-2472)

- Professor, Electrical and Computer Engineering, The Ohio State University
- ♦ 205 Dreese Laboratories, 2015 Neil Ave., Columbus, OH 43210
- * Dr. Passino was my graduate adviser.

Dr. Bruce W. Weide (e-mail: weide.1@osu.edu; phone: +1-614-292-1517)

- Professor and Associate Chair, Computer Science and Engineering The Ohio State University
- ♦ 395 Dreese Laboratories, 2015 Neil Ave., Columbus, OH 43210
- \star Dr. Weide is a co-PI on the NSF grant that funded my previous postdoctoral position.

Dr. Ian M. Hamilton (e-mail: hamilton.598@osu.edu; phone: +1-614-292-9147)

- Assistant Professor, Evolution, Ecology, and Organismal Biology and Mathematics The Ohio State University
- ♦ 300 Aronoff Laboratory, 318 W. 12th Avenue, Columbus, OH 43210
- * Dr. Hamilton has been a valuable interdisciplinary resource to me.

Dr. Andrea Serrani (e-mail: serrani.1@osu.edu; phone: +1-614-292-4976)

- Associate Professor, Electrical and Computer Engineering The Ohio State University
- ♦ 205 Dreese Laboratories, 2015 Neil Ave., Columbus, OH 43210
- * Dr. Serrani was a member of my doctoral committee.

Dr. Paolo A. G. Sivilotti (e-mail: sivilotti.1@osu.edu; phone: +1-614-292-5835)

- Associate Professor, Computer Science and Engineering, The Ohio State University
- ♦ 395 Dreese Laboratories, 2015 Neil Ave., Columbus, OH 43210
- \star Dr. Sivilotti is a co-PI on the NSF grant that funded my previous postdoctoral position.

Dr. Richard J. Freuler (e-mail: freuler.1@osu.edu; phone: +1-614-688-0499)

- Professor of Practice, Mechanical and Aerospace Engineering The Ohio State University
- ♦ 244 Hitchcock Hall, 2070 Neil Ave., Columbus, OH 43210
- * Dr. Freuler coordinates the Fundamentals of Engineering for Honors program in which I served as an instructor early in my academic career.

Dr. George H. Staab (e-mail: staab.1@osu.edu; phone: +1-614-292-7920)

- Associate Professor, Mechanical and Aerospace Engineering The Ohio State University
- ♦ W192 Scott Laboratory, 201 W. 19th Ave., Columbus, OH 43210

* Dr. Staab is the faculty adviser for the OSU FIRST robotics and engineering outreach group of which I was a four-year member and team leader.

 $\textbf{Dr. Clayton Daigle} \ (e\text{-mail: Clayton.Daigle@silabs.com}; \ phone: \ +1\text{-}512\text{-}532\text{-}5935)$

- Mixed-Signal Engineer, Silicon Laboratories, Austin, TX
- \star Dr. Daigle was my direct supervisor when I worked for National Instruments as an analog hardware R & D engineer.

More Information More information and auxiliary documents can be found at

http://www.tedpavlic.com/facjobsearch/.