



The University of Georgia

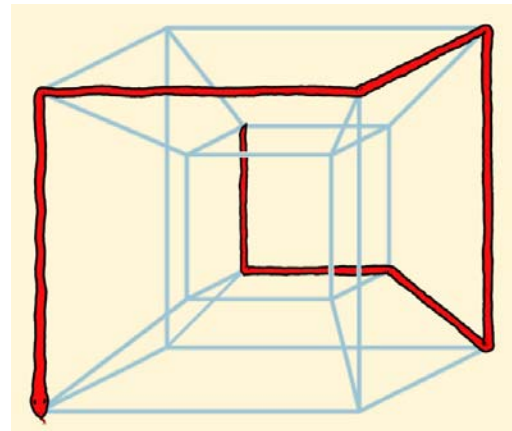
AI Newsletter

Institute for Artificial Intelligence
The University of Georgia
Athens, GA 30602-7415 U.S.A.

Fall 2009

Research Spotlight: Snakes on a Plane, or Cube, or Hypercube

For several years, the IAI has been a hotbed of snake-hunting activity. But don't worry, we don't hunt legless reptiles. The snakes that we hunt are special paths in an N-dimensional hypercube. The picture shows a 4-dimensional example. The search for snakes is known as the Snake-In-The-Box Problem (www.ai.uga.edu/sib).



A snake is a path along the corners of a hypercube. The path has to follow the edges of the cube. It also has to avoid ever coming back to a point that is separated by only one dimension from the points already on it.

Snakes are useful for binary coding. Consider a 3-dimensional cube of size 1. Its corners (vertices) have coordinates $\langle x,y,z \rangle$ such as $\langle 0,1,1 \rangle$, which you can treat as a binary number, 011. Any two consecutive binary numbers on the snake have to differ by only one digit. Further, any two numbers that differ by only one digit have to be consecutive. This leads to an error-checking code similar to a Gray code, but even more restricted and hence better at detecting errors.

How do you catch snakes? Beyond 7 dimensions, the search space is too large for exhaustive search, and heuristics have to be employed. Josh Griffin (M.S. in AI, Fall 2009) is the latest in a long line of AI students and faculty who have used genetic algorithms. Other important work has been done by AI students Darren Casella and Daniel Tuohy and UGA faculty members Don Potter, Bob Robinson, and Krys Kochut.

In fact, snake-hunting is a competitive sport with record-holders. Currently, the longest-known 10-, 11-, and 12-dimensional snakes were discovered at the IAI, but longer ones may be found any day. Check out the current record-holders at <http://www.ai.uga.edu/sib/records/>.

News: Industrial Associates Visit and Speak

IAI Industrial Associates Michael Jarus (Applied Systems Intelligence) and Paul Reavis (Partner Software) gave presentations about their companies at seminars for first-year master's degree students during fall semester. If you'd like to do the same, please contact us.

Letter from the Director

Welcome to our second newsletter! We hope you enjoy receiving the IAI Newsletter and keeping up to date on all our cool activities. Fall semester marked the return of abundant MSAI applicants and enrollees. Like other technology-related programs, we had been experiencing a decline in applicants and enrollees, but in Fall 2009, the trend reversed itself, and we expect the increase to continue. With increasing public awareness that artificial intelligence becoming more entwined in our day to day lives, we expect interest in the IAI to return to record levels. For example, keep an eye on holiday automobile TV commercials. You are likely to hear things like “new and improved AI” or “advanced intelligent management” in the commercials as automakers emphasize the features of their new line-up (especially, Lexus, Mercedes, Cadillac, BMW and other premium brands).



The budget is really the only distraction we’ve had to deal with lately, and it appears that more cuts are on the horizon. On the bright side, we’ve had a wave of students defending theses and graduating this semester. We expect the total number of MSAI graduates may reach 155 by the end of fall semester. We are especially pleased that the research reported in these theses accounts for a number of student co-authored publications. You can keep track of our graduates via the web page at http://www.ai.uga.edu/IAI/graduates_of_AI.htm.

Dr. Covington is to be commended for jump-starting the new Newsletter. I believe he has collected a very exciting batch of news items for this edition, so please read on, and let us know what you think about it. And, oh yes, Happy Holidays from the IAI!

– Don Potter
Director
Institute for Artificial Intelligence

News: Uchiyama Wins Award for “Smart Wheelchair”

AI master’s degree graduate Hajime Uchiyama received the 2009 UGA Graduate Student Excellence-in-Research Award for his work developing a “smart wheelchair.” Motivated by a blind wheelchair-bound freshman who required a full-time attendant, Uchiyama prototyped an alternative, a wheelchair that senses its environment and actively helps the driver avoid obstacles.

Recent Theses

For a copy of any thesis, e-mail shbrooks@uga.edu or see http://www.ai.uga.edu/IAI/graduates_of_AI.htm.

Max Martin, *Crop Yield Prediction Using Artificial Neural Networks and Genetic Algorithms*

Joshua Griffin, *Methods for Reducing and Evaluating Fitness Functions in Genetic Algorithms for the Snake-In-The-Box Problem*

Eric Drucker, *Exploring Applications of Extremal Optimization*

Research Spotlight: Who's Saying Bad Things About Whom?

How do fights break out? That's a critical question in international relations these days, and with the help of an NSF MINERVA grant, IAI faculty member Michael Covington is helping to figure it out.

Led by Stephen Shellman of the College of William and Mary, the project comprises six scientists at five institutions. Its goal is to integrate many sources of data and techniques of modeling, so that human "gut feelings" about international situations will be supplemented by empirically based mathematical models.



And that's where the AI comes in. Building on earlier work with Shellman, Covington and his team are using natural language processing software to monitor expressions of sentiment. The idea is to read newspapers and blogs automatically on the Web and track who supports, endorses, condemns, or opposes whom. It's like taking a poll, except that you can do it almost continuously and watch how the situation changes in response to events.

The MINERVA initiative is a joint venture of the National Science Foundation and the Department of Defense for collaborative projects addressing our national security needs. But Covington sees much wider applications for sentiment analysis – such as advertising and public relations.

Recent Publications and Presentations

Michael A. Covington, "How to Build a Lumpy Random Number Generator," 4th International Workshop on Plan 9, Athens, Georgia, 2009.

Frederick Maier and Donald Nute, "Well-Founded Semantics for Defeasible Logic," *Synthese*, in press.

W.D. Potter, E. Drucker, P. Bettinger, F. Maier, D. Luper, M. Martin, M. Watkinson, G. Handy, and C. Hayes, "Diagnosis, Configuration, Planning, and Pathfinding: Experiments in Nature-Inspired Optimization", in *Natural Intelligence for Scheduling, Planning and Packing Problems*, edited by R. Chiong, Springer-Verlag, Studies in Computational Intelligence (SCI) Series, 2009.

David Luper, Muthukumaran Chandrasekaran, Khaled Rasheed, and Hamid R. Arabnia, "Path Normalcy Analysis Using Nearest Neighbor Outlier Detection," IC-AI 2008: 776-783.

Liang Shi and Khaled Rasheed, "A Survey of Fitness Approximation Methods Applied in Evolutionary Algorithms", in *Computational Intelligence in Expensive Optimization Problems*, Springer-Verlag, to appear, accepted 2009.

Boseon Byeon and Khaled Rasheed, "Using Genetic Algorithms for Simultaneous Noise Removal and Feature Selection in Classification and Regression Problems", in Proceedings of the Int'l Conf. on Artificial Intelligence (ICAI'09), pp. 304 – 310, 2009.

Dongsheng Che, Cory Hockenbury, Robert Marmelstein and Khaled Rasheed, "Classification of Genomic Islands Using Decision-tree Based Algorithms", in Proceedings of The International Conference on Bioinformatics and Computational Biology (BIOCOMP'09), pp. 252 – 258, 2009.

Prashant Doshi and Piotr Gmytrasiewicz, "Monte Carlo Sampling Methods for Approximating Interactive POMDPs," *Journal of Artificial Intelligence Research (JAIR)*, Vol. 34: 297-337, 2009.

Prashant Doshi, Yifeng Zeng, Qiongyu Chen, “Graphical Models for Interactive POMDPs: Representations and Solutions,” *Journal of Autonomous Agents and Multiagent Systems (JAAMAS)*, Springer Publishing, Vol. 18(3):376-416, 2009.

Yifeng Zeng and Prashant Doshi, “Speeding Up Exact Solutions of Interactive Dynamic Influence Diagrams Using Action Equivalence,” Twenty-First International Joint Conference on Artificial Intelligence (IJCAI), pp. 1996-2001, Pasadena, CA, 2009.

D. L. Young, A. S. Goodie, and D. B. Hall, “Modeling the Impact of Control on the Attractiveness of Risk in a Prospect Theory Framework,” *Journal of Behavioral Decision Making*, in press.

N. Unsworth, J. D. Miller, C. E. Lakey, D. L. Young, J. T. Meeks, W. K. Campbell, and A. S. Goodie, “Exploring the Relation among Executive Functions, Fluid Intelligence, and Personality,” *Journal of Individual Differences*, in press.

Research Grants

NSF MINERVA, “Terror, Conflict Processes, Organizations, and Ideologies: Completing the Picture,” Stephen M. Shellman (project leader), Michael Covington (UGA PI), Ryan Bakker (UGA Co-PI), September 2009 – August 2011.

ARO, “Strategic State Estimation in Uncertain and Mixed Multiagent Environments,” Prashant Doshi (PI), Adam Goodie (Co-PI), Daniel Hall (Co-PI), Sept. 2009 – August 2012.

NSF CAREER, “Scalable Algorithms for Individual Decision Making in Multiagent Settings,” Prashant Doshi (PI), June 2009 – May 2014.

UGA Faculty Research Grant, “Knowledge Representation and Natural Language Processing for Architectural Discourse,” Stefaan Van Liefferinge (PI), Michael A. Covington (co-PI), Don Potter (co-PI), 2010.

How to Sponsor Research

As an industrial partner or associate of the IAI, there are four ways you can be involved in our research:

Collaboration, especially student projects. It doesn’t necessarily cost anything to work with us. We are always looking for good research topics, especially for master’s theses.

Sponsored research. You can contract with us through the University of Georgia Research Foundation (UGARF) to do research for your company. *We are always looking for research sponsors.*

Donations. If you don’t need confidentiality or a specific deliverable, you can simply make a gift to the IAI designated to support a particular research program. Donations are made through the Arch Foundation and are fully tax-deductible; contact us to make arrangements, or click on the “Support” button on www.ai.uga.edu.

Consulting. You can hire faculty members or advanced graduate students to work for you part-time as independent contractors. The University encourages this, within reasonable limits. It’s a good way to do a small project with a high level of confidentiality, but the consultant works privately, and you don’t get access to University facilities. Consulting projects often grow into sponsored research.

The AI Newsletter is published twice a year. For more information about the Institute’s activities, e-mail shbrooks@uga.edu or look at www.ai.uga.edu. Thanks for your interest!