The University of Georgia

# AI Newsletter

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

**Fall 2010**

## Research Spotlight: **Computers, Language, and Schizophrenia**

The IAI's CASPR research team has teamed up with Emory University to use computers to detect, analyze, and quantify abnormal speech in mental illness.

Emory's project is called ACES (Atlanta Cohort on the Early course of Schizophrenia) and is led by Dr. Michael T. Compton and Dr. Patrick Haggard. Its work is done at Grady Memorial Hospital.

CASPR has been a familiar name around the IAI since about 2001, when Michael Covington formed a research group at the IAI to study language in schizophrenia, initially funded by GlaxoSmithKline Plc. The CASPR group has already developed software tools to measure idea density, sentence complexity, and discourse disorganization, and is working on phonetic signs of schizophrenia. For more information see http://www.ai.uga.edu/caspr and http://psychiatry.emory.edu/aces_project.

## News: **Perdisci, Compton join IAI**

Dr. Roberto Perdisci of the UGA Department of Computer Science is the newest member of the AI Faculty. Dr. Perdisci's research area is machine learning and data mining as applied to computer security. We also welcome Dr. Michael T. Compton of George Washington University (formerly of Emory University) as an IAI Fellow. He leads the ACES Project described above.

## Research Spotlight: **Fuzzy Logic Controls Unmanned Aircraft**

Autonomous Unmanned Aerial Vehicles (UAVs) have been increasingly employed by researchers, commercial organizations, and the military to perform a variety of missions. In a conference paper currently under development, Yan Qu (MSAI candidate), Swetha Pandhiti (MSAI candidate), Kalesha Bullard (CS Ph.D. candidate), Don Potter (IAI faculty), and Karl Fezer (MSAI candidate) discuss the design of an autopilot for an autonomous UAV using a messy genetic algorithm for evolving fuzzy rules and fuzzy membership functions. This scheme satisfies the need for flexibility in terms of the consequents applied within the conditional statement framework used in the fuzzy rules, enabling the controller of a UAV to deal with uncertainty in both its internal state and external environment.

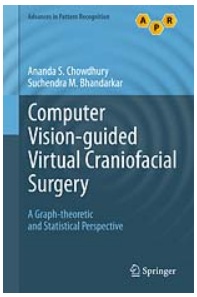
## Letter from the Associate Director

There already isn't enough room in this newsletter to tell you everything that's going on, so my editorial will be brief. As the economy comes back to life, the IAI is teeming with activity. Look for example at the bumper crop of publications and student research on the next three pages. To meet our expanding needs, UGA AI alumnus Dr. Fred Maier will teach Knowledge-Based Systems this spring, and Dr. Prashant Doshi will teach a special topics class, Decision Making Under Uncertainty.

There's no limit to the variety of things we do – this semester I found myself, on consecutive days, writing software to detect international incidents in the news, visiting a psychiatric ward to observe the speech of patients, and giving a radio interview about a UFO, which I identified as a meteor. And notice that I'm a co-author of a paper about the speech of a parrot. We don't get bored! Please stay in touch with us and join in any activities that interest you. And happy holidays!

Michael A. Covington
Associate Director
Institute for Artificial Intelligence

## Book: **Computer Vision-guided Virtual Craniofacial Surgery**




Planning reconstructive surgery is essentially a matter of analyzing and planning alterations to a three-dimensional image. UGA IAI Faculty Fellow Dr. Suchendra Bhandarkar and his former Ph.D. student Dr. Ananda Chowdhury have authored a book on their research, *Computer Vision-guided Virtual Craniofacial Surgery,* to be published by Springer in April 2011. Theirs is one of the first attempts to model the problem of reconstructive surgery from a graph-theoretic and statistical perspective. More information is available at:
http://www.springer.com/computer/image+processing/book/978-0-85729-295-7

## Research Spotlight: **How People Reason Strategically**

Research led by an IAI Faculty Fellow shows that people can reason about future moves in a game much more adeptly than was previously thought. "In fact, they do it fairly easily and automatically," said Adam Goodie, head of the Georgia Decision Lab at UGA, "if the game is one that is simple and engages the tendency to pay attention to competition."

The study was published in the *Journal of Behavioral Decision Making.* Co-authors are Prashant Doshi, also an IAI Faculty Fellow, and Diana Young, now of Georgia College and State University. (She was at UGA when the study was done.)

To find out how well people can think about steps beyond the current one, Goodie and his colleagues set up an experiment in which student participants played a game against a computer. Contrary to previous literature, those in the experiment easily learned to think as many as four steps ahead.

The research at UGA was supported by the U.S. Air Force.

## News: **CPIDR is now CPIDR®**

The name of CPIDR (pronounced "spider,") the IAI's software package for measuring idea density in samples of written English, is now a registered trademark and the University of Georgia Research Foundation is looking to license it commercially. Originally designed to detect early signs of Alzheimer's disease in people's speech, it has also proved useful for distinguishing introductory from advanced written texts about a given subject, and it has other uses in both psycholinguistics and document classification. CPIDR version 3 was distributed free; CPIDR 5, substantially improved, is almost ready. Send inquiries to mc@uga.edu.


## Research Spotlight: **Neural Network Identifies Authors**

AI graduate student Charles Hollingsworth has shown that you can distinguish authors by their grammatical preferences. He used a dependency parser to count frequencies of grammatical constructions, then trained a neural network to classify essays in the *Federalist Papers* papers by author (Madison or Hamilton). His results will be presented at the Linguistic Society of America's annual meeting in January 2011.

## Research Spotlight: **Optimization of Timber Cutting**

In another paper under development, new MSAI graduate Philip Brooks and faculty member Dr. Don Potter examine the poor performance of Discrete Particle Swarm Optimization when applied to forest planning, a combinatorial optimization problem in which the goal is to maintain an even flow of timber from a forested area of multiple plots over several time periods while cutting each plot no more than once and no two adjacent plots within the same period. They suggest an alternative priority representation using Particle Swarm Optimization with real numbers and justify it with experimental results. For a copy of Philip Brooks' just-completed thesis on this subject, e-mail shbrooks@uga.edu.

## Research Spotlight: **How Do You Know Where You Are?**

CS doctoral candidate B. J. Wimpey and IAI director Don Potter are preparing a paper on location recognition by robots – and it's not too different from the art of recognizing fingerprints. Their system encapsulates various visual feature "ridges" into location "fingerprints" to be stored in a topological map. One of the ridge features used in this project is SIFT, the Scale Invariant Feature Transform. SIFT is a powerful feature extractor, adding to the system the ability to recognize interesting locations with its keypoints. SIFT is complemented with other machine vision techniques, including object recognition, straight line segment detection, color histograms and text recognition. Wimpey and Potter call the system SPLINTR, Spatial PLace recognition IN a Topologically mapping Robot.

## **Recent Publications**

Bettinger, P. 2010. An overview of methods for incorporating wildfires into forest planning models. Mathematical and Computational Forestry & Natural-Resource Sciences. 2(1): 43-52.

Byeon, Boseon, and Khaled Rasheed, "Bayesian Networks and Genetic Algorithms for Promoter Recognition," to appear in Proceedings of the IASTED International Conference on Computational Bioscience (Compbio 2010), 2010.

Byeon, Boseon, and Khaled Rasheed, "Selection of Classifier and Feature Selection Method for Microarray Data," to appear in Proceedings of the Ninth International Conference on Machine Learning and Applications (ICMLA 2010), 2010.

Che, Dongsheng, C. Hockenbury, R. Marmelstein, and Khaled Rasheed. Classification of genomic islands using decision trees and their ensemble algorithms, to appear in BMC Genomics, accepted 2010.

Colbert-White, Erin N.; Covington, Michael A.; and Fragaszy, Dorothy. An African Grey parrot's vocalization varies across social context. Accepted by Journal of Comparative Psychology.

Ebell, M. H. (2010). AHRQ White Paper: Use of clinical decision rules for point-of-care decision support. Medical Decision Making, 30(6),712-21.

Ebell, M. H., and Cervero, R. M. (2010). Clinical questions at the point of care: implications for learning and continuing education. OT Practice, 15(10), 7-8.

Elvevaag, Brita; Wynn, R.; and Covington, Michael A. Meaningful confusions and confusing meanings in communication in schizophrenia. Accepted by Psychiatry Research.

Goodie, Adam S.; Doshi, Prashant; and Young, Diana L. 2010. Levels of theory-of-mind reasoning in competitive games. Journal of Behavioral Decision Making (in press).

Li, R., and P. Bettinger. 2010. Assessing forest fragmentation in southern U.S. industrial forest plans that accommodate different clearcut size restrictions. Journal of Forest Planning. 15(2): 81-98.

Li, R., P. Bettinger, and K. Boston. 2010. Informed development of meta heuristics for spatial forest planning problems. The Open Operational Research Journal. 4: 1-11.

Li, R., P. Bettinger, and A. Weiskittel. 2010. Comparisons of three different methods used to generate forest landscapes for spatial harvest scheduling problems with adjacency restrictions. Mathematical and Computational Forestry & Natural-Resource Sciences. 2(1): 53-60.

Mahamuda, Vasim, ManChon U and Khaled Rasheed, "Application of Machine Learning Algorithms for Binning Metagenomic Data," in Proceedings of the International Conference on Bioinformatics and Computational Biology (BIOCOMP 2010), pp. 68 – 74, 2010.

ManChon U, and Khaled Rasheed, "A Relative Tendency Based Stock Market Prediction System," to appear in Proceedings of the Ninth International Conference on Machine Learning and Applications (ICMLA 2010), 2010.

ManChon U, Vasim Mahamuda, and Khaled Rasheed, "On the Scalability of Supervised Learners in Metagenomics," to appear in Proceedings of the Ninth International Conference on Machine Learning and Applications (ICMLA 2010), 2010.

Oliwa, Tomasz, and Khaled Rasheed, "A Machine Learning Approach for Sensitivity Inference in Genetic Algorithms," in Proceedings of the 2010 Int'l. Conf. on Genetic and Evolutionary Methods (GEM'2010), pp. 36 – 41, 2010.

Qian, Bo, and Khaled Rasheed, "Foreign Exchange Market Prediction with Multiple Classifiers," Journal of Forecasting, 29(3), pp. 271 – 284, 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, donations, sponsored research** (where you hire UGA to do work for you), and **consulting** (where you hire individual faculty members or students). The University welcomes all four kinds of support. We also invite all industrial partners and associates to **come and visit us** and speak with groups of students. This is your "inside track" to recruiting. **Stay in touch!**

The University of Georgia

*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!*