From Tanzania to U

CSE professors collaborate with U ecologists to analyze chimpanzee research data

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Dr. Jane Goodall with an orphan Chimpanzee at the Tchimpounga Sanctuary in the Republic of Congo.

By Robyn White

In the lush tropical forest of Tanzania's Gombe National Park, famed chimpanzee expert Dr. Jane Goodall and her research team spent decades documenting chimpanzee behavior and habitat. Researchers there are still following chimpanzees daily, recording their travel, food choice, interactions with other chimpanzees, and geographical data.

Far from the forest, the products of this work — 46 years worth of paper-based maps, hand written checksheets, notes, video, and satellite images — have found a home at the Jane Goodall Institute's Center for Primate Studies (JGI-CPS), on the University of Minnesota's St. Paul campus.

While Goodall's research in Gombe and her outreach efforts have given the world a better understanding and appreciation for chimpanzees, University ecologists and computer scientists teamed up to find new ways to use the data. They are analyzing

the data for patterns in everything from female grouping habits to male aggression and mating habits relating to the Simian Immune Deficiency Virus (SIV). They are also constantly seeking new research techniques and areas of study.

CSE Professors Shashi Shekhar and Jaideep Srivastava have worked with their students for nearly five years on two of the University center's projects. CSE Professor John Carlis and his students also helped set up a database of the behavioral data for the center in the late 1990s. Dr. Anne Pusey, director of the University primate center, said interdisciplinary collaborations with CSE have been very helpful in understanding the chimpanzee data.

For one of the current projects CSE graduate student Mete Celik created a searchable database prototype that would organize more than 600 hours of chimpanzee video footage from the Jane

Goodall Institute's (JGI) Videographer Bill Wallauer. The video database is housed in the University's Digital Technology Center (DTC).

Celik explained how the technology works in a presentation to Goodall when she visited the University center in March. "It's kind of a Google-like search engine," he said. A chimpanzee's name and behavior can be entered to retrieve the corresponding video clips. Eventually the researchers would like to make the database into a searchable library that allows users to add their own perceptions of the research material.

"Years and years and years of data is being computerized, so that questions that I used to ask which entailed going back through file after file after file by hand, can now be found very quickly by pressing buttons. It's quite extraordinary," Goodall said in a campus press conference. "It

makes me very jealous, because I could have done so much. We didn't have some of these technologies back then."

The other CSE related project focuses on analyzing the data. For this project, behavioral ecology doctoral student Carson Murray used Shekhar and Srivastava's expertise in temporal, spatial, and spatio-temporal data mining to study patterns and commonalities in female chimpanzee relationships and location behavior. CSE graduate student Sandeep Mane also worked on this project.

Srivastava said they discovered patterns in female chimpanzee association and location behavior that revealed the importance of dominance. In her presentation to Goodall, Murray said she found that a high dominance rank equals an increased loyalty to core areas in the wild. Core areas are specific territories occupied by a chimpanzee. "[CSE researchers] helped me to come up with a way to look at these point patterns," she said, adding that she's now looking at male core areas. "They are very much driven by food. It looks like they inherit their mother's core area," Murray said.

Shekhar said his CSE collaboration with the University primate center started in 2002 when Pusey approached the DTC seeking collaborators for the project. Andrew Odlyzko, director of the DTC, helped facilitate the research partnership, funded by the DTC and later the National Science Foundation (NSF). Srivastava said these projects appealed to them because they had tremendous opportunity for data analysis. "Data mining is suited for exploration," he added.

Shekhar and Srivastava said they have been amazed at the information gleaned from the data so far. "To me personally, it's fascinating," Srivastava said. "I learned how similar chimpanzee behavior is to human behavior." Pusey said this is a common realization. "Because chimps are our closest relatives, we're always thinking about their similarities and differences," she said.

Pusey, who studied in Gombe with Goodall in the 1970s, said computer

scientists have proved helpful in both organizing the data and analyzing it. "Computer Science can bring interesting new ways of understanding factors that control group composition and size and even disease transmission," Pusey said.

While work is still ongoing for these two projects, new areas of study are being discussed. "We're interested in the different types of social bonds you see in the [chimpanzee] community," Pusey said.

JGI funds the long-term field work at Gombe. The University center work is funded by NSF, the National Institutes of Health (NIH), and a private grant from Milton Harris. Pusey said she is continuously working on fund raising and hopes that JGI will partner with the center on future fund-raising initiatives.

On her visit to campus, Goodall touted the value in the University center's work and expressed hope for future study of the data. "It means that years and years and years of blood and toil, crawling through the forest, being scratched by thorns, having your hair caught, is put down on these bits of paper and is now amazingly is being amalgamated and will be useful to students all over the world," she said.
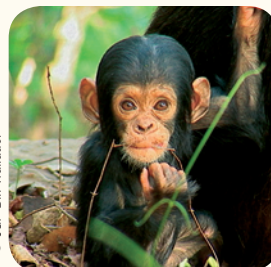
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Infant chimpanzee Taurus at Gombe National Park.

Understanding Spatio-Temporal Data Mining

Most of the work done by ecologists on the chimpanzee research data relates to using statistical techniques to prove various hypotheses. In these University projects, CSE Professors Shekhar and Srivastava apply temporal, spatial, and spatio-temporal data mining techniques to identify patterns and pull out desired information.

Shekhar said that classical data mining techniques fail when studying this type of data, because it's assumed that each chimpanzee observation is independent from others. But spatio-temporal data mining accounts for auto-correlations. Through using these techniques, CSE researchers are helping University ecologists gain a new understanding of chimpanzee behavior, identify new patterns, and are able to find new ways to look for hypotheses.

(From left to right) CSE Professor Shashi Shekhar, CSE doctoral student Mete Celik, Dr. Jane Goodall, and CSE Professor Jaideep Srivastava.

SOUNDBYTE

FIGHTING HIV IN CYBERSPACE

CSE Professor Joe Konstan and U epidemiologist use the Internet to help prevent HIV

By Robyn White

University of Minnesota researchers are finding new ways to save lives using computer science. CSE Professor Joseph Konstan and B. R. Simon Rosser, a University professor in the Division of Epidemiology and Community Health, have been working for more than five years to create computer systems to help prevent the spread of HIV, the virus that causes AIDS.

Konstan worked with Rosser and a team of scientists from across the University to develop an online assessment of the risks undertaken by men seeking sex with other men through online venues. Konstan and the team are also developing an online intervention program designed to reduce sexual risk-taking and sexually-transmitted infections. Testing of the prevention software program started in June.

Rosser said using the Internet for prevention is essential, because sex is the most popular use for the Internet among high-risk, hidden populations, like gay men — still the highest risk group for HIV. "If we don't do [HIV prevention outreach] right or in a way that's most responsive, we're going to have new HIV epidemics. There's enormous urgency in addressing HIV prevention gaps," he said.

Rosser, program director for the HIV/STI Intervention and Prevention Studies (HIPS), said his work with Konstan formed out of a discussion on ways to stop AIDS in the world using computers. That conversation ignited the first step in what has become a multi-phased, interdisciplinary project called the Men's Internet Study (MINTS),

CSE Professor Joe Konstan reviewing HIV online prevention software.

researching the behavior and patterns of men who use the Internet to seek male sexual partners.

"At the time it was a fairly ambitious program," Konstan said. Phase I of the study entailed building an online survey in which each question is determined by the user's previous answers. The study targeted Latino men, because they are one of the highest risk groups for HIV, so the survey was made available in Spanish and English. Volunteers were reached by advertising through the Web site www.gay.com, which Rosser said boasts three million users.

"Joe's role is to help us identify what we should be measuring, what we should be capturing," Rosser said. He said Konstan also looks at the validity of the survey and for patterns in the survey results.

INSIDE

SAVE THE DATE!
CSE Open House
Friday, Oct. 5, 2007

Awards

Faculty Achievements

The CSE department is proud to announce that the National Science Foundation (NSF) has awarded CSE Assistant Professors **Abhishek Chandra** and **Stergios Roumeliotis** the CAREER Award. This award is the most prestigious honor given to new faculty, recognizing those likely to serve as academic leaders later in their careers. These two new awards mark the 14th CAREER awards won by CSE junior faculty over the past 11 years.

CSE Assistant Professor **Tian He** and Electrical Engineering student Qingquan Zhang won the Best Paper Award at the International Conference on Mobile Ad Hoc and Sensor Networks (MSN 2006) for their paper, "Gradient-Driven Target Acquisition in Wireless Mobile Sensor Network."

The Institute of Technology Student Board (ITSB) named CSE Assistant Professor **Nick Hopper** winner of the 2007 Best Professor Award for the CSE department. The ITSB selects a recipient for this award from every IT department each spring. Selection is based on a student poll.

CSE Professor **Wei-Chung Hsu** received the collegiate Charles E. Bowers Faculty Teaching Award for 2006-2007. The award honors Institute of Technology professors who have demonstrated an outstanding commitment to teaching.

The American Association for the Advancement of Science (AAAS) has awarded the distinction of AAAS Fellow to CSE Department Head and William Norris Professor **Vipin Kumar** for his superior work in data mining and high performance computing.

CSE Professor **Nikolaos Papanikolopoulos** has been awarded the distinction of IEEE Fellow. IEEE honored Papanikolopoulos with the title of fellow for his contributions to robotics and the creation of the Scout robot. He is the sixth CSE faculty member to receive this honor. Papanikolopoulos has also been named one of the 2007 Distinguished McKnight University Professorship recipients for his work in, 'Robotics and Vision-Based Algorithms – Breaking New Frontiers.' The University of Minnesota Graduate School selects Distinguished McKnight Professorship recipients as a way to highlight and reward the most notable faculty members at the mid-career level.

CSE Professors **Yousef Saad** and **Zhi-Li Zhang** were both awarded endowed chairs on Jan. 1, 2007. Saad is now a William Norris Land Grant Chair in Large-Scale Computing, along with CSE Department Head, Vipin Kumar. Zhang is a Qwest Land Grant Chair in Telecommunications.

The University of Minnesota awarded CSE Assistant Professor **William Schuler** a McKnight Land-Grant Professorship for 2007-2009. The professorship is reserved for select junior faculty members who have the potential to make significant contributions to their fields.
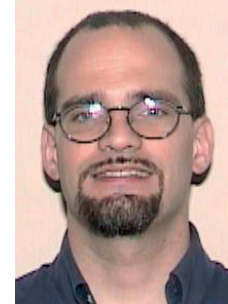
The IEEE Computer Society awarded CSE Professor **Shashi Shekhar**, a Distinguished McKnight University Professor, with a Technical Achievement Award for his innovative work on spatial storage methods for road maps. Shekhar has also been selected to serve on the National Academies' Mapping Science Committee from 2007-2010. This committee provides oversight for the National Research Council's studies, which gives direction to government agencies on geospatial science, technology, and policy issues.

CSE ranks high for citation impacts of published research papers

Science Watch, a subscription newsletter that tracks research trends and performance, ranked the University of Minnesota's CSE department ninth in the nation for the citation impact of published research papers among the top 100 federally funded universities. The department's papers were measured between 2001 and 2005. The source for the ranking is Thomson Scientific University Science Indicators, the company that publishes *Science Watch*. Rankings were published in the January/February 2007 issue.