june 2011

FACULTY newsletter

CPMS Physical and Mathematical Sciences

ABOVE Dr. Dan Olsen

Making the Calls With Interactive Sports TV

Ever wish you could watch Jimmer Fredette from every angle?

According to Dr. Dan Olsen, that wish could come true in the near future.

Olsen, a professor in the Computer Science Department, recently published a paper about sports on Internet television. Olsen and his team researched new software which creates more options for sports viewers. The software he developed, based on the Move Networks platform, allows viewers to change camera angles, repeat the last play or skip ahead.

"We are exploring new ways for people to interact with their television experience," Olsen said.

Unlike any options currently on the market, Olsen's software allows viewers to select the angles of the game. By capturing all of the camera feeds and uploading them to a web server, these angles are available live.

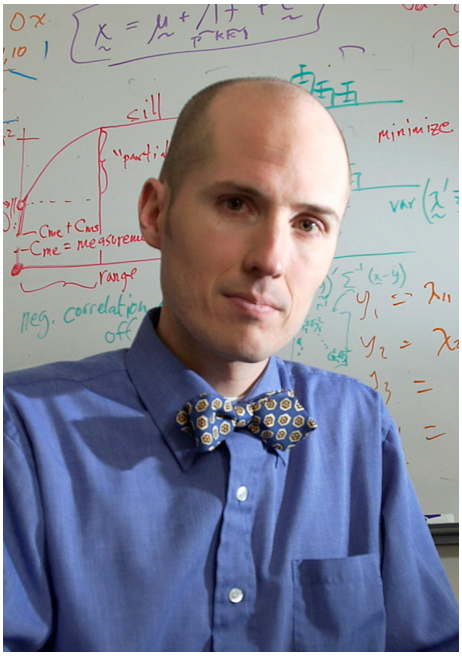
Fans will use a basic game controller to manage their experiences with the click of a button.

This software takes Digital Video Recording (DVR), which is now used in many households, to an entirely new level. As opposed to simply fast-forwarding to the next play, those utilizing Olsen's software would be able to immediately skip ahead to a specified point in playback.

For example, instead of watching BYU quarterback Jake Heaps set up plays this fall, viewers would have the option of pressing the "skip" button, which would jump forward to the glorious tackles and touchdowns.

This new software scores major points for interactivity. Next winter, if senior basketball stars Noah Hartsock and Charles Abouo make an especially

Continued on page 3



BYU Photo

ABOVE Dr. William Christensen

Heating Things up With Statistical Tools

Global climate change seems to cause a heated debate nearly every day in Congress. Many argue about its origins and effects without knowing that most of the research involved in understanding global climate change requires statistics.

"Many environmental problems are inherently statistical problems," said William Christensen of the BYU Department of Statistics. "Any time you look at a set of numbers over the years you will see trends; environmental statistics is really about pulling out important signal from the noise that is embedded in any environmental data."

Environmental statisticians like William Christensen focus their research on variables that affect the environment, such as air quality, pollution, and temperature. In his upcoming publication in the journal Biometrics, Christensen provides a new method for estimating trends in spatial data, and illustrates the approach in modeling climate.

His new method involves kriging – predicting climate variables at geographical locations based on data gathered from neighboring locations. For example, kriging could be used to calculate the temperature in Provo from temperatures gathered from surrounding cities.

Christensen's research uses statistical processes to weight data according to accuracy. This optimizes spatial prediction when variability exists. In the local example, his method would focus on how to predict the temperature in Provo when the individual thermometers at surrounding cities do not have the same level of trustworthiness.

The research Christensen has done throughout his career is often targeted toward answering specific questions, but this paper's purpose was to be a tool for future researchers.

"As a statistician, I sometimes am involved in specific scientific questions, but

Continued on page 2

BYU Photo

ABOVE Dr. Branton Campbell & Dr. Harold Stokes

Rank & Status Advancements

Candidacy for CFS

- Scott Burt, Chemistry & Biochemistry
- Jay McCarthy, Computer Science
- Paul Jenkins, Mathematics
- Karine Chesnel, Physics & Astronomy
- Shannon Neeley, Statistics

CFS & Advancement to Associate Professor

- Daniel Austin, Chemistry & Biochemistry
- Jaron Hansen, Chemistry & Biochemistry
- Eric Ringger, Computer Science
- Scott Hendrickson, Mathematics Education
- Keith Leatham, Mathematics Education
- Kent Gee, Physics & Astronomy

Advancement to Professor

- Mark Clement, Computer Science
- Michael Dorff, Mathematics
- Robert Davis, Physics & Astronomy
- Gus Hart, Physics & Astronomy (also recieved CFS)

Taking Group Theory to the Crystallographers

Crystallographers spend their time solving problems and answering questions about much more than crystals. Using x-ray and neutron diffraction data, they work to determine the arrangement of atoms within solid specimens – an act of detective work that is far from easy.

Crystallographers, also referred to as structural scientists, can have backgrounds in chemistry, physics, geology, material science, biology or other sciences. No matter the field though, all crystallographers encounter difficulties with the samples they are studying.

Drs. Branton Campbell and Harold Stokes of the Department of Physics and Astronomy recently developed a web application for crystallographers that helps them solve and interpret crystal symmetry changes occurring during phase transformations. Their web application interfaces with commercial software to solve the atomic structures of crystals from x-ray diffraction data using group theory.

Group theory is an abstract mathematical construct that explains the behavior of repeating mathematical groups. Although group theory is used widely in many fields, it is somewhat foreign to many crystallographers who find group theory difficult to use. This provided an opportunity for Campbell and Stokes. Campbell, a material scientist himself, collaborated with Stokes, a computational physicist who had studied algorithms for 25 years, to develop the new web application.

"When I found out Harold was a leader in the field, I told him, 'You've got really neat stuff here, but the tools are too hard to use,'" Campbell said. "Collaboration took off from there."

In the past, software of this nature required users to type in commands from a keyboard. By contrast, the application developed by Campbell and Stokes presents a friendly graphical user interface (GUI), such as those now commonly used in computers and iPods.

"The application lets others use group theory without actually requiring knowledge of it," Stokes said. "This allows exploration of the difficult concept in a friendly atmosphere."

For crystallographers, GUIs with drop down boxes and choices are much easier to use than command software. If errors arise, crystallographers can go back and change their selections without having to worry about inputting the wrong text.

Traveling to various corners of the world, Campbell and Stokes have contributed to several crystallography workshops. In May, scientists from around the world gathered in New Orleans, La. to hear a presentation by Campbell and Stokes at the Annual Meeting of the American Crystallography Association.

"We show them how to use the software and get feedback about what they don't understand," Stokes said.

The two have also presented the software to crystallographers in Lekeitio, Spain; Osaka, Japan; and Florence, Italy. Later this year, they will present in Madrid, Spain and Karlsruhe, Germany.

"Interest is definitely picking up," Dr. Campbell said. "Lots of people are interested because now we have made [group theory] accessible."

by: Alysa Hoskin

Statistical Tools continued from page 1

I also work on building 'hammers,'" he said. "I build tools for people who are working on their own projects or questions in a wide variety of areas."

His new method will likely serve geologists, statisticians, ecologists and scientists from other areas as well. Using climate data on the Hudson Strait in northern Canada, Christensen demonstrated the utility of his new approach. He used kriging with the location-specific measurement error taken into account for this set of data. Christensen's new kriging approach is becoming known as a successful, improved predictor in climate modeling.

Research like his will assist other scientists in pursuing questions about global climate change.

"Hopefully it really affects how people do research in a variety of areas," he said.

by: Alysa Hoskin

College Grants

Mathematics

Jessica Purcell
Sponsor: Sloan Foundation
Title: Sloan Fellowship

Physics & Astronomy

Tim Leishman & Scott Sommerfeldt
Sponsor: Caterpillar, Inc.
Title: "Advanced Acoustic Modeling"

Announcements

New Associate Chairs

- John Lamb, Chemistry & Biochemistry, replacing Steven Goates
- Dan Siebert, Mathematics Education, replacing Blake Peterson

Olsen continued from page 1

momentous play, Dr. Olsen's software would allow viewers to relive the moment with the click of just one button and then view the play from several different camera angles.

Olsen's software was tested on several BYU sports games.

"We showed that our software can handle any [two-opponent] sport and provide a consistent viewing interaction experience," he said. "Our data also showed that viewers interacted with the software every 20 seconds on average; thus they are highly engaged with their viewing experience."

Combining these new options of skipping forward, backward and changing angles, Olsen's research found that many viewers enjoyed acting like a referee, replaying and deciding the calls for themselves. Rather than using the software as a time saver, most people actually spent more time watching sports.

"Internet TV is definitely the wave of the future," Olsen said, "Interactive experiences like our sports work will become normal within 10 years."

That should give BYU sports fans something to rise and shout about.

by: Alysa Hoskin

College Publications

Chemistry and Biochemistry

D. Henderson, S. Lamperski, "A Simple Description of the Capacitance of a High Concentration Electrolyte", Journal of Chemical and Engineering Data, 2011, volume 56, pp. 1204-1208

D. Mortensen, D. Dearden, "Influence of Charge Repulsion on Binding Strengths: Experimental and Computational Characterization of Mixed Alkali Metal Complexes of Decamethylcucurbit[5]uril in the Gas Phase", Chem. Commun., 2011, volume 47, pp. 6081-6083

T. Nagy, M. Valisko, D. Henderson, D. Boda. "Behavior of 2:1 and 3:1 Electrolytes at Polarizable Interfaces", Journal of Chemical and Engineering Data, 2011, volume 56, pp. 1316-1322

P. Nge, W. Yang, J. Pagaduan, A. Woolley, "Ion-permeable Membrane for On-chip Preconcentration and Separation of Cancer Market Proteins", Electrophoresis, 2011, volume 32, pp. 1133-1140

A. Pearson, E. Pound, A. Woolley, M. Linford, J. Harb, R. Davis. "Chemical Alignment of DNA Origami to Block Copolymer Patterned Arrays of 5 nm Gold Nanoparticles", Nano Letters, 2011, volume 11, pp. 1981-1987

A. Quast, F. Zhang, M. Linford, J. Patterson, "Back-Surface Gold Mirrors for Vibrationally Resonant Sum-Frequency (VR-SFG) Spectroscopy Using 3-Mercaptopropyltrimethoxysilane as an Adhesion Promoter", Applied Spectroscopy, 2011, volume 65, pp. 634-641

C. Snow, L. Martineau, R. Hilton, S. Brown, J. Farrer, J. Boerio-Goates, B. Woodfield, R. Watt, "Ferritin Iron Mineralization Proceeds by Different Mechanisms in MOPS and Imidazole Buffers", Journal of Inorganic Biochemistry, 2011, volume 105, pp. 972-977

P. Stewart, L. Rodriguez, D. Ess, "Electron Correlation and the Stability of Substituted Alkenes", Journal of Physical Organic Chemistry, 2011, volume 24/issue 5

D. Walker, H. Vollmer-Snarr, D. Eberting. "Ocular Hazards of Blue-light Therapy in Dermatology", Journal of the American Academy of Dermatology, 2011

F. Yang, D. Dearden, "Gas Phase Cucurbit[n]uril Chemistry", Israel Journal of Chemistry, 2011, volume 51, pp.1-8

M. Yu, Q. Wang, J. Patterson, A. Woolley, "Multilayer Polymer Microchip Capillary Array Electrophoresis Devices with Integrated On-chip Labeling for High-throughput", Analytical Chemistry, 2011, volume 83, pp. 3541-3547

Computer Science

T. Sederberg, H. Lin, X. Li, "Curvature of Singular Bezier Curves and Surfaces", Computer Aided Geometric Design, 2011, volume 28/issue 4, pp. 233-244

Physics & Astronomy

A. Pearson, E. Pound, A. Woolley, M. Linford, J. Harb, R. Davis. "Chemical Alignment of DNA Origami to Block Copolymer Patterned Arrays of 5 nm Gold Nanoparticles", Nano Letters, 2011, volume 11, pp. 1981-1987

C. Snow, L. Martineau, R. Hilton, S. Brown, J. Farrer, J. Boerio-Goates, B. Woodfield, R. Watt, "Ferritin Iron Mineralization Proceeds by Different Mechanisms in MOPS and Imidazole Buffers", Journal of Inorganic Chemistry, 2011, volume 105, pp. 972-977

Statistics

D. Allison, R. Wilcox, K. Ellefsen, C. Askew, D. Hansen, J. Wilcox, S. Sandoval, D. Eggett, Y. Yanagawa, S. Steffensen, "Mefloquine Effects on Ventral Tegmental Area Dopamine and GABA Neuron Inhibition: A Physiologic Role for Connexin-36 Gap Junctions", Synapse, 2011, volume 65/issue 8, pp. 804-813

J. Lawson, S. Henderson, J. Peterson, "Model-Robust Choice Experiments: Discussion and Case Study", Quality and Reliability Engineering International, 2011, Wiley Online Library, http://onlinelibrary.wiley.com/doi/10.1002/qre.1225/full

M. Weitze, J. McGhee, C. Graham, D. Dewey, D. Eggett, "Variability in L2 Acquisition across L1 Backgrounds", Proceedings of the 2009 Second Language Research Forum, Cascadilla Proceedings Project, 2011, pp. 152-163