The Link

NEWS FROM Information and Telecommunication Technology Center

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ITTC Receives Bioinformatics Grant

University of Kansas researchers have received a $2.1 million, two-year grant from the Department of Defense (DoD) to develop innovative software tools to benefit life-sciences research. The software will decrease the time between acquiring information and using it to solve complex problems, such as those found in developing chemical and biological defenses or detecting a chemical or biological attack.

The transformation of raw laboratory data into knowledge is fueling rapid advancements in understanding what drives extraordinarily complex life processes. Researchers are creating computational tools to extract the most knowledge possible from growing life-sciences data sets, such as those describing genes and proteins. Unfortunately, these data sets are generated independently based on diverse research methodologies, such as molecular biology or pharmaceutical purposes. But each set constitutes an additional piece of the puzzle from symptom discovery to development of effective treatments.

"Integrating data from a variety of databases allows researchers to see a bigger picture by putting the pieces of the puzzle together," said **Victor Frost**, director of ITTC.

ITTC researchers are building software to facilitate integrated analysis of information from multiple databases. Currently, scientists must move their data from one program to another manually, reformatting the information each time. This process is error prone and tedious. Manual processing is not conducive to tracking the origin and previous manipulations performed on the data. Further, it is not suitable for comparing computational methods or optimizing processing. ITTC researchers are creating a comprehensive framework that will address these issues, Frost said.

The project will benefit research conducted in the KU School of Pharmacy, Department of Chemistry, and Department of Molecular Biosciences, among others. ■

Life Sciences' Backbone Developed

Scientists have only begun deciphering the highly complex biological systems that will lead to the discovery of new drugs, improvements in agriculture, and advancements in numerous other areas. Deriving the greatest possible benefit from the data from biological systems poses one of the most significant challenges of the modern era.

ITTC researchers are using information technology, including advanced computational methods, to transform data into useful information. To foster the development and applications of this needed technology, ITTC is building a computing infrastructure aimed at creating the next generation of algorithms and information integration methodologies required to continue advances in life sciences.

When the infrastructure is completed, researchers will have access to massive data storage—20 terabytes, the equivalent of 25,000 copies of the Encyclopedia Britannica—and will have processing capabilities equivalent to those possessed by nearly 100 powerful desktop computers working in unison. All of a $492,000 grant from the federal Health Resources and Services Administration is being used toward the deployment of this infrastructure.

"Increased storage in combination with faster processing will facilitate turning new data into knowledge of biological systems," said **Victor Frost**, ITTC director. ■

Director's News


Director Victor Frost

In March, ITTC is part of a group representing the University of Kansas at "KU in the Capitol Day." We are proud to show legislators and other Kansans how the Center serves the State. ITTC is the only Kansas Technology Enterprise Corporation (KTEC) Center of Excellence that focuses on information technology and telecommunications. ITTC is one of five KTEC Centers of Excellence, located at state universities, that conduct basic and applied industry-led research, providing the foundation for new products and technologies.

ITTC works with corporations of every size from global organizations to small start-up companies. We have a relationship of over 10 years with Sprint that includes four U.S. patents. A Lenexa-based company, Rush Tracking Systems, and the RFID Journal have chosen to partner with the Center to develop the RFID Alliance Lab. The non-profit research facility provides unbiased performance information on radio frequence identification (RFID) devices for industry. RFID tags are microchips that contain tiny antennas, allowing products to be tracked anywhere in their supply chain. The Lab published its first report in November, and the second report is due out this month. The RFID Lab article, on page 3, highlights the Center's continuing testing of the technology. Cadstone, featured on page 4, represents another example of how we transfer technology from our laboratories to the marketplace. This KU start-up company develops tools for the system design language Rosetta. Rosetta allows different subsystems within complex electronics such as computers to interact with one another.

Industry recognizes the ability of our researchers. IBM recently awarded **Ron Sass**, research assistant professor, a $20,000 Faculty Award. Sass is improving embedded systems, a combination of computer hardware and software, that are found in everything from automobiles to vending machines. For more on Sass's work, please see page 3.

Our expertise in bioinformatics, information technologies, telecommunications, and radar and remote sensing positions ITTC as an instrument for economic growth in Kansas. ■

Information and Telecommunication Technology Center
A KTEC Center of Excellence at The University of Kansas

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ITTC Welcomes Bioinformatics Researchers

Jianwen Fang recently joined the Center as a research assistant professor. Fang has been a bioinformatics specialist in KU's Bioinformatics Core Facility since July 2002. His research interests include genomic data analysis, protein-protein interaction prediction, biomolecular simulation, protein homology modeling, machine learning and statistics in bioinformatics and cheminformatics, and software development. Fang earned his Ph.D. in chemistry and master's in computer science at Wayne State University.


Jianwen Fang

Xue-wen Chen, assistant professor in electrical engineering and computer science, is working with two new postdoctoral researchers. **Huilin Xiong** received his Ph.D. degree, majoring in pattern recognition, from China's Huazhong University of Science and Technology in 2000. He spent one year at the Chinese University of Hong Kong as a researcher and then joined Concordia University in Canada as a postdoctoral fellow. Xiong's research interests include pattern recognition, machine learning, and image processing.


Huilin Xiong

Jiangsheng Yu is the second new postdoctoral researcher in bioinformatics. Yu comes to ITTC from Peking University's Department of Computer Science and Technology. His present research interests include statistical machine learning and Bayesian data analysis with applications to bioinformatics. Yu has taught courses in such areas as algorithm design and analysis, probability theory and mathematical statistics, decision theory and Bayesian analysis, and artificial intelligence. ■


Jiangsheng Yu

NSF, IBM Finance Sass's JVM Research

Consumers clamor for technology that allows electronic devices to shrink in size while providing users with more and more options. This contradictory notion is made possible by advancements in technology, such as those by **Ron Sass**, an ITTC research assistant professor.

Ron Sass

Sass has received a National Science Foundation (NSF) grant and an IBM Faculty Award to improve the performance of embedded systems. These systems, a combination of computer hardware and software, are found in everything from automobiles, medical equipment, and airplanes to vending machines, toys, and mobile phones. Sass is developing systems of reconfigurable hardware, allowing one chip to perform a myriad of tasks within these products.

Sass gives the example of a mobile phone: the ubiquitous device can be used not only as a telephone, camera, and calculator but nowadays also as a television. While a few mobile phones can receive video data now, these phones must contain different computer chips for each function. Sass has developed a prototype that fuses all these actions and more onto one chip.

"Most integrated chips are fixed when they are manufactured, but the field programmable gate array (FPGA) chips can be repeatedly reconfigured—even while they are in use," Sass said. "Rather than use multiple special-purpose chips, we use an FPGA device coupled with a system that continuously monitors and updates devices based on what users are doing."

The same principles apply to high-end computers. As computationally-intensive scientific applications run, their hardware needs change. Sass explains that a particular application may need multiple units at one point in the execution. In another phase, that same hardware could be better used to perform other functions.

The two-year NSF project, "Dynamic Hardware Reconfiguration to Accelerate Java-Based Embedded Systems," will convert Java classes into "hardware." However, not all of the hardware, like those needed for talking or watching television on a mobile phone, will fit simultaneously into programmable hardware. ITTC researchers have developed software, a Java Virtual Machine or JVM, that automatically adapts the most beneficial hardware to use. JVM continuously monitors the FPGA device and configures the hardware to the users' needs.

IBM presented Sass with a $20,000 Faculty Award in December to extend his system to Linux and Power PC programs.

Currently, researchers measure success by an increased performance rate, how fast an application runs. But in the future, Sass says they hope to include temperature and/or power consumption in the equation. Taking into account these important aspects, researchers could prolong the lives of computer chips. According to Sass if a particular spot of a chip is being heavily used, it will overheat. If the chip's temperature can be measured, it may be possible to reconfigure the computation to another cooler spot on the chip. This reduces failures and increases the longevity of embedded systems. For more information on Sass's research, please see www.ittc.ku.edu/rtrjvm. ■

RFID Lab Receives National Exposure

Daniel Deavours has been invited to speak at a series of events this spring. As principal author of a report assessing the performance of radio frequency identification (RFID) tags, Deavours will provide reliable and unbiased information on commercially available RFID devices.

Using a system of readers and tags to communicate information, RFID technology enables items to be identified and tracked throughout the supply chain. Suppliers are scrambling to understand what RFID devices will work best for them while trying to meet government and industry mandates. The newness of the technology and lack of performance standards led to the creation of the RFID Alliance Laboratory, www.rfidalliancelab.org, which provides reports on RFID equipment.

The Lab's first report, "*A Performance Analysis of Commercially Available UHF RFID Tags Based on EPCglobal's Class 0 and Class 1 Specifications*," was released last fall and is garnering regional and national attention. In early March, Deavours participated in the Midwest RFID Symposium. He discussed RFID tag durability studies at Underwriters Laboratories, Inc., in Chicago on March 10 and 11. Deavours will travel to Philadelphia to take part in the RFID Pharmaceutical Focus conference on March 30 and 31, highlighting how RFID can benefit the pharmaceutical industry. On April 10 and 11, Deavours will speak at the premiere RFID conference, RFID Journal Live!, and man a booth for the Alliance Lab.

ITTC teamed with Rush Tracking Systems, a private RFID systems integrator, and RFID Journal, a leading media company, to establish the RFID Alliance Lab. The Lab's first report may be purchased at www.rfidjournal.com/labreports. The second report, due out this month, will include how quickly tags can be read individually and in populations, statistical variation between tags, write performance, and effectiveness of the "kill" command. ■

Achievements and Acclaim

ITTC Staff, Radar Aid NASA Mission

Pannirselvam Kanagaratnam, ITTC research assistant professor, participated in a joint mission between NASA and the Center for Scientific Studies, a private Chilean institution, this winter. Kanagaratnam conducted airborne radar soundings, using a system developed in ITTC's Radar Systems and Remote Sensing Laboratory (RSL).

The radar is providing a more accurate picture of the Antarctic and Patagonian ice fields, aiding scientists in their understanding of long-term climate change. New data, detailing ice thickness and geology of the region, are helping scientists piece together the changes occurring on 13.72 million square kilometers of ice, almost 1.5 times the size of the United States. ■

PRISM Web Site Earns Honors

The Polar Radar for Ice Sheet Measurements (PRISM) Web site has been selected as an exemplary site for math and science educators. Each month the Eisenhower National Clearinghouse (ENC) publishes the "Digital Dozen," a list of Web sites that would be useful to teachers. The PRISM site made the February list, which can be found at www.enc.org. The United States Department of Education funds the ENC. ■

Technology Day Is in April

ITTC will host a by-invitation Technology Review Day on April 7. The event will include four sessions: Wireless and Networking; Intelligent Systems; Computer Systems Design; and Bioinformatics and Life Sciences. For more information, contact info@ittc.ku.edu. ■

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KU Spin-Off Company Markets Rosetta Tools

Designers of complex electronic systems, such as computers, must develop individual pieces while making sure they are complementary to other parts of the system. Different vocabulary and engineering processes make communication between parts difficult. The system-level design language Rosetta allows these subsystems to interact with one another.

The KU spin-off company Cadstone is developing a suite of electronic design automation (EDA) tools to analyze designs written in the Rosetta system specification language. These tools will perform abstract interpretation on specifications to identify problems in the earliest stages of the design process. The software will help electronics designers develop devices such as cellular phones, PDAs, gaming systems, semiconductor chips, and avionics.

Perry Alexander, Rosetta creator and director of ITTC's Computer Systems Design Laboratory, and his team are developing tools for analyzing embedded systems. Embedded systems often have operating constraints not found in traditional computer systems that make it necessary to account for non-functional requirements such as power consumption, weight, heat dissipation, and electromagnetic interference. Designers will use Rosetta tools to explore tradeoffs of various design decisions with respect to various systems-level requirements. For example, Rosetta-based power-aware analysis combines one model for power consumption with another for functional behavior to determine the effects of design decisions on the battery life of a portable component, Alexander said.

For more information, please log on to the Cadstone Web site at www.cadstone.com. ■