Louisiana EPSCoR
EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH VOL.6 NO.7 JULY 2009

You can't do one without the other. Or, as the guiding axiom of LA EPSCoR's Research Improvement Infrastructure (RII) project, a. k.a. CyberTools, puts it: Cyberinfrastructure development must be guided by scientific questions and, conversely, the scientific strategies must include advanced cyberinfrastructure. The trend-setting project is funded by the National Science Foundation (NSF) EPSCoR program, LA Board of Regents, and the nine participating universities. The following is the first in a series based on some reports on ongoing collaborations showcased in the "2009 RII CyberTools/Science Drivers Symposium Proceedings" publication.

Leave or Ride It Out?

Where is it now? Where is it headed? How strong is it? When and where is it expected to hit?

There is no need to explain what *it* is if you live in South Louisiana or any other Gulf Coast State. It's the dreaded H word, the one that inevitably leads to the question: "Should we leave or ride it out?"

A CyberTools/Science Drivers team of civil engineering, computer science and physics faculty and researchers at Louisiana State University (LSU) and Louisiana Tech is investigating how research could lead to a new system able to provide more timely hurricane predictions that could help decision makers at all levels make that judgment call.

Engaged in a discussion of a poster at the 2009 Cybertools/Science Drivers Symposium is External Review Board member Dr. Valerie Taylor, Department Head, Computer Science and Engineering, Texas A&M University,

The researchers are building a simulated hurricane database that includes data from new computer simulations of the major hurricanes that have occured within the past 50 years as well as hypothetical storm simulations.

The objective is the development of new modes of prediction that combine machine learning techniques— programs and data structure systems that approximate the operation of the human brain— with simulated data.

The project also involves collaborations between the CyberTools/Science Drivers team, the Office of Naval Research-funded Coastal & Ocean Modeling Infrastructure project, and the NSF ALPACA project, which provides high-level tools that allow researchers to examine and validate the correctness of an application, as well as aid in measuring and improving its performance.

In order to train machine learning techniques such as Neural Networks, it is necessary to provide a broad set of training data in which parameters are varied to cover the entire domain of interest. Hurricane model parameters include the path of the hurricane track, strength of the wind, size of the hurricane, etc.

The collaborative team is first developing a "Simulated Hurricane Database" containing data produced from accurate runs of the ADCIRC Code, a computer software program that runs on large supercomputers to accurately model the storm surge and water velocities in coastal regions driven by hurricane force winds.

The data is hosted on PetaShare, an NSF-funded computer system deployed at seven Louisiana campuses that links over 50 senior researchers and 200 graduate and undergraduate researchers from 10 different disciplines to perform multidis-

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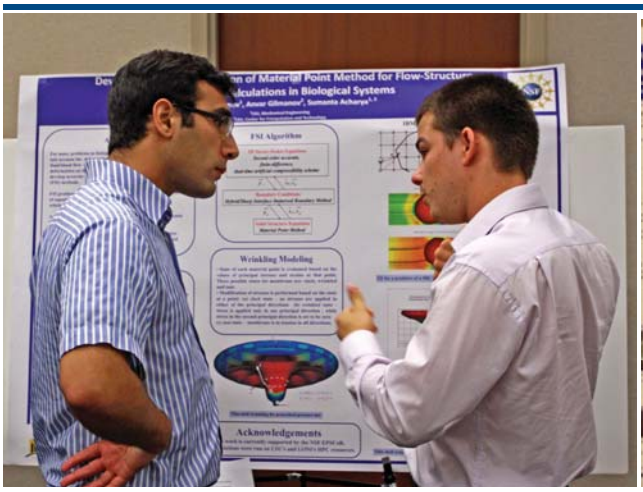
Dr. B. Vincent McKoy, RII External Review Board Chair and Professor of Chemistry, California Institute of Technology, left, discussing the contents of a poster with a symposium participant.



Two symposium participants, left, checking out one of the 44 student posters. Two RII evaluation consultants are center, Mary Jo McGee Brown, Qualitative Research & Evaluation, Inc., and, right, Linda Ramsey, retired, Director, Center for Applied Teaching & Learning to Yeild Scientific Thinking, Louisana Tech University.

Leave or Ride It Out? Continued

ciplinary research.

PetaShare also allows the researchers to enter "metadata"—additional pertinent information—to describe the parameters essential for developing the complex machine learning algorithms or procedures.

The initial phase of the project will populate this database by deploying ADCIRC runs for hind casts of hurricanes and tropical storms that have occurred in the Gulf of Mexico over the past 50 years. Input parameter files will be created and simulations run on resources of LONI (Louisiana Optical Network Initiative), which gives researchers access to one of the most advanced optical networks in the nation, along with the most powerful supercomputing resources available to any academic community.

A second phase will supplement the database with additional simulation data representing hypothetical storm events.

The CyberTools/ScienceDrivers team will provide interfaces, including a web portal to the database to allow easy analysis of the data so researchers in the region can investigate data from different storms, compare the effects of different resolution grids, etc.

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Finally, team members will research new modes of prediction—by means of combining machine learning techniques with simulation code—to provide instantaneous predictions based on simulation data and prediction errors in forecast simulations.

The end result of this novel approach is a more timely prediction of hurricanes. The machine learning algorithm should potentially take just a few seconds, even running on small mobile devices, as compared to the hours required to run accurate simulations on large supercomputers.

This, in turn, could greatly assist decision makers in implementing appropriate evacuation plans for the wellbeing of citizens and help individuals answer that inevitable question, “Should we leave or ride it out?"

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