

## **General Motors, Virginia Tech scientists collaborate to advance neuroinformatics**

November 15 2007

Advances in sensing technologies have made exquisite measurements of brain activity possible in the past decade. Using these measurements, computer scientists will now help neuroscientists discover the complex neuronal networks in the brain that result in the actions we take for granted, like reaching for a glass of water.

General Motors (GM) officials visited the Virginia Tech computer science department to launch the Laboratory for Neuroinformatics. Naren Ramakrishnan, associate professor of computer science, and his students will collaborate with K.P. Unnikrishnan, research scientist at the General Motors R&D Center, to create new algorithms that will process the massive amounts of data neuroscientists are now able to collect from the brain. Ramakrishnan and Unnikrishnan will be the co-directors of the laboratory.

Unnikrishnan, a physicist who has conducted neuroscience-related research for 20 years, met Ramakrishnan through the community of computer scientists. "GM is today an information-rich company. Deriving knowledge from information is important to us. This is why we teamed up with Naren Ramakrishnan's group that works on data mining," Unnikrishnan said.

Unnikrishnan is a member of GM's Discovery program, which undertakes basic research on questions that may appear unrelated to the interests of a motor company. Ramakrishnan is expert at instructing computers to digest huge amounts of information to find important



connections and discern sequences within complex processes.

"Virginia Tech's emphasis on interdisciplinary research across traditional department boundaries is what attracted us here," said Jeffrey D. Tew, a General Motors Technical Fellow and Group Manager at its Research and Development Center. "We think of this collaboration as a start to identifying emerging technologies for General Motors in the near future. The discovery projects are aimed at such basic research."

Richard Benson, dean and the Paul and Dorothea Torgersen Chair of Engineering at Virginia Tech, said, "We are extremely pleased that GM is partnering with Virginia Tech in the area of neuroinformatics. Through initiatives such as the Institute for Critical Technology and Applied Science (ICTAS), the College of Engineering has a history of innovation in emerging disciplines. This project will provide impetus to the growing area of neuroinformatics."

In recent decades, bioinformatics has given biologists the ability to gather and quickly analyze massive amounts of data, such as about the genomes of plants, animals, and microbes. Similarly, neuroscientists can now gather huge amounts of information using sensing technologies with thousands of electrodes on a chip that can simultaneously record brain activity across many neurons. However, "what is happening with computation in molecular biology is not yet happening in neuroscience," Unnikrishnan said.

"Neuroscientists are making the transition from studying neurons to studying networks – the sequences of firings and spikes of activity across big groups of neurons," said Ramakrishnan. "What we are trying to do is analyze all this data and discover something about the network – the connections and relationships."

Such neuroscience-related research may be basic research at this point,



but Unnikrishnan foresees applications. "In the near-term, in the process of solving problems in neuroscience, we will develop advanced algorithms that will have usefulness outside of neuroscience," said Unnikrishnan. "For example, we may be able to analyze data from cars – from the mechanical and electrical systems – to maintain vehicle health."

"It is interesting that techniques used in assembly line diagnostics also find application in neuroscience. This project can be a stepping stone to larger efforts that utilize data mining to solve important scientific questions," said Dennis Kafura, computer science department head at Virginia Tech.

But the most compelling application is in neuroscience.

"Creation of brain-machine interfaces is the next frontier," said Unnikrishnan. "Recording from a large number of neurons and deciphering the underlying neuronal network might enable interfaces with prosthetic devices, such as the creation of an artificial retina. Giving senses to people who have lost them – vision, touch, hearing, and motor - would be a contribution to humanity." An even more ambitious goal would be to "discover the neural code" leading to fundamental insights about information processing, memory, and higher-level functions."

"Virginia Tech's focus on nanofabrication through ICTAS provides the potential for an extended partnership to realize this application," Unnikrishnan said.

In addition to applications, asking basic science questions is also important motivation for the research, he said. "How do we learn" That is – the mechanics of learning. How do we store memories?" asked Unnikrishnan. "We will be able to study networks and patterns of neuronal activity so we can ask these questions. They are fundamental



scientific questions, and this pursuit connects back bioinformatics and the analysis of essential data."

What brought GM to Virginia Tech is, "first, the core group of data mining expertise; second, capabilities such as the System X supercomputer put Virginia Tech in a different league in terms of computational resources," said Unnikrishnan.

The third reason GM decided to partner with Virginia Tech is the university's commitment to interdisciplinary research, such as through ICTAS and the centralized support of advanced research computing resources, including System X, for the entire university.

"In addition to research activities, new interdisciplinary courses at the meeting point of data mining and neuroscience can be proposed and offered," said Don Leo, associate dean of engineering for research and graduate studies at Virginia Tech.

GM will provide \$220,000 over one year for the development of advanced algorithms for neuroinformatics. "They want us to work fast" said Ramakrishnan.

Source: Virginia Tech

Citation: General Motors, Virginia Tech scientists collaborate to advance neuroinformatics (2007, November 15) retrieved 2 May 2024 from <u>https://phys.org/news/2007-11-motors-virginia-tech-scientists-collaborate.html</u>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.