Intelligent Machine Technology Gets Humans Thinking at George Brown

by Lisa E. Boyes

What began, in George Brown College’s Centre for Construction and Engineering Technologies, as one project to develop technology to simulate human thinking has spawned a new laboratory site at George Brown: a web-based, remote-sensing research laboratory for industry partners, and a host of green applied research projects.

Along the way, Professor Leo Salemi and cross-disciplinary teams of students in electromechanical design, mechanical design and computer programming, with college volunteers, have had in-kind support (equipment and mentoring) and funding from industry partners, as well as seed funding from George Brown’s Office of Applied Research and Innovation.

Says Salemi, “Hierarchical temporal memory [HTM] theory says that machines can be designed to detect underlying patterns and categorize images and novel attributes or capabilities not seen before, based on foundational data that the system was previously trained with.

“Then,” Salemi adds, “the HTM system can be programmed to respond accordingly to understand and automate a process like heating, lighting or security in a building.” Full utilization of HTM technology in an application like this is still a ways down the road.

Professor Salemi and his students have discovered plenty to keep them busy in applying technology to immediate and near-future challenges. Their inaugural project involved working with Numenta Inc.’s new HTM computing technology, at the point when its programming platform for HTM, NuPIC, was in its infancy. Creating a functional system was beyond the scope of the initial project. But with mentoring and support from Industrial Technical Services, International Society of Automation (ISA) Toronto Section, Grace Instrumentation, Hatch Engineering and Hoskin Scientific, the research team quickly adapted the project to the creation of a living laboratory space on the George Brown Casa Loma campus. Here they generate data on the space itself that the technology has been primed to detect—data pulled from motion sensors and video cameras—in order to monitor and control the process systems in the lab.

The logical next step was to develop a remote site, a web technology that could deal with sensory input, not only from the George Brown lab, but from any remote site, and test new applications. The result, the Salemi team’s Infrastructure Research & Testing Lab
(greenenergy.georgebrown.ca) is a kind of first-step HTM. In April 2009, Salemi’s team demonstrated the remote-sensory lab at ISA’s Technical Conference.

The applications of a sensory-detection system to green energy projects are numerous, as Salemi saw when the opportunity came to demo their remote site application to the Kortright Centre in Vaughan, Ontario. With funding from Prolet Inc. and matching funds from GBC to support student researchers, the team started work at the Archetype House, a demonstration home featuring leading-edge green technologies. In a relatively short time the team reached their first milestone by establishing an internet connection, which was difficult to achieve given the isolated location of the house.

This, in turn, allowed the team to essentially duplicate the remote site design back at the college. Further, by utilizing the George Brown team’s unique intelligent-router design, other researchers and industry partners were able to gain remote access to all the computers in the Kortright demonstration house, making it easier for them to conduct research and develop their own applications without the need to travel to the site.

In a short time, the Salemi team was able to access and log data generated from the solar panels, video cameras, and other sensors in the house, also working closely with a Ryerson University research team and other industry partners. “Since then,” says Salemi, “We’ve spun four or five different projects from the original project at the Kortright house.” These include a solar tracking system to capture at least 30 to 40 percent more light energy from the sun; a security and home-automation system; and a web portal to monitor energy consumption.

The Salemi team is now mimicking the Kortright solar tracking project on the roof of George Brown’s Casa Loma campus. Solar panels are being installed, with the solar tracker to be mounted in 2010. The team will use the collected energy from the Casa Loma roof to charge batteries and power the lighting in Salemi’s lab.

Upcoming projects for the Infrastructure Research and Testing Lab include: a “homeowners’ dashboard” remote-sensing project to monitor energy consumption in real time, linked to time-of-use cost data so that homeowners can manage their consumption; the application of the Salemi lab’s results at the Kortright Centre to future George Brown green-energy initiatives now in the planning stages; and an HTM memory camera system powered by Vitamin D Video software.

All this activity is leading to novel George Brown algorithms that will link, monitor and control all process systems in a building. And that could be one big step toward training a machine-brain HTM to automate novel processes and troubleshoot problems in building processes.

“We’ll get there,” says Salemi.