# Computer program makes night sky searchable

June 27 2007

Computer science PhD candidate Dustin Lang has embarked on his own Star Trek as part of astronometry.net, a collaboration between computer scientists at U of T and astronomers at New York University.

Under the tagline Making the Sky Searchable, Lang and fellow graduate student Keir Mierle have put together a system that takes an image of the night sky and figures out which stars the image contains. The goal of the project, a concept originated by Lang's supervisor, Professor Sam Roweis, is to apply cutting-edge machine learning and computer vision ideas to huge astronomical data sets.

"We call it a blind astronometry solver," Lang explained. "It's a bit like going utside on a dark night and trying to find the constellations, except we're trying to recognize images that come from all kinds of cameras, amateur telescopes, large ground-based telescopes and space telescopes such as the Hubble Space
Telescope.

"Some of the images we are trying to solve cover less than a millionth of the area of the sky — about 10 per cent of the size of the full moon."

When asked what he enjoys most about the project, Lang said, "Working with astronomers is great. They deal with extremely small and extremely large things, so they get to be really good at "order-of-magnitude" thinking: Is this process going to take a minute, an hour or a week? Do we need 10, 100 or 1,000 computers to solve this problem?"

On the technical side, because the group is processing information about a billion stars, Lang noted, “We have to ensure that everything we do is done efficiently … the project requires a lot of tricky technical engineering, which I find fun.” He added, “And, of course, I get to look at a lot of beautiful pictures of the sky.”

Astonometry.net has significant implications for both professional and amateur astronomers, since, said Lang, “Amateur astronomers can take great pictures but they rarely record where their telescopes are pointing — we can figure out exactly where the image came from and combine images into a high-resolution picture of the sky that is always being updated. Professional astronomers can use this data to look for transient events like comets, supernovae — things an amateur astronomer may have taken a picture of without even knowing it.”

What’s more, Lang explained, “observatories around the world have large archives of photographic plates, some going back to the early 1800s. These collections are being scanned to make them available digitally; if astronomers could easily tap into these images, they would have a much longer history to look for changes over time.”

This project is also helpful in correcting possible telescope errors; the system can check to make sure information recorded by telescopes is correct and recover images where the telescope information was wrong.

Current plans for the project include making the system more robust, flexible and fast, creating a way of incorporating new images to make a map of the sky that is updated and improved as people add new images to it. There are groups interested in hooking the system up to new telescopes that are being built and other astronomers hoping to use it in their own research.

Lang is enthusiastic about these possibilities and is pleased that while the

project is “geared towards professional astronomers, we’ll end up producing a system that should be of interest to amateur astronomers — and anyone who has looked up at the sky and wondered … .”

Source: University of Toronto