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TOO MUCH INFORMATION

Nathoo. PHOTO BY UVIC PHOTO SERVICES

How do we make sense of the vast amounts of data on how our brains work?

by Patty Pitts

From our daily medications to the public policies that govern society, many familiar products and aspects of our lives depend on the collection and analysis of data and statistics.

Yet the escalating ability of technology to gather and produce data—and the sheer volume and complexity of it—sometimes threatens to overwhelm researchers and statisticians working to make sense of it.

This is especially true for researchers trying to learn more about the function and structure of the brain.

Modern neuroimaging tools can provide hundreds of thousands of "snapshots" of the inner workings of the brain by monitoring its blood flow. But without an effective method of analyzing this vast amount of data, researchers can't harness its potential to make new discoveries about brain disease or disorders.

They also can't do a comparative analysis of the genetic variations that can affect and possibly predict brain dysfunction, such as dementia and Alzheimer's.

Farouk Nathoo, a University of Victoria statistician and the Canada Research Chair in Biostatistics for Spatial and High-Dimensional Data, wants to change this. His research uses large-scale models, mathematical approximations and high-performance computing to blend large datasets from different sources so that other scientists can understand complex systems.

When neuroimaging was a fledgling field, he says, the emphasis was on analyzing data collected from a single neuroimaging technique. Now, studies collect data using multiple technologies at the same time, or combine imaging with the study of genes and their functions, known as genomics.

"The development of statistical methods for these problems has fallen seriously behind the technological advances that allow us to collect the data," says Nathoo. Along with a University of Alberta researcher, he's co-leading a research project seeking better ways to analyze neuroimaging data.

"We're asking how do we tie together data on genetic sequencing and brain activity," says Nathoo, whose team consists of 18 researchers from Ontario, Alberta and the US.

"Neuroimaging data is quite complicated and adding genetic data into the mix makes things much more difficult. The theoretical and computational power needed for this kind of work has only recently come available within the last 10 years."

The research team—which includes statisticians, computer scientists, biomedical engineers, neuroscientists and experts in molecular medicine—will use the powerful computational resources of WestGrid, which provides an inter-institutional pool of high-performance computing infrastructure, storage and expertise.

Nathoo became involved in neuroimaging data analysis for the first time during a collaborative research project several years ago. He's also worked on data analysis related to lung function in children with cystic fibrosis, sports psychology, drug clinical trials, and forest diseases.

Data analysis is vital to all areas of research and to just about every aspect of our lives, says Nathoo. "Statisticians get to play in everybody's backyard," he says, quoting the late statistician, John Tukey. "We get to make contributions to many kinds of science."

He wants neuroscientists to be the next beneficiaries of his research, giving them access to downloadable, public domain data analysis software. "If we're successful, we'll provide them with the tools they need to make the next big breakthroughs in brain research."

EDGEWISE

When many people hear the word "statistics" they think of sports numbers or the college class they took and barely passed. But statistics touches our lives far more than we know—examples are weather forecasts, transportation systems, insurance policies, disease risks, crop yields, and consumer demand for goods and services.

The need for statisticians and data analysis is expected to increase by 4.4 million jobs worldwide in the years ahead. To find out more visit *www.worldofstatistics.org*

Mathematicians and statisticians tackle problems as diverse as chess moves to determining the drug administration protocol in treating early stage malaria. This summer, math and stats students from across the country will share their research when UVic hosts the Canadian Undergraduate Math Conference for the first time in 20 years.

The Canadian Statistical Sciences Institute (CANSSI) is providing nearly half ($180,000) of the $412,000 budget for the neuroimaging project, with St. Joseph's Healthcare, McMaster University Medical School, UVic, the University of Alberta and the Natural Sciences and Engineering Research Council providing the rest.

Much of the CANSSI funding will train graduate students to participate in the project and conduct workshops once the research is complete. The work will inform their graduate theses and dissertations, and as workshop leaders they'll instruct other researchers on how to access and use the new data analysis software.

Meet Farouk Nathoo at *bit.ly/uvic-nathoo*