

The Newsletter of the Statistical and Applied Mathematical Sciences Institute

SAMSI Summer Workshop: Semiparametric Bayesian Inference: Applications in Pharmacokinetics (PK) and Pharmacodynamics (PD)

by Peter Mueller and Gary Rosner

It may have been hot in North Carolina this summer, but the real heat being generated was happening inside the halls of SAMSI during the Pharmacokinetics (PK) and Pharmacodynamics (PD), better known as the PKPD workshop.

The aim of this two week program was to bring together researchers working in non-parametric Bayesian inference and PK and PD modelers. PK studies what happens to drugs inside the body, while PD models attempt to characterize responses to the drug. The motivation for this program was a recent surge in research in Bayesian nonparametric (BNP) statistics, especially applied to real-world problems



Participants in the PKPD workshop enjoy a reception and poster session.

BNP has traditionally focused on basic inference problems like density estimation, survival analysis, and, more recently, mixed-effects models. BNP methodology has now sufficiently matured to address scientific research problems with all the complexities and complications that arise in real applications. Population PK and PD could be one such application. Honest representation of population heterogeneity, learning across related studies, exploit-

ing available covariates, and including genomic data are some of the important research questions that BNP approaches could address.

A workshop during the first week of the program served to introduce participants from the BNP research community to current problems and challenges in PK and PD modeling, and to introduce PK and PD modelers to BNP methodologic issues.

Tutorial reviews on Monday were important

to introduce notation and to lay out basic problems and challenges. Talks on Tuesday through Friday focused on different research topic areas, with more diverse talks following in the afternoon. Focus areas included prior elicitation, joint modeling of PK and

PD, dependent Dirichlet process models, and clustering.

On Friday afternoon, participants formed working groups for the second week. Working groups discussed Model Fit and Comparison; Joint PK& PD Modeling; Nonparametric Bayes & Clustering for Population PK& PD; Joint PK&PD Simulation for Study Design and Dose Individualization; and

Pharmacogenomics and Networks.

“This was one of the most interactive workshops I have attended,” commented Julien Cornebise, postdoctoral fellow from



Gary Rosner (left) from Johns Hopkins University and Peter Mueller (right) from MD Anderson, led the SAMSI summer program.

the University of British Columbia and former post-doctoral fellow of SAMSI.

The program was successful in bringing researchers from

different areas together to initiate new projects that will hopefully lead to exciting advances in PK& PD research, driven by state-of-the-art BNP models. The program served the purpose of establishing PK and



Attendees listen to a presenter during the first week of the workshop.

PD as a very natural application area for BNP.

From the director...

At the time of writing this, I have been Director of SAMSI for exactly two months, and already it has been an action-packed time.

Elsewhere in this newsletter you can read about our summer workshop and about the graduate students' IMSM workshop. For the second year in a row, I was one of the faculty advisors for IMSM, working alongside Eric Gilleland of the National Center for Atmospheric Research (the "industrial sponsor") and SAMSI postdoc Emily Kang, with six graduate students on a problem of spatio-temporal forecast verification. It was amazing to see how, after the students had grappled with the problem unsuccessfully for several days, suddenly everything clicked and they put together a fine report.

The Opening Workshop of the Complex Networks program has just concluded, and will shortly be followed by that of the Analysis of Object Data program. Those are our two main programs this academic year; each has several more

workshops planned over the year, and of course, the usual weekly meetings of the Working Groups.

The summer has seen several changes to SAMSI. As Jim Berger steps away from the Directorship after eight years at the helm, it is a pleasure to make a public "Thank You" to Jim for the enormous service he has rendered SAMSI, and for Jim's vision that made SAMSI what it is today. Also departing was Michael Minion, after three hard-working years as UNC's Associate Director. Given that I am also from UNC, we needed a new Associate Director from Duke, and I was personally delighted when Rick Durrett, newly arrived from Cornell, volunteered for the role. It is very good that Probability and Stochastic Processes will be represented on the Directorate and Rick has already contributed many excellent ideas for future programs, of which you will hear much more in due course.

Our next major task is to prepare a proposal for our renewal, due at NSF in

February. It is daunting to map out a plan for the next five years of SAMSI, but fortunately, our community feeds us lots of ideas, and we are always open to more. If you have an idea for what you would like SAMSI to do, please do drop me an email about it – we can't use all the ideas we get, of course, but we always want to hear them!

One other thing – if you haven't seen our new webpage yet, please do take a look at it. This reflects many months of hard work by our staff and is much improved from the old version!



SAMSI Postdoc Profile: Bruce Rogers

While Bruce Rogers attended graduate school at Arizona State, he met Tom Taylor who would eventually become his advisor. Bruce was fascinated by a presentation Dr. Taylor made about stochastic control theory looking at water use in the desert. It was the first time that Bruce saw how mathematics could integrate with social sciences. This became a life changing event, as Bruce realized he could combine the two disciplines together.

Bruce studied social networks when he came to SAMSI as a postdoctoral fellow. Last summer, he joined the Stochastic Dynamics program and has been working on models of epidemics on networks. He is studying networks that have different properties in different places and how the epidemic spread from one place to another. It is an attempt at incorporating spatial structure into compartmental epidemiology. In very dense patches of a network, the classic differential equation models of epidemiology give a good approximation for the number of infected individuals in that patch. But dense patches may be far from one another in the network, so

the goal is to figure out how much time it takes the epidemic to infect a new patch.

Bruce hopes to use the information he collects and help turn it into something that can help people live better, more healthy lives. "It would be great to convince people to exercise more, or eat better," comments Bruce.

One thing that Bruce has enjoyed while working at SAMSI is having access to so many of the top mathematicians and statisticians who come to SAMSI to attend workshops. "I have been able to learn more about statistics and learn to become more data-centric."

Bruce is very excited about the Complex Networks and the Analysis of Object-Oriented Data (AOD) programs that will begin this month. He hopes to have some level of participation in just about every working group that the Complex Networks program offers and some of the AOD working groups as well.

Bruce is also happy to report that one of his papers was recently accepted by the **Journal of Natural Resources**. He has submitted a paper about modeling internet

traffic to the **Journal of Communications**, and there are some other papers he is

working on that deal with methodology in experimental design that came out of the data assimilation working group. Bruce has also been attending some conferences this summer, including the Sunbelt conference in northern Italy for the International Network of Social Network Researchers.

Bruce is one of three people who commute to work most days via their bicycles. When he's not at work, he likes to play guitar and piano and joked that anytime others want to join him, he's ready to start a math/stats rock band!



Industrial Mathematical and Statistical Modeling Workshop Held at NC State



Graduate students from around the United States gathered at North Carolina State University for the 16th annual Industrial Mathematical and Statistical Modeling Workshop (IMSM) this July.

The objective of the workshop is to expose graduate students in mathematics, engineering, and statistics to challenging and exciting real-world problems arising in industrial and government laboratory research. Students were divided into six research teams and collaborated with people from industry and academia.

This year, there were several very interesting problems presented to the students. Some of these included working on verifying the forecasting for extreme weather conditions, spatial weather forecasting, looking at issues in commodity forecasting, and looking at the electrical impulses that were used in a certain chip (called Brain Gate) that was implanted in the brain of some quadriplegic patients so they could use their brains to control various motor functions.

The students worked with a mentor from the sponsoring organization and a professor. Each team presented its results at the end of the two week period.

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Calendar of Events for SAMSI

For more information about SAMSI programs and workshops, visit SAMSI's Web site at <http://www.samsi.info>

2010-11 Program on Complex Networks
Tutorials and Opening Workshop
August 29-September 1, 2010

2010-11 Program on Analysis of Object Data
Tutorials and Opening Workshop
September 12-15, 2010

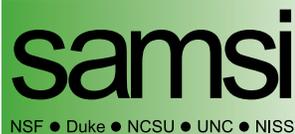
2009-10 Program on Space-time Analysis for Environmental Mapping, Epidemiology and Climate Change
Spatial Transition Workshop
October 11-13, 2010

2010-11 Program on Complex Networks
Complex Networks Modeling Workshop
October 20-22, 2010

2010-11 Education and Outreach Program
Two-Day Undergraduate Workshop
October 29-30, 2010

2010-11 Program on Analysis of Object Data
Workshop on Interface Functional and Longitudinal Data Analysis
November 8-10, 2010

2009-10 Program on Stochastic Dynamics
Stochastic Dynamics Transition Workshop
November 17-19, 2010



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