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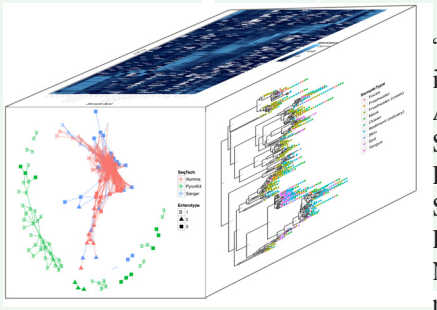
The Newsletter of the Statistical and Applied Mathematical Sciences Institute

2014-2015 SAMSI Programs Announced

The Statistical and Applied Mathematical Sciences Institute, (SAMSI) announces its 2014-2015 programs. SAMSI's programs will integrate applied mathematicians and statisticians with other scientific disciplines to further research in bioinformatics and ecology.

One program, entitled "Beyond Bioinformatics, Statistical and Mathematical Challenges," will look at the statistical and mathematical challenges arising in the analysis of genomic and related data with the goal of addressing relevant biological questions. As genomic and related data are growing more complex, novel methods need to be developed to help with data synthesis and analysis to answer previously inconceivable questions about biological processes. This program will focus on: 1) Statistical pre-processing of emerging high throughput data; 2) Dependence in high-dimensional data; in particular, multivariate discrete counts; 3) Integration of multi-omics data; 4) Modeling dynamics of mixtures, such as populations of cells, variants and metagenomics; and 5) Big data and machine learning for addressing 'omic' issues.



Program leaders for "Beyond Bioinformatics" include: Alexander Alekseyenko, NYU School of Medicine; Karin Dorman, Iowa State University; Nick Hengartner, Los Alamos National Lab; Susan Holmes, Stanford University; Katerina Kechris, University of Colorado-Denver; Shili Lin, The Ohio State University; Dan Nettleton, Iowa State University and Hongyu Zhao, Yale University.

The other SAMSI program is "Mathematical and Statistical Ecology." This program brings together three groups of researchers – statisticians, mathematicians and theoretical ecologists – to study and develop the interactions among different approaches that ecological modeling has developed. One approach is that theoretical ecologists have developed mathematical models that are analyzed using traditional tools of applied mathematics, such as partial differential equations (PDEs) and dynamical systems. These models are then used to look at resilience, tipping points or other ecological properties. A second approach, typically used by statisticians and data analysts, involves sophisticated statistical tools such as Bayesian hierarchical models that are applied to large spatio-temporal datasets, but often these models are developed without the detailed consideration of nonlinear dynamics. Some of the topics that will be explored through the year include: 1) Critical thresholds and tipping points; 2) Resilience of ecological systems; leading indicators; 3) Multi-scale and multivariate statistical method; 4) Climate and Biodiversity; 5) Implications for public policy. There is also likely to be a joint working group between the two programs, on the topics of Landscape Genomics.

Program leaders for "Mathematical and Statistical Ecology" include: Philip Dixon of Iowa State University, Lou Gross of the University of Tennessee and NIMBioS, Jennifer Hoeting of Colorado State University, Mevin Hooten of Colorado State University, Lea Jenkins of Clemson University, Claire Lunch of the National Ecological Observatory Network, Ron McRoberts of the U.S. Forest Service, Jay Ver Hoef of NOAA, and Linda Young of the National Agricultural Statistics Service.

There are many opportunities for people to be involved with the SAMSI programs. Financial support is available for visiting researchers to be resident at SAMSI for periods of one month to one year. Several postdoctoral positions are funded for each SAMSI program. Young researchers have special opportunities to participate that typically have a one year appointment. Workshops and working groups give many people the opportunity to collaborate with others on research projects and to network with their peers. Dedicated workshops will allow graduate and upper level undergraduate students to learn about the latest research and applications in the statistical and mathematical sciences. All involved researchers will get chances to broaden their interests and skill sets, participate in cutting edge interdisciplinary projects and make new connections. New researchers and members of underrepresented groups are especially encouraged to participate in SAMSI workshops and programs.

To find out more about either of these research programs, or to apply, go to the SAMSI website, www.samsi.info.

From the director...

As I write, we have just concluded our latest workshop, about censuses and surveys, which we held at the Bureau of Labor Statistics in Washington (thanks to John Eltinge and the other staff at the Bureau for making this possible). The main thing that I learned from this is how much the themes of "big data" – and the computations needed to analyze large datasets – have taken over this field as they have so many other areas in recent years. Come to think of it, that has been the overriding theme of our whole program on Computational Methods in Social Sciences, one of two major research programs that SAMSI is holding this year.

The other is on Low-Dimensional Structure in High-Dimensional Systems, very capably coordinated by our Associate Director Ezra Miller. This program has an even broader range of topics, ranging from topological data structures at the more theoretical end, through to biology and genomics at the applied end of the spectrum.

Looking further ahead, next year will see another two programs at SAMSI, one on bioinformatics and the other on ecological modeling. More details about both programs are given elsewhere in this newsletter. The organization of both programs is well under way, but we are still open to applications from researchers wanting to visit SAMSI, so please get in touch with us if you would like to be involved.

Earlier in the year we had two summer programs, one on neuroimaging data analysis (NDA) and one on the Kepler project. NDA drew a very large number of applicants and we had to turn quite a few away – clearly an indication of an actively growing field of research, and one that we might return to some day. The Kepler program was smaller, but had an unusual format. The program brought together a mix of astronomers and astrophysicists working on data from NASA's Kepler telescope (designed to detect planets outside our solar system which might be capable of supporting life) and statisticians bringing modern ideas from (mostly) Bayesian data analysis to bear on those problems. It was one of the most truly interdisciplinary programs we have had, in the sense of drawing virtually equal numbers from astronomy and statistics.

So could we do the same thing again, in a different field? Climatology is one of my own areas of interest, but it's not widely appreciated how much statistical work goes into what might seem to be a relatively simple problem – the construction of "global temperature averages" which are the starting point

(Continued on page 3)

Postdoctorlal Profile: Bailey Fosdick

"When most people think of social networks, they immediately think of interactive sites on the Internet. They assume I am studying Facebook and Twitter and I have to explain it is like that but on a much smaller scale," said Bailey Fosdick, SAMSI postdoc. However, the social networks that Bailey is studying have nothing to do with the Internet. She is looking at scenarios such as how substance abuse and obesity of adolescents are related to their social networks and how baboon troops socialize and fission over time.

Bailey was born and raised in the small town of Steamboat Springs, Colorado, which most people identify as a ski resort town. She was a ski racer for six years.

After high school, she spent a year at the Colorado School of Mines, a small school located in Golden, Colorado, specializing in engineering and science. She rounded out her undergraduate time at Colorado State University (CSU) majoring in mathematics with a minor in computer science.

Bailey felt statistics was her calling and was urged to pursue graduate school by a great group of faculty mentors in the Department of Statistics at CSU. One year later she was in the statistics graduate program at the University of Washington in Seattle.

The University of Washington's Center for Statistics and the Social Sciences gave Bailey a place to learn about important statistical questions in the social sciences. She enjoys working on real-world problems and collaborating with experts in specific areas of science to develop and apply statistical methods to solve pressing problems in their areas.

Bailey's love for sports continued at the University of Washington where she was a part of intramural co-ed volleyball and coed-flag football championship winning teams multiple years. She also played co-ed softball.

She heard about SAMSI after seeing an advertisement announcing that SAMSI was looking for postdoctoral fellows and several of the faculty told her it would be a great opportunity to pursue. She is here for one year as a fellow for the Computational Methods in Social Sciences program. "I felt the SAMSI program was a great fit for the work I had been doing at the University of Washington," said Bailey.

Bailey is involved with several working groups including social networks, censuses and surveys, and the topology working group, which is actually a part of the Low-dimensional Structure in High-dimensional Systems (LDHD) program.

"I have really enjoyed being here. This region is rich in opportunities with the three major universities located so close together. Although I have yet to visit all three statistics departments, the events at SAMSI have allowed me to meet and engage with many of the incredible researchers in the area," noted Bailey.

She has found social network research to be very interesting and fulfilling. She is also happy to be making new connections at SAMSI with whom she will most likely continue to collaborate with in the coming years.

When she is not at SAMSI, Bailey enjoys running. She says while in Seattle she usually ran when the sun was out and that typically equated to a couple times a

(Continued on page 3)

Chief Meteorologist Greg Fishel Talk Sponsored by SAMSI

SAMSI held a public lecture featuring Capitol Broadcasting (WRAL-TV, WRAL-Radio, Fox50) Chief Meteorologist Greg Fishel in December. Fishel's lecture was entitled," The Changing Climate of Weather Prognostication: The Irony of Uncertainty Leading to Better Forecasts."

Fishel talked about what computer models actually do. He explained they are a myriad of mathematical equations. He said that if we know how one variable is changing in respect to another, it helps us to predict how it will change in the future. The amount of details available help to make the prediction more accurate. But just one model, even with a lot of detail, does not make it better. So, meteorologists use ensembles, which is altering the initial conditions of the model just slightly to, say, 20 different extents and then running the same models with these 20 differing initial conditions. This helps the forecasters to see how much sensitivity there is to the initial conditions.

He talked about how these models are at times less reliable the further out the predictions are made. For example, he showed the audience how the ensembles compared to the control model over time for the prediction of the frost line. As it went further out, the various models showed the line to be anywhere from Tallahassee, Florida to Fort Wayne, Indiana. In other words, it was not very useful. But, Fishel said when the models show a huge variance, it is still useful to say he just doesn't know where the frost line will be.

To see more of Greg Fishel's talk, go to the SAMSI website and look for videos under the communications tab.

Postdoc Profile Continued

(from page 2)

week. However, she has found that to be a nearly daily occurrence in North Carolina. She and her husband are also playing softball in a softball league on the weekends.

Next year, Bailey will take a job as assistant professor of statistics at Colorado State University. She is happy to be returning to her home state and is very thankful that the university allowed her to take this year to do the postdoctoral fellowship at SAMSI.

Read more about Bailey Fosdick on the SAMSI blog at samsiatrtp.wordpress.com.

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Director's Letter Continued

(from page 2)

of most analyses of climate change. One person who knows a lot about this is Peter Thorne, a meteorologist who has held positions in the U.K., Norway and, in between, North Carolina. For the last several years, Peter been leading an international effort on surface temperatures. Now he has agreed to lead a summer program for SAMSI, jointly with the National Center for Atmospheric Research, which will take place in Boulder, CO, in July.

Other recent activities have included a workshop on seismology, which was part of SAMSI's contribution to the international year on Mathematics for Planet Earth, and a public lecture by Greg Fishel (see related article above), which was part of the International Year of Statistics. Greg is well known in our area as a TV meteorologist; in this lecture, he demonstrated some striking original ideas for presenting probabilistic weather forecasts.

So there has been a lot going on at SAMSI, but at least as busy a year ahead. If you haven't participated in one of our activities lately, we hope you soon do!

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Directorate:

Richard Smith | Director
The University of North Carolina at Chapel Hill

Snehalata Huzurbazar | Deputy Director
University of Wyoming/North Carolina State University

Ilse Ipsen | Associate Director
North Carolina State University

Alan Karr | Associate Director
National Institute of Statistical Sciences

Ezra Miller | Associate Director
Duke University

SAMSI Staff:

Amarjit Budhiraja | VI-MSS Coordinator
budhiraj at email.unc.edu

Gordon Campbell | Operations Director
campbell at samsi.info

Rita Fortune | Financial Analyst
rita at samsi.info

Thomas Gehrmann | Program Assistant
tgehrmann at samsi.info

Karem Jackson | Workshop Specialist
kjackson at samsi.info

Katherine Kantner | Webmaster
kak at niss.org

Sue McDonald | Senior Program Coordinator
sue at samsi.info

Jamie Nunnelly | Communications Director
nunnelly at niss.org

Lori Pennington | Program Assistant
pennington at samsi.info

James Thomas | Computational Systems
help at samsi.info

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19 T. W. Alexander Drive
P.O. Box 14006
Research Triangle Park, NC 27709-4006

Calendar of Events for SAMSI

LDHD: Topological Data Analysis
February 3-7, 2014
RTP, NC

Education and Outreach:
Undergraduate Workshop Focusing on LDHD
February 20-21, 2014
RTP, NC

LDHD: Statistical Inference in Sparse High-dimensional Models: theoretical and computational challenges
February 24-26, 2014
RTP, NC

LDHD: SAMSI-CRM Workshop on Geometric Aspects of High-dimensional inference
March 31-April 2, 2014
RTP, NC

Spring Opportunities for Women
April 9-11, 2014
Knoxville, TN

CMSS Transition Workshop
May 5-7, 2014
RTP, NC

LDHD Transition Workshop
May 12-14, 2014
RTP, NC

Education and Outreach
Undergraduate Modeling Workshop
May 18-23, 2014
RTP, NC

Geometric, Topological and Graphical Model Methods in Statistics: Low-dimensional Structure in High-dimensional Systems
Sponsored by CANSSI/Fields Institute and SAMSI
May 22-23, 2014
at the Fields Institute in Toronto, Canada

Recruiting and Retaining Graduate Students in Statistical Sciences and Applied Mathematics
June 5-6, 2014
RTP, NC

Computational Methods for Surveys and Census Data in the Social Sciences
Sponsored by CANSSI/CRM and SAMSI
June 20-21, 2014
at the Centre de Recherches Mathématiques (CRM) in Montréal, Canada

Summer Program: The International Surface Temperative Initiative
Sponsored by SAMSI and the Institute for Mathematics Applied to Geosciences
July 8-16, 2014
Boulder, CO

Education and Outreach
Industrial Mathematical and Statistical Modeling Workshop for Graduate Students
July 14-22, 2014
Raleigh, NC

Mathematical and Statistical Ecology Opening Workshop
August 18-22, 2014
RTP, NC

Bioinformatics Opening Workshop
September 8-12, 2014
RTP, NC

For more information about SAMSI programs and workshops, visit SAMSI's website at ***http://www.samsi.info***