

The Newsletter of the Statistical and Applied Mathematical Sciences Institute

SMC Transition Formally Closes Program: Many Research Projects Continue

By Julien Cornebise

The 2008-2009 Sequential Monte Carlo (SMC) program, a very popular program involving about 155 researchers, drew to a close at its Transition Workshop on November 9-10, 2009. However, this only marks the end of SAMSI's formal involvement, as many projects stemming from the working groups are continuing to develop.

The Transition Workshop displayed a wide panel of some of the progress made in SMC and related fields by the seven active working groups: **Big Data and Distributed Computing; Continuous Time Modeling; Model Assessment; Population Monte**

of identifying cells in a microscope video, evaluating their interaction, their growth and their multiplication.

The **Population Monte Carlo** group helped advance the design of fully adaptive Monte Carlo methods for arbitrary sequences of probability distributions. Automatically designing the proposal distributions for sequential sampling is key to MC algorithms. It has seen an even broader demand with the recent surge of likelihood-free Approximate Bayesian Computation methods, which tackle models too intricate to compute likelihoods by sequentially narrowing thresholds on similarities between true observations (e.g. instances of a genome) and simulated observations.

emphasis on heavily censored observations, as used to value residential mortgages. They combined partial-likelihood estimation with Sequential Monte Carlo to estimate the whole vector of parameters in a latent doubly stochastic Poisson process, which ultimately drives the probability of premature termination of a mortgage.

The **Model Assessment and Adaptive Design** group worked on a new method for high dimensional model selection and modeling. The group also worked on sequential learning for dynamical graphical model structures using particle approximations. It finally applied this new methodology in the financial portfolio analysis area.

Finally, the **Big Data** working group presented one of its projects: algorithms to process massive datasets, through targeted

re-sampling of rare and significant sub-populations, identifying them from the bulk so as to ensure efficient and focused inference on low-probability regions of the sample space, as typically required in flow cytometry experiments.



Jim Lynch and Sarah Schott attended the SAMSI SMC Transition workshop.



The participants at the SMC Transition workshop check email during a break in the action.

Carlo; Particle Learning; Theory; and Tracking. Non-exhaustively, the talks of these two days went as follows.

The main focus of the **Tracking and Large-scale Dynamical Systems** working group was the development of sequential variable dimension methods for the multiple-target tracking problem in clutter noise, for an unknown number of targets, appearing and disappearing randomly: think for example

The **Particle Learning** group developed algorithms especially suited for parameter inference, with a special emphasis on key application models from economics, such as long memory stochastic volatility, epidemiology and neurological data.

The **Continuous Time** group investigated filtering for diffusion processes, with an

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From the director...

SAMSI has, of course, had a long and indispensable collaboration with NISS. Less well-known is our extensive collaborations with our sister institutes from North America in the mathematical and statistical sciences. The most visible result of this collaboration is the webpage <http://www.mathinstitutes.org>, where one can simultaneously search for research programs and events at all of the National Science Foundation sponsored institutes. The latest collaboration – involving an even larger number of institutes – is at <http://www.mathinstitutes.org/climate-initiative>, and focuses on Sustainability and Climate Change. With these topics becoming increasingly significant drivers of research, the North American institutes have banded together to stimulate and coordinate research programs in these areas.

In November, I was delighted to attend the Transition Workshop of last year's program on Sequential Monte Carlo Methods. It was inspiring to see what had been accomplished in this research program, some of the highlights of which are discussed in the lead article of this newsletter.

Lately I've been spending most of my time in a favorite activity: lining up the people who will be at SAMSI next year. Many outstanding researchers plan long-term visits to SAMSI, to participate in the two year-long programs Analysis of Object Data and Complex Networks. As usual, it looks like we will have a packed house, although there are still some opportunities for visits in the Spring to these programs.

The second group of SAMSI researchers that we are finalizing for these programs are the Postdoctoral Fellows. While we will be carrying over six postdoctoral fellows from last year (primarily from year 2 of the joint institutes postdoctoral initiative), we are also hiring 5 new postdoctoral fellows. The candidates this year are

exceptional, and we look forward to a very stimulating influx of new researchers.

It is with great pleasure that I report a few changes in the SAMSI organization. We were delighted to welcome Karem Jackson – who is highlighted in this newsletter – as our new Workshop Specialist. Pierre Gramaud transitioned from Associate Director to full-time Deputy Director on January 1, and has leapt in to greatly improve numerous aspects of the SAMSI operation, while enjoying his big new office!

Finally, we just heard the tremendously exciting news that Richard Smith – from the Statistics and Operations Research Department at the University of North Carolina Chapel Hill – has accepted the offer from the SAMSI Governing Board to be the next SAMSI Director, to begin on July 1, 2010. The next newsletter will highlight Richard and this transition but I couldn't wait to break the great news!

James O. Berger
Director



SAMSI Staff Profile: Karem Jackson

Karem Jackson joined the SAMSI staff in November as the new Workshop Specialist. Karem grew up in Chicago, Illinois. Karem received her Masters Degree in Public Administration from Southern University in Baton Rouge, LA. She originally was in human resources and worked as an Allied Health Recruiter for a number of years before taking time off to raise her children.

She and her husband moved to the Triangle region in 2003 after her husband got a job in the area. Karem worked at Duke Temporary Services since March 2008 before she landed the job at SAMSI.

In her new position, Karem is working on various details for the SAMSI workshops. She is the person responsible for disseminating the workshop materials, making sure the name badges are correct, the AV equipment is running properly, etc. She sends out the monthly *SAMSI at a Glance* e-mail that informs folks of who is currently residing at SAMSI. She also helps other staff members as they need her assistance.

"I have already learned a lot from this job," remarks Karem, "I have had a chance to go to a class about cost centers and also will be attending a class about Visa documentation. I'm happy to get more exposure to things I didn't know before."

Karem and her family reside in North Raleigh.



Karem Jackson is our
new Workshop Specialist

SAMSI Postdoc Profile: Julien Cornebise

Julien Cornebise is a postdoctoral fellow at SAMSI who has been working on the Sequential Monte Carlo (SMC) program. Julien grew up in Paris, France. He received his Master's degree in engineering and computer science from the ESIEA engineering school, and his Master's degree in mathematical statistic from University Pierre and Marie Curie – Paris 6, both in 2005. From 2005-2008, he pursued his Ph.D. in mathematical science and statistics at University Pierre and Marie Curie - Paris 6 and Telecom ParisTech.



When he arrived at SAMSI in September 2008, he still had to finish his dissertation. He participated in the Population Monte Carlo working group and the Tracking working group, which were both part of the SMC program. He was the webmaster for both working groups, coordinating all the logistics for the groups, and co-lead the Population Monte Carlo group with Arnaud Doucet. He also had the opportunity to co-organize the final Transition Workshop of the program.

“My time at SAMSI has been tremendous. I moved from only knowing great researchers from the field as sort-of-mythic names on articles, to actually meeting them, working together, debating of their theorems and algorithms and of mine on a white board, getting to grip with and building on top of the most recent works of the field: this is a mind-blowing experience!” remarks Julien.

Julien has been working on simulation algorithms, looking at models where it is impossible, or nearly impossible, to compute the likelihood of the data. Working with other researchers from Australia, Great Britain, and British Columbia that he met at SAMSI, they have adapted the simulation algorithms to be as fast as possible, optimally and progressively “bridging” the intermediate probability distributions corresponding to more and more accurate approximations of the target distribution. The team theoretically analyzed existing Sequential Monte Carlo (SMC) algorithms, and from there, is developing new algorithms using these adaptive SMC methods. What would have taken a month to run, or not even been possible to run at all, is now taking a matter of hours or minutes.

“I could not recommend highly enough to apply to SAMSI at all costs to any graduate student or researcher who has the opportunity. Working here is a tremendous research booster and career booster. You get involved in fascinating topics and receive fantastic quality and quantity of feedback from many people – ranging from practitioners raising concrete issues to mathematicians focusing on the most challenging theoretical proofs and analysis. By reaching out to the people of your working groups, and to the many visitors, you will make the most of this experience. SAMSI gives you the incredibly best conditions both to lead your very own research and to become a living and active part of the research community. Jim Berger once summarized it all as ‘What is best for you is best for SAMSI’, and I am deeply grateful for this extremely helpful and open spirit that reigns here.”

Julien is currently working at the University of British Columbia (UBC) with Arnaud Doucet, an associate professor at UBC and co-organizer of the SMC program, whom Julien worked closely with over the past year and a half. Julien will be working with Arnaud as the prolongation of his SAMSI postdoc.

Education and Outreach – Poster Session at SAMSI

The Theory of Continuous Space and Space-Time Process course ended on November 19 with a poster session held at SAMSI. The course was taught by Dr. Alan Gelfand of Duke University. The students each presented a poster of their work. Students worked on projects such as examining if there were certain parameters that might affect the weight gain of pregnant women, extreme weather events over time, and volcano explosions over time. Although the last class was a final, it was also a celebration. Students had pizza and sodas after their posters were reviewed.



Students review each other's work at the poster session.

The fall undergraduate workshop was also a great success. Students visited SAMSI October 30-31. The workshop focused on space-time analysis for environmental mapping, epidemiology and climate change.

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National Institute of Sta-
tistical Sciences

SAMSI Staff:

Gordon Campbell | Opera-
tions Director
campbell at samsi.info

Rita Fortune | Financial
Analyst
rita at samsi.info

Karem Jackson | Workshop
Specialist
kjackson at samsi.info

Katherine Kantner |
Webmaster
kak at niss.org

Debbie Lesitkow |
Program Assistant
dcleisti at samsi.info

Cammy Cole Manning |
Interdisciplinary Under-
graduate Coordinator
manningc at Meredith.edu

Sue McDonald | Senior
Program Coordinator
sue at samsi.info

Jamie Nunnally |
Communications Director
nunnally at niss.org

Debbie Smith | Program
Assistant
dsmith at samsi.info

James Thomas |
Computational Systems
help at samsi.info

Calendar of Events for SAMSI

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

2009-10 Program on Stochastic Dynamics
Theory and Qualitative Behavior of Stochastic Dynamics Workshop
February 8-10, 2010

2009-10 Program on Space-time Analysis for Environmental Mapping, Epidemiology and Climate Change
Climate Change Workshop
February 17-19, 2010

2009-10 Education and Outreach Program
Two-Day Undergraduate Workshop
February 26-27, 2010

2009-10 Program on Stochastic Dynamics
Workshop on Molecular Motors, Neuron Models, and Epidemics on Networks
April 15-17, 2010

4th Annual Graduate Student Probability Conference
April 30, 2010 - May 2, 2010
Duke University, Durham, NC

