NISS
Parameters

A quarterly newsletter from the National Institute of Statistical Sciences

NISS at Twenty: A Look Back at Our Past - Part 3

In 2000, Alan Karr became director of NISS after Jerry Sacks retired.

Many people associated with NISS saw the transition as an opportunity to define a new era for NISS, and a time to create a more mature organization. In the late 1990's NISS had submitted a proposal to the Division of Mathematical Sciences at the National Science Foundation (NSF) to become one of the Mathematical Sciences Research Institutes, but the proposal was turned down. The Board of Trustees came to the realization that there should be two closely linked institutes:

• A more tightly focused NISS, addressing cross-disciplinary, cross-sector statistical challenges arising in government and industry.

• An identifiably NSF-style institute focused on the interactions among statistics, applied mathematics and disciplinary science, which became the Statistical and Applied Mathematical Sciences Institute (SAMSI), which came into existence in 2002.

NISS

Celebrating 20th year of NISS

20 10

10th year of affiliates program

Alan Karr, Director of NISS, speaking at the 2003 JSM reception.

In concept, and as it turns out in reality, NISS and SAMSI are perfect complements to one another, and each is dramatically strengthened by the other.

To focus on challenges arising in government and industry, NISS needed a direct pathway to leading statistical science groups in the community. So in 2000, the affiliates program (which had been envisioned by the founders of NISS) was created. While the principal goal was to inform the course of NISS research, the program rapidly developed an identity and momentum of its own. By the end of the first year, there were more than 40 members from industry, government and academia. When SAMSI was created, the program became shared by both institutes. In 2005, the American Statistical Association recognized the affiliates with its SPAIG (Statistical Partnerships among Academia, Industry and Government) Award. Today, the affiliates program is inseparable from the identity of NISS.

Many new projects began in the early 2000's. The largest activity was a series of projects on data confidentiality beginning in 2002, funded by the Digital Government program at the National Science Foundation, the Bureau of Labor Statistics, the Census Bureau, the National Agricultural Statistics Service, the National Center for Education Statistics and the National Center for Health Statistics, Centers for Disease Control and Prevention. Over ten years, these programs produced theory, methodology and software tools addressing issues ranging from geographical aggregation of county-level data to risk-utility formulations for a plethora of data dissemination problems, to tools for secure, principled statistical analysis of distributed databases.

Another accomplishment was the evaluation of complex computer models, which included a Focused Research Group (FRG) award from the National Science Foundation and several projects funded by General Motors.

The 1990s-era grant on educational assessment (whose PIs were Sacks, Daniel Horvitz, Lyle Jones and Ingram Olkin) became the foundation for one of NISS' strongest relationships, with the National Center for Education Statistics (NCES). In 2002, NISS led a review of NCES' statistical standards, and then subsequently convened task forces on high school graduation, completion and dropout indicators (whose recommendations were endorsed by the National Association of Governors and underlie the Obama administration's Race to the Top program, as well as the Bush administration's No Child Left Behind program), US participation in international assessments, and Title IX surveys. In 2005, NISS became a partner with the American Institutes for Research (AIR) in operating the Education Statistics Services Institute (ESSI) and the NAEP Education Statistics Services Institute (NESSI). Today, two NISS employees based in DC work on ESSI and

From the Director

I am delighted to welcome Larry Cox as Assistant Director of NISS for Official Statistics. Larry retired from the Federal government in May following a distinguished career that included the Census Bureau, the National Academies, the Environmental Protection Agency, and most recently, the National Center for Health Statistics. Larry is a long-time friend of NISS, ever since his EPA stint in Research Triangle Park, during which he even attended the 1997 ground-breaking for the original NISS building! Larry's roles will include serving as convener of the affiliates survey cluster, enhancing data confidentiality research at NISS and working with me—and ultimately many others—to develop a microsimulation model for surveys. Larry, it's great to have you as part of the NISS family! To learn more about Larry, read the story on page 3.

As part of long-term plans to strengthen the senior leadership, the Executive Committee approved in June a search for a Deputy Director of NISS, whom we hope to appoint by July 1, 2011. A copy of the announcement appears elsewhere in this issue of *Parameters*, but to summarize, the Deputy Director will work with Nell, me and our now two assistant directors (Larry and Stan Young) to further develop our research portfolio, to solidify and deepen the NISS-SAMSI relationship, and to help us move in the direction of attracting foundation as well as funding agency and corporate support for NISS research. Jessica Utts, Vice-Chair of the Board of Trustees, is chairing the search committee, which seeks suggestions and expressions of interest from academia, government and industry.

So by a year from now, we expect to have a leadership team of five, which will also include Associate Director Nell Sedransk, who will be based full-time in Washington DC, providing us strong senior leadership presence in DC, strengthening relationships with affiliates and other organizations there, and tending to our now-5-and-expected-to-grow set of employees and postdocs based in the DC area.

This year, as many of you know, is a series of anniversaries for NISS. The institute is now 20 years old, and the affiliates program is 10 years old. It is also a personal anniversary: I have had the privilege of serving as director for 10 years. Without question, the most gratifying part of being the director is the set of wonderful people I interact with. Thanking them all is impossible, but at the top of the list are three wonderfully supportive chairs of the Board of Trustees (Jon Kettenring, Vijay Nair and Jim Landwehr), fellow NISS geezer Dan Solomon, associate director Nell Sedransk, founding SAMSI director Jim Berger, and our superb staff, notably administrative assistant Martha Williamson, who has been at NISS longer than I have! They and everyone else associated with NISS are why I get up each day thinking that our future is brighter than our past.

Alan Karr
Director

NISS Seeks New Deputy Director

To continue expanding its scale, impact and relationships with the statistical sciences community, NISS seeks to appoint an energetic, visionary individual as its Research Triangle Park-based Deputy Director. This person will also serve as Associate Director of the Statistical and Applied Mathematical Sciences Institute (SAMSI), and may in addition hold a faculty appointment at one of the Research Triangle universities.

The principal responsibility of the Deputy Director of NISS is to expand and diversify the NISS research program. The Deputy Director will play a leadership role in creating high-impact cross-disciplinary and cross-sector projects addressing major societal problems such as health, education and sustainable energy; working with NISS affiliates and others to form research teams built on strong participation from the statistical sciences community; securing the necessary resources; and carrying out the research.

The Deputy Director will also oversee and build the NISS–SAMSI relationship, emphasizing the role of NISS in stimulating SAMSI programs and realizing the potential of NISS projects catalyzed by SAMSI programs.

The Deputy Director will work closely with the Director, the Associate and Assistant Directors, and the Board of Trustees to further develop NISS along multiple other dimensions, including the affiliates programs; communications; key relationships between NISS and industry, government and academia, both within and beyond the statistics community; and attracting foundation support for NISS activities.

The Deputy Director will report to the Director. Criteria for the position include a Ph.D. in the statistical sciences or a related discipline; a strong record of scientific activity and creativity; experience in assembling, generating funding for, and managing cross-disciplinary, multi-organization collaborations; superb communication skills; and passion for NISS

NISS Hires Lawrence H. Cox as Assistant Director

Lawrence H. Cox is joining NISS as Assistant Director for Official Statistics. In his new position, Cox will serve as convener of the survey cluster for the NISS affiliates program, expand the NISS presence in data confidentiality research and further plans to develop a microsimulation model for surveys. He will also help deepen the scientific connections between NISS and its sister institute SAMSI.

Alan Karr, Director of NISS, said "Larry Cox is a distinguished statistician who will help NISS in many ways, especially on research conducted in partnership with the federal statistical agencies. Larry's joining us is an important step in the evolution of NISS. With the transition of associate director Nell Sedransk to a Washington base and the plan to appoint an RTP-based deputy director, NISS will have a five-person leadership team, enabling us to continue expanding our service to the statistics community."

Larry Cox has joined NISS as its new Assistant Director for Official Statistics.

Prior to joining NISS, Cox was Associate Director for Research and Methodology at the National Center for Health Statistics, Centers for Disease Control and Prevention. His other former positions include Senior Mathematical Statistician for the U.S. Environmental Protection Agency, during which time he was located in Research Triangle Park, NC, and interacted with several NISS projects. He also served as Senior Mathematical Statistician for the U.S. Census Bureau, and Director, Board on Mathematical Sciences, National Academy of Sciences. He has taught for several universities, the Joint Program in Survey Methodology, and other organizations. Cox holds a Ph.D. in Mathematics from Brown University.

Cox has over 150 publications in the scientific literature, including more than 70 peer reviewed publications. He is a Fellow of the American Statistical Association (ASA) and an Elected Member of the International Statistical Institute (ISI). He has served on the ASA Board of Directors, the ISI Council and the Board of Directors of the National Computer Graphics Association. He has been associate editor of several journals including the **Journal of the American Statistical Association**, has taught, consulted and presented over 300 scientific lectures in the U.S. and abroad, and has organized many scientific meetings. He is the recipient of several awards, including a Department of Commerce Medal for Superior Federal Service.

His primary research contributions are on mathematical and computational theory, methods and optimization algorithms applied to problems in statistical science and surveys. He is the developer of many statistical data protection methods in current use. His current research is on quantitative methods for balancing the data protection effects of statistical disclosure limitation methods with their effects on data quality and usability.

Deputy Director Search (Continued)

(From page 2)

to lead the statistics community in serving the nation.

The goal is to fill the position as of July 1, 2011. Applications, expressions of interest and nominations should be sent to DDSearch11@niss.org. Both NISS Director Alan Karr and search committee chair Jessica Utts may be contacted at this e-mail address with questions. Applications should consist of a letter of interest, CV and names of five references. Review of applications will begin in October, 2010 and continue until the Deputy Director is appointed.

NISS is committed to recognizing and nurturing merit, talent, and achievement by supporting diversity and equal opportunity in all of its activities. NISS does not discriminate against employees or applicants for employment on any legally recognized basis, including, but not restricted to, race, color, religion, gender, national original, age, physical or mental disability, veteran status, or uniformed service member status. NISS seeks and welcomes applications from women and members of historically underrepresented groups.

Former Postdoc Profile:
Francisco Vera

Francisco Vera was a postdoctoral fellow at NISS during the years 2005-2006. He worked on developing software for secure statistical analysis of distributed data as part of the Digital Government project. This software allows data owners (for example, government agencies or corporations) to do regression and other analyses with data that are horizontally partitioned among several parties without revealing each individual's data.

Francisco Vera was a postdoc at NISS from 2005-2006.

Francisco grew up in Guayaquil, Ecuador and originally thought he would pursue a career in computer engineering. While he was in high school and was preparing to take his exams, he met a professor at the Escuela la Superior Politnica del Litoral (ESPOL) who told him they had just started a new degree program in statistics, so he decided to major in statistics. After receiving his degree at ESPOL, he came to the United States and studied at the University of South Carolina (USC) where he received his Ph.D. degree. His advisor at

USC was Jim Lynch, a frequent visitor to NISS and SAMSI. Jim told him about NISS and SAMSI, so after Francisco completed his work at USC, he applied for the postdoctoral position. During his year at NISS, half the time was spent working for NISS and half the time was spent at SAMSI, as part of SAMSI's National Defense and Homeland Security program.

"Working at NISS was a great experience. You have the opportunity to meet so many important people there. The networking is amazing. I got to meet people who actually wrote the books that I read when I was studying statistics in college. I also got to travel to some conferences and interact with people there," remarked Francisco. At SAMSI, Francisco was part of the anomaly detection working group. His research at SAMSI focused on predicting terrorist and crime events.

After leaving NISS and SAMSI, Francisco immediately returned to Ecuador

to get married to Paola, whom he met there. She also had an interest in studying mathematics. After they married, Francisco became a faculty member in the Department of Mathematical Sciences at Clemson University, and his wife got her degree in mathematics. She has been teaching mathematics at a local middle school.

The work that Francisco started at NISS and SAMSI eventually led to other research on predicting future behaviors, and he started studying disease outbreaks. Thanks to his continued relationship with NISS, Francisco was asked to join the syndromic surveillance project, which he says was a natural progression of the work he has been doing since he left NISS. This research project focuses on the probability that a particular disease is present somewhere in the US, or present in a particular city, together with the associated uncertainty. Some of the work that Francisco and his students at Clemson have done was to look at one hospital and the reports of a certain disease. The current syndromic surveillance project links multiple hospitals and other health care facilities together to help predict an outbreak faster. This project reunited Francisco with Alan Karr, Director of NISS and Jim Lynch, his former advisor at University of South Carolina, among others who are working on the project.

"Working at NISS also helped me to find a research path. Before, I would work on different projects, but never had a clear goal in mind. The work I did at NISS and SAMSI gave me the focus and direction I needed," commented Francisco.

This summer, Francisco and Paola returned to Ecuador, where both of their families live. He will be working as a professor of statistics at ESPOL beginning this Fall. Francisco will continue to work on the syndromic surveillance project.

Postdoctoral Fellow Profile:

Jian (Frank) Zou

Jian (Frank) Zou is an integral part of a project at NISS to make all of us safer. The focus of his research is Bayesian methods in syndromic surveillance, and his involvement spans development of new methodology to computational implementation at a national scale (nearly 8000 hospitals). Frank, along with Alan Karr, Director of NISS, David Banks and Matthew Heaton of Duke University, Gauri Datta of the University of Georgia, James Lynch of the University of South Carolina, and Francisco Vera of Clemson University, are all working on creating software that will provide early and accurate detection of disease outbreaks. The model can also be applied to threats such as biological weapon attacks. The project is funded by the National Science Foundation Division of Mathematical Sciences and by the Defense Threat Reduction Agency (DTRA).

Frank is working with spatial-temporal conditional autoregressive (CAR) models for syndromic surveillance. Initial experiments show that the model can work better than previous models that just use actual cumulative counts, or those that just focus on spatial modeling.

The research team began its research by conducting a massive literature review. Frank was also fortunate enough to be at NISS working on this project when SAMSI was holding a major research program on space-time analysis for environmental mapping, epidemiology and climate change. "I was able to talk to many of the top researchers in the world who are in this field of study," remarks Frank.
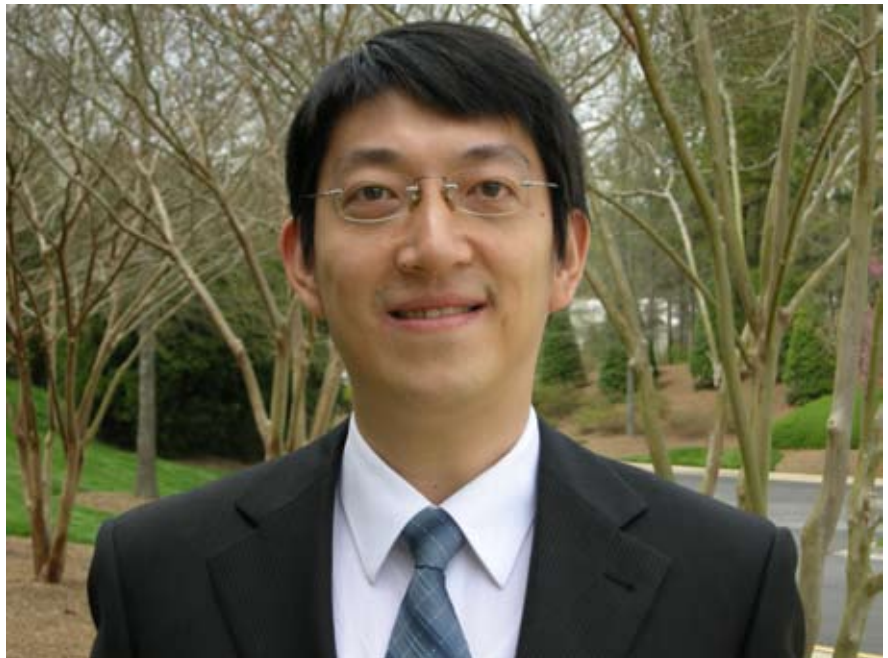
"We found that one of the most widely used methods by public health officials is the cumulative sum control (CUSUM) chart. This method detects small shifts in the mean of a process but it fails to account for the spatio-temporal structure in the data," notes Frank. The objective of the research group is to help healthcare workers and others have a way to detect these shifts as rapidly as possible. By detecting a disease outbreak early, for example, it is much easier to lessen

the outbreak. One day may make a huge difference.

Disease outbreaks are rife with uncertainty, so it is important that the syndromic surveillance system be able to handle this uncertainty and convey it to decision makers. Bayesian hierarchical models are popular methods to handle spatio-temporal data, explains Frank, so that was incorporated into the methodology.

The second phase of the group's research was to use simulated data with the model. It is important that the model detect outbreaks

Frank Zou has been at NISS for a year working on the syndromic surveillance project.

quickly and accurately without having too many false alarms. Frank explained that tests with simulated data have been very successful, but that more work is need to understand the model fully. The next phase of the research will use actual data provided by hospitals in North Carolina.

Frank grew up in China and attended Shandong University, where he received his Bachelor of Science degree in Mathematics and his Master of Science degree in Computer Science. He moved to the United States in 2003 and attended the University

of Connecticut, where he received another Master of Science degree in Mathematics and his Ph.D. in Statistics. Yazhen Wang, a former NSF program director, was his advisor at the University of Connecticut. His studies at Connecticut were focused on financial modeling. He came to NISS in 2009 to work on the syndromic surveillance project. Frank and his wife, Xiaqin, just welcomed their second daughter into the world! He will be busy both at work and at home.

Project ORCA
Online Reading Comprehension

Children are acquiring and comprehending information in new ways. Many educational environments rely on traditional methods of learning, such as textbooks, but many people these days get on the Internet to read news articles, read about products and services and learn about the world. NISS is participating in a $2.8 million research project with the University of Connecticut, the Pennsylvania State University and the University of Rhode Island funded by the Institute of Education Sciences (IES) of the US Department of Education to study just this subject.

Assessing Online Reading Comprehension: The ORCA Project directly involves the states of North Carolina, Connecticut and Maine. The Regional Educational Laboratory Northeast and Islands will also be involved in the project to consider the practicalities of online assessment. The project will be carried out by a research team with expertise in multiple areas essential to developing online reading comprehension assessments. The team members are at work on theory development, research design, measurement and statistical analysis to develop valid, reliable, and practical assessments of online reading comprehension. NISS' role focuses on the design of the studies and on the statistical analysis of the data gathered from the three states.

The study has four main goals. The first is to develop three different types of valid and reliable assessments to measure online reading comprehension. The second goal is to evaluate the internal assessment characteristics for each instrument type to inform decisions about which is most useful and practical for schools. Next, the research team will evaluate the extent to which performance on each format is associated with four measures of contextual validity. Finally, the utility and practicality of each instrument in the eyes of key decision makers will be estimated.

Most schools have not kept up with the way people are learning, and as a result these schools are not in a position to adequately teach online reading skills. The schools lack a valid, reliable assessment of online reading comprehension and the diagnostic tools to identify individual students' strengths and weaknesses with the specific skill set required for online reading. This study will help these schools get a better idea of how students are learning and will give school systems a way to develop curriculum and technology that will give students a better retention rate.

When the study was being developed in 2008, not a single state included these new types of tasks in their state reading assessments; and educators and policymakers were only beginning to consider whether and how best to measure the new skills required to comprehend dynamic Internet texts. When reading from Internet sources,

students need not only to comprehend but even more importantly, they need to decide what is real and credible. By evaluating reading comprehension in terms of four parts of online reading (locating information, evaluating credibility, synthesizing information and communicating knowledge and inferences), the study also aims to see whether or how Internet reading skills go beyond simple text comprehension and if so, whether traditionally measured reading skills are accelerated or impeded.

The evaluation will involve problem solving with online science-oriented texts, instead of traditional paragraphs used in regular text comprehension tests. The data from iterative cycles of cognitive labs, focus groups and both small- and large-scale pilot studies will be combined with a rigorous sequence of analyses using item response theory, multi-facet Rasch modeling and structural equation modeling procedures to deliver the best set of online reading comprehension assessments.

"NISS will provide the statistical expertise that will allow evaluation of the components of online reading comprehension as well as the overall competency. What makes this exciting is that by considering online reading comprehension as a multi-skill task, it should be possible in the future to assist students individually to learn to read effectively, depending on their particular strengths and weaknesses," remarked Nell Sedransk, Associate Director of NISS. NISS has been a key participant in this project from its inception, bringing statistical principles to bear on the problem of designing this study to ensure unbiased results. NISS is also developing the sampling plans that will assure each participating state that the classrooms participating are fully representative of the state.

Donate to the NISS Fund

The NISS Fund was created to help NISS pursue new paths. We promise to use the fund in targeted, imaginative ways, and especially to leverage the further growth of NISS.

NISS is on a trajectory to grow and to help the statistics community to serve the Nation.

Consider contributing to the NISS Fund when you are thinking about charitable contributions. Go to :

www.niss.org

Click on the NISS Fund link to make your contribution. Thank you for supporting NISS!

NISS History (Continued)

NESSI teams.

In 2003 NISS hired Stan Young (recently retired from GlaxoSmithKline) to be an assistant director for bioinformatics and Tom Gerig (who had just stepped down as head of the Department of Statistics at North Carolina State University) as assistant director for affiliates. However, the most important appointment was of Nell Sedransk as associate director, in 2005. Nell's extraordinary successes include new projects that doubled the number of NISS postdocs

Several changes from the recommendations have been enacted, including hiring a communications director.

More recently, NISS has continued to broaden its research portfolio. NISS worked with Merck on a project measuring the evaluation and analysis of electrocardiograms. NISS held a major Data Confidentiality Conference in 2008, leading to a special issue of the on-line **Journal of Privacy and Confidentiality**, one of whose founders is Alan Karr. In 2008, NISS and the National Agricultural Statistics Service (NASS) embarked on a two-year

From L-R: Dan Solomon, Jim Landwehr, Jon Kettenring, Nell Sedransk, Jim Berger and Alan Karr at the 2007 groundbreaking for the expansion of the NISS building.

research project called the NISS-NASS Cross-Sector Research in Residence program. The National Cancer Institute on the Clinical Proteomic Technology Assessment for Cancer (CPTAC) engaged NISS in 2009 to work on new multi-center studies including digestion, bioinformatics and verification. And, NISS started holding Exploration Workshops, which were a series of workshops that focus on topics of interest in emerging fields.

In the next edition of *NISS Parameters*, read about the plans NISS has for the future of the organization.

and the successful SAMSI renewal in 2007.

Long before 2007, it was clear that NISS and SAMSI needed more space. "From the time SAMSI was created, we knew we would need more room so that both NISS and SAMSI could continue to grow," said Alan Karr, director of NISS. Thanks to the success of both organizations, more research, workshops and programs were happening in the NISS/SAMSI building. NISS was able to secure financing from BB&T, and the decision to expand was made. By 2007, the ground was broken for the new wing and in November of 2008, a ribbon cutting ceremony took place to celebrate the new addition.

The Board of Trustees worked on a new strategic plan that helped lay out a community oriented vision for NISS. In 2007, NISS hired the Art & Science Group to help the board understand how to implement its vision.

The new wing of the NISS/SAMSI building in 2008.

A ribbon cutting ceremony for the building addition was held in November 2008. From L-R: Jim Berger, Dan Solomon, Alan Karr, Peter March and Jim Landwehr.

NISS Calendar of Events

Workshop on Threat Detection and Syndromic Surveillance
Dates TBD

Workshop on Comparative Effectiveness Research
Dates TBD

NISS Annual Board of Trustees Meeting
November 5-6, 2010

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P.O. Box 14006
19 T.W. Alexander Drive
Research Triangle Park, NC 27709
919.685.9300 (phone) 919.685.9310 (fax)
www.niss.org

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