Institute for Pure and Applied Mathematics, UCLA
Annual Progress Report for 2012-2013
Award #0931852
June 18, 2014

TABLE OF CONTENTS

Institute for Pure and Applied Mathematics, UCLA
Annual Progress Report for 2012-2013
Award #0931852
June 18, 2014

EXECUTIVE SUMMARY

IPAM held two long programs in 2012-2013:

- Materials Defects
- Interaction Between Analysis and Geometry

IPAM's 2013 winter workshops included:

- Structure and Randomness in System Identification and Learning.
- Adaptive Data Analysis and Sparsity
- Convex Relaxation Methods for Geometric Problems in Scientific Computing
- Multimodal Neuroimaging

IPAM's summer programs included:

- Research in Industrial Projects for Students – Los Angeles
- Research in Industrial Projects for Students – Hong Kong
- Women in Shape Modeling Workshop
- Summer School: Computer Vision

IPAM held reunion conferences for four long programs: Chemical Compound Space, Optimization, Climate Modeling, and Genomics.

IPAM's outreach and diversity activities included:

- Modern Math Workshop at SACNAS (with other math institutes)
- Reception at the Joint Mathematics Meetings (with other math institutes)
- Panel discussion of Latinos in mathematics, featuring five Latino mathematicians

IPAM continues to raise private funds through its membership society. IPAM held its second "donor salon" in September 2012.

IPAM published its fourth annual newsletter on September 1, 2012.

IPAM continues to work with an evaluation consultant. We have implemented pre- and post-program surveys for long programs and RIPS and a tool to evaluate the success of RIPS projects.

Jinqiao Duan completed his second/final year as Associate Director. Skip Garibaldi (Emory University) replaced him starting July 1, 2013.

Sallie Keller (Waterloo) and Alan Lee (AMD) joined IPAM's Board of Trustees.

The second annual Green Family Lecture Series, held on June 6-7, 2013, featured Fields Medalist Wendelin Werner.

IPAM held the public lecture "Toward Brain Computer Interfacing" by Klaus Robert Mueller in March 2013.

IPAM began recording most workshop lectures in September 2012 (videos available online).

The first NSF site visit of this grant period took place on December 5-6, 2012.

A. PARTICIPANT LIST

A list of all participants in IPAM programs will be provided in electronic form (Excel). The list includes participant lists for programs whose start dates fall between September 1, 2012 and August 31, 2013. This list includes our summer 2013 programs. It includes programs that were supported by other sources.

B. FINANCIAL SUPPORT LIST

A list of participants that received support from IPAM is provided in electronic form (Excel). The list includes all funded participants of programs that occurred between September 1, 2012 and August 31, 2013. It does not include programs that were entirely supported by other sources.

C. INCOME AND EXPENDITURE REPORT

This table covers years 1 through 3 of grant #0931852.

	A	B	C	D	E	F
			A-B=C		B+D=E	A-E=F
Budget Category	Appropriations Year 1 thru 3	Actual Expenses through August 2013	Current Balance as of August 2013	Encumbered Expenses as of August 2013	Total & Encumbered Expenses at August 2013	Encumbered Balance as of August 2013
A. Operations Fund	$6,810,000	$6,301,776	$508,224	$606,402	$6,908,178	$<98,178>
B. Participant Costs	$6,690,000	$5,145,064	$1,544,936	$23,556	$5,168,620	$1,521,380
3-Year Total Budget	$13,500,000	$11,446,840	$2,053,160	$629,958	$12,076,797	$1,423,203

IPAM received funding of $13,500,000 for the first three years of this grant. Expenditures in years 1 through 3 totaled $11,446,840 and $629,958 is encumbered for a total of $12,076,797 in expenses. The encumbered Grant balance is $1,423,203 at the end of year 3.

Expenditures for the three years ended August 31, 2013:

A. The Operational Fund (salaries, benefits, equipment, supplies, and travel including overhead) for first three years budget has an appropriation of $6,810,000 with total expenditures of $6,908,178. Included in the encumbered expenses is $497,281 for Associate Director Skip Garibaldi's subaward with Emory University for duties to be performed in years 4 and 5.

B. Participant Support Costs for the first three years budget has an appropriation of $6,690,000 with total expenditures of $5,168,620.

The balance of $1,423,203 as of August 31, 2013 is due to the nature of the budget. The budget is funded at constant annual increment of $4,500,000 per year for five years. During the first year IPAM was spending down the carryforward from Grant #0439872-01315100. IPAM manages its constant annual increments of $4,500,000 in a non-constant manner over the life of the grant. We expect our participant and operational expenses to increase over the remaining two years of the grant.

D.POSTDOCTORAL PLACEMENT LIST

In 2009, IPAM appointed 8 postdoctoral scholars through the NSF Mathematical Sciences Institutes Postdoctoral Scholars program. Five of them continued the position for a second year (2010-2011). One of them, Ricardo Alonso, continued the position for a third year, through July 31, 2012.

IPAM did not appoint postdoctoral fellows in 2012-2013, so we have no data to report in this section.

E. MATH INSTITUTE DIRECTORS' MEETING REPORT

You will find the minutes from this meeting (May 13-14, 2013) in Appendix 1.

F. PARTICIPANT SUMMARY

In fiscal year 2012-2013, 1,692 participants enrolled in two long programs, 17 workshops, four reunion conferences, three summer programs for students, and two other programs. IPAM actively seeks women and members of underrepresented ethnic groups to participate in its programs as organizers, speakers and participants. While most participants report their gender and ethnicity, some choose not to do so, and some did not respond to our request for the data. In this year, 7.5% of IPAM participants were members of an underrepresented minority group (combined), and almost 21% were women. See table F-1, below.

Table F-1: All Participants' Gender and Ethnicity by Program Type (2012-2013)							
				Underrepresented Ethnic Groups*			
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Long Programs	118	17	115	0	2	4	115
Workshops	1259	248	1235	2	18	62	1163
Summer Programs	272	76	295	0	9	19	254
Reunion Conferences	90	19	89	0	0	5	82
Total	1739	360	1734	2	29	90	1614
Percent of No. Reporting		20.8%		0.1%	1.8%	5.6%	

all members of underrepresented groups 121 7.50%
*gender and ethnicity is self-reported

IPAM also looked at unique participants for 2012-2013. There were 989 unique participants. Out of those reporting gender, 25% were women. Out of those reporting ethnicity, 9% reported that they are a member of an underrepresented ethnic group. Finally, 60% of unique participants listed mathematics and/or statistics as their primary field of interest.

IPAM tries to balance the expectation that we primarily serve the U.S. community (citizens and permanent residents) with the goal of attracting the best organizers, speakers and participants in the relevant fields. See Table F-2.

Table F-2: All Participants' Citizenship by Program Type (2012-2013)			
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	57	114	50%
Workshops	612	1222	50%
Summer Programs	136	252	54%
Reunion Conferences	50	90	56%
Total	855	1678	51%

The majority (96%) of the year's participants of IPAM programs hold academic positions (faculty, postdoc, graduate student, or undergraduate student). Out of the remaining participants, 19 held positions in government or military, and 35 worked in industry. The following sections provide summary data for the requested sub-groups: postdocs, graduate students, and undergraduate students.

G. POSTDOCTORAL PROGRAM SUMMARY

Postdocs attend IPAM's workshops, long programs, reunion conferences, and summer school, and a few serve as academic mentors in RIPS. See tables G-1 and G-2.

Table G-1: Postdocs' Gender and Ethnicity by Program Type (2012-2013)

Program Type	Total Participants	Female*	No. Reporting Gender	Underrepresented Ethnic Groups*			No. Reporting Ethnicity
				American Indian	Black	Hispanic	
Long Programs	28	4	27	0	1	2	27
Workshops	267	39	261	0	6	13	252
Summer Programs	21	1	21	0	0	2	21
Reunion Conferences	20	6	19	0	0	3	17
Total	336	50	328	0	7	20	317
Percent of No. Reporting		15.2%		0.0%	2.2%	6.3%	

all members of underrepresented groups 27 8.52%

*gender and ethnicity is self-reported

Table G-2: Postdocs' Citizenship by Program Type (2012-2013)

Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	11	28	39%
Workshops	96	267	36%
Summer Programs	9	21	43%
Reunion Conferences	8	20	40%
Total	124	336	37%

H. GRADUATE STUDENT PROGRAM SUMMARY

Graduate students participate in IPAM's workshops, long programs, reunion conferences, and summer school, and a few serve as academic mentors in our undergraduate summer programs.

Graduate students often find a compelling thesis topic at an IPAM program, and also frequently make contacts that lead to their first job. See tables H-1 and H-2.

Table H-1: Graduate Students' Gender and Ethnicity by Program Type (2012-2013)

Program Type	Total Participants	Female*	No. Reporting Gender	Underrepresented Ethnic Groups*			No. Reporting Ethnicity
				American Indian	Black	Hispanic	
Long Programs	20	2	19	0	0	1	19
Workshops	304	82	300	2	3	16	284
Summer Programs	81	23	80	0	3	4	91
Reunion Conferences	21	3	21	0	0	0	19
Total	426	110	420	2	6	21	413
Percent of No. Reporting		26.2%		0.5%	1.5%	5.1%	

all members of underrepresented groups 29 7.02%
*gender and ethnicity is self-reported

Table H-2: Graduate Students' Citizenship by Program Type (2012-2013)

Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	5	20	25%
Workshops	113	303	37%
Summer Programs	17	81	21%
Reunion Conferences	7	21	33%
Total	142	425	33.41%

I. UNDERGRADUATE STUDENT PROGRAM SUMMARY

Undergraduate students participate in our summer programs, Research in Industrial Projects for Students (RIPS) in Los Angeles and Hong Kong. RIPS Projects Day is listed as a separate workshop, as we invited undergraduate students and others interested industrial applications of math. A detailed description of RIPS-LA and Hong Kong as well as comments from participants is available in section J of this report.

In addition, several undergraduates students participated in a one-day event (called a workshop for the purpose of this report) called "¿Así Que Quieres Ser un Matemático? A Panel Discussion with Latino/a Mathematicians."

Table I-1: Undergraduates' Gender and Ethnicity by Program Type (2012-2013)

Program Type	Total Participants	Female*	No. Reporting Gender	Underrepresented Ethnic Groups*			No. Reporting Ethnicity
				American Indian	Black	Hispanic	
Workshops	5	2	5	0	0	5	5
Summer Programs	89	41	87	0	4	6	80
Total	94	43	92	0	4	11	85
Percent of No. Reporting		46.7%		0.0%	4.7%	12.9%	

all members of underrepresented groups 15 17.65%

*gender and ethnicity is self-reported

Table G-2: Postdocs' Citizenship by Program Type (2012-2013)

Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Workshops	4	5	80%
Summer Programs	63	89	71%
Total	67	94	71%

J. PROGRAM DESCRIPTION

The programs are listed in chronological order by start date. The list includes all IPAM programs from September 1, 2012 through August 31, 2013, which includes:

- Two long programs, and the workshops associated with each
- Four IPAM independent workshops, most of which are five days in length
- Four summer programs
- Four reunion conferences of long programs held at IPAM in previous years
- Three public lectures, including the Green Family Lecture Series
- A panel discussion sponsored by IPAM

Public lectures feature a speaker with a national reputation who speaks on a topic of broad interest to an audience that includes non-scientists. IPAM's first public lecture of 2012-2013 featured Klaus-Robert Müller and was held during the Multimodal Neuroimaging workshop (he also gave research a talk during the workshop) and is described below. Additionally, IPAM

offered two talks featuring physicist Wendelin Werner as part of the **Green Family Lecture Series.**

Most IPAM workshops include poster sessions; all participants are invited to present a poster, but graduate students are especially encouraged to participate.

LONG PROGRAM: Materials Defects: Mathematics, Computation, and Engineering.
September 10 - December 14, 2012

Organizing Committee:

Vasily V. Bulatov (Lawrence Livermore National Laboratory)
Jiun-Shyan Chen (University of California, Los Angeles (UCLA), Civil & Environmental Eng)
Kristen Fichthorn (Pennsylvania State University)
Nasr Ghoniem (University of California, Los Angeles (UCLA), Mechanical & Aerospace Engr.)
Mitchell Luskin (University of Minnesota, Twin Cities)
Michael Ortiz (California Institute of Technology, Aeronautics and Applied Mechanics)
Tim Schulze (University of Tennessee, Math)
Vivek Shenoy (Brown University)
Axel Voigt (Technishche Universtitat Dresden)

Scientific Overview:

Mathematics and computation have long played a significant role in materials science. Material defects present a huge challenge for mathematical modeling and simulation, as anything that breaks up the regular, homogeneous structure of a calculation requires special consideration. Examples include crack-propagation, dislocations, grain boundaries, impurities, shear bands and strain localization. In recent years, there has been particular focus on the multiscale nature of materials research --- how computational methods and mathematical models for describing materials vary from the atomistic to the continuum scale. The workshops in this program continued this trend, but with a new emphasis on defects. While individual minisymposia in conferences have been organized in response to this increasingly important field, the science of material defects remains one of the most challenging subjects owing to its interdisciplinary nature that spans mechanics, mathematics, materials science, physics, computer science, and other scientific disciplines. This program aimed to promote collaboration among this diverse group to assess the current status of defect modeling, promote the development of new computational techniques, and stimulate new applications. The program attracted both junior and senior participants.

Below are some comments from the participants of the program:

“It was a great opportunity to be able to participate in all the activities of the program (courses, seminars, workshops…) that mixed techniques from different fields. I was also able to follow the seminars from the Math Department at UCLA. I talked to many mathematicians about open problems and new directions of research. People in general were willing to talk to you and share ideas. I also take part of an event for women mathematicians that help to share the worries and

problems that we encounter during our career. I really want to thank again this opportunity to IPAM."

Estibalitz Durand Cartegena, Applied Mathematics, UNED

"The IPAM program I attended gave me a much broader view of my field and introduced me to many new methods and phenomena that are starting to alter my research direction. The program allowed me to interact with many researchers who I normally would not have come in contact. This was very useful."

Ken Elder, Oakland University

"Together with Sebastian Schreiber (also a participant), we established a collaboration in which we worked out a computational scheme to evaluate the error propagation within electronic structure coarse graining procedures. Sebastian and I work both on atomistic simulations of materials properties, but still with rather different techniques (density functional theory and bond order potentials). Within the research time at IPAM we combined our knowledge to investigate, in how far first-principles thermodynamic materials predictions suffer from simplifying the underlying electronic structure method. The work was initiated at IPAM. I have presented related research on two occasions in 2013. I hope to write up this research for a common manuscript in the near future.

"The research stay enriched my career and my personal evolvement in many ways. The warm, nice and great atmosphere at IPAM definitely confirmed my general intention to follow a career in science. The long-term workshop allowed me to not only attending lectures from a larger number of eminent and outstanding researchers, but in particular to get the chance to work and learn from them during the workshops. I highly appreciated the opportunity to work with researchers from different fields. Discussing research problems in a team of mathematicians, physicists, and engineers reveals their sometimes completely different point of view on the same problem. Over the months I learned not only about new research topics, but in particular, I became sensitive to look on things from different perspectives. This is an invaluable experience for me and I'm extremely grateful for the opportunity given to me by IPAM."

Fritz Kormann, Max-Planck-Institut für Eisenforschung GmbH, Computational Materials Design

WORKSHOP: Materials Defects Tutorials. September 11 - 14, 2012

Organizing Committee:

Jiun-Shyan Chen (University of California, Los Angeles (UCLA), Civil & Environmental Eng)
Mitchell Luskin (University of Minnesota, Twin Cities)
Tim Schulze (University of Tennessee, Math)
Axel Voigt (Technishche Universtitat Dresden)

Scientific Overview:

This long program opened with four days of tutorials that provided an introduction to major themes of the entire program and the four workshops. The goal was to build a foundation for the participants of this program who have diverse scientific backgrounds. Topics that were discussed during the tutorials included:

- Interatomic Potentials: From Ab-Initio to Empirical Potentials
- Molecular Dynamics
- Kinetic Monte Carlo Simulations
- Surface Dynamics
- Dislocations
- Grain Boundaries and Polycrystalline Materials
- Crack Propagation
- Fracture Mechanics
- Continuum Plasticity

WORKSHOP: Quantum and Atomistic Modeling of Materials Defects (Materials Defects Workshop I). October 1 - 5, 2012

Organizing Committee:

Eric Cances (École Nationale des Ponts-et-Chaussées, Applied Mathematics)
Kristen Fichthorn (Pennsylvania State University)
Graeme Henkelman (University of Texas at Austin, Department of Chemistry)
Nick Kioussis (California State University, Northridge (CSU Northridge))
Axel Voigt (Technishche Universtitat Dresden)

Scientific Overview:

The modeling and simulation of defects in materials at the atomic scale is a prominent topic in solid-state physics, chemistry, materials science and nanotechnologies. Besides its importance for the applications, it is also a rich field of research for mathematicians, which gives rise to many interesting mathematical and numerical questions (modeling and simulation of infinite, weakly disordered, quantum systems, in the presence of long-range interactions). The purpose of this workshop was to gather experts of different communities to discuss the state-of-the-art models and numerical methods used to compute the properties of materials with atomic-scale defects. Both quantum and classical models were considered, and several topics were covered, including:

- Density Functional Theory (DFT) for materials with defects;
- Alternatives to Kohn-Sham DFT methods (for example, simulation of very large systems by semi-empirical methods or orbital-free DFT, energy functionals accounting for van der Waals forces, Quantum Monte Carlo methods, QM/MM approaches);
- Accelerated molecular dynamics and computation of rare events, with specific applications to the diffusion and aggregation of defects in the bulk and on interfaces.

WORKSHOP: Modern Math Workshop (sponsored by the NSF Math Institutes). October 10 - 11, 2012

Organizing Committee:

Jeff Brock (ICERM, Institute for Computational and Experimental Research in Mathematics)
Ricardo Cortez (Tulane University)
Ruth Crane (ICERM, Institute for Computational and Experimental Research in Mathematics)
Suzanne Lenhart (University of Tennessee and NIMBioS)
Ivelisse Rubio (University of Puerto Rico, Computer Science)
Kelly Sturner (NIMBioS, National Institute for Mathematical and Biological Synthesis)

Scientific Overview:

The eight NSF mathematics institutes and NIMBioS were pleased to offer three concurrent sessions immediately preceding the SACNAS annual meeting – one for graduate students and recent PhDs, and two for undergraduate students – to invigorate the research careers of minority mathematicians and mathematics faculty at minority-serving institutions. The "Modern Math Workshop" is one of the workshops in the *Mathematical Sciences Collaborative Diversity Initiative*. This workshop highlighted presentations on topics drawn from the institutes' upcoming programs, a keynote speaker, and an informative panel presentation on the 2013-14 programs and workshops. The two undergraduate sessions (applicants chose one) were appropriate for students of any major interested in learning how mathematics contributes to our understanding of various scientific topics. Activities included lectures and group work. Participants also attended the keynote lecture and panel discussion.

WORKSHOP: Atomistic and Mesoscale Modeling of Materials Defects (Materials Defects Workshop II). October 22 - 26, 2012

Organizing Committee:

Vasily V. Bulatov (Lawrence Livermore National Laboratory)
Wei Cai (Stanford University)
Marisol Koslowski (Purdue University)
Talat Rahman (University of Central Florida)
Tim Schulze (University of Tennessee, Math)
Ellad Tadmor (University of Minnesota, Twin Cities)
Axel Voigt (Technishche Universtitat Dresden)

Scientific Overview:

Current nanoscale devices often aim to exploit materials defects, either naturally occurring or induced by a processing technique. For example, solute atoms or nano-clusters, which are ubiquitous in metals, play a key role in altering their mechanical properties, such as strength and ductility. Understanding how to build such devices requires growth models that can simulate the

entire manufacturing process. Over short time scales, molecular dynamics is an ideal tool for exploring such atomic scale behavior, but due to the very small scale of atomic vibrations and relatively rare transitions between atomic configurations, this method is nearly useless for modeling growth and non-equilibrium behavior. While a great deal of progress has been made with accelerated molecular dynamics, methods that can address still longer scales and incorporate aspects of continuum modeling are frequently turned to for this type of simulation. This workshop brought together a diverse research community exploring alternative methods for simulating the atomic scale evolution of defects like dislocations, point defects, cracks, grain boundaries, and more general interfaces using methods like phase field crystal, quasicontinuum, accelerated molecular dynamics and kinetic Monte Carlo. Collectively, these methods seek to idealize or coarse-grain atomic scale dynamics while preserving atomic scale detail.

WORKSHOP: Mesoscale and Continuum Scale Modeling of Materials Defects (Materials Defects Workshop III). November 13 - 16, 2012

Organizing Committee:

Nasr Ghoniem (University of California, Los Angeles (UCLA), Mechanical & Aerospace Engr.)
David Kinderlehrer (Carnegie-Mellon University)
John Lowengrub (University of California, Irvine (UCI), Mathematics)
Nele Moelans (Katholieke Universiteit Leuven)
Vivek Shenoy (Brown University)

Scientific Overview:

Nearly all engineered materials have microstructures which suffer defects, either by nature or by design. These defects play a major role in the properties and function of a material as well as lifetime properties. Their complexity render analysis and simulation important to their investigation. This workshop focused on four broad classes of materials defects: grain boundaries, cracks, dislocation dynamics, and point defects like vacancies and interstitials. Many of these types of defects have been studied from the point of view of continuum elasticity. Increasingly, however, it is desirable to understand atomic scale details of such phenomena and to understand how mesoscale theory can predict features of macroscopic behavior. Mesoscale models such as Kinetic Monte Carlo, Phase-Field Crystal, and Quasi-Continuum models offer the potential to resolve these details on length and time scales that can make contact with the macro-scale and corresponding continuum theories. Moreover, the discovery of new network level properties, like the Grain Boundary Character Distribution, enlarge the role of both analysis and simulation methods. Important questions concerning the relationship between such models remain to be answered.

WORKSHOP: Computational Methods for Multiscale Modeling of Materials Defects (Materials Defects Workshop IV). December 3 - 7, 2012

Organizing Committee:

Jiun-Shyan Chen (University of California, Los Angeles (UCLA), Civil & Environmental Eng)
Jacob Fish (Columbia University)
Mitchell Luskin (University of Minnesota, Twin Cities)
Michael Ortiz (California Institute of Technology, Aeronautics and Applied Mechanics)
Axel Voigt (Technishche Universtitat Dresden)

Scientific Overview:

This workshop integrated mathematical, computational, and physics based approaches to the multiscale modeling of materials with defects. While many new multiscale methods have been recently proposed, new theory is needed to validate and optimize multiscale computational methods. Further, most multiscale methods are not applicable to problems considering defects or other nonuniform microstructural features. Material defects thus call for new homogenization theory. This workshop promoted the further development of multiscale modeling of materials defects.

WORKSHOP: Materials Defects Culminating Workshop at Lake Arrowhead Conference Center. December 9 - 14, 2012

The culminating workshop was organized by the long program organizing committee.

The final workshop in the long program, held at Lake Arrowhead Conference Center, provided an opportunity for the program's core participants to report on their work during the past three months and to discuss future projects. Many of the collaborations and interactions that were formed during the program had a chance to deepen.

REUNION CONFERENCE: Chemical Compound Space Reunion at Lake Arrowhead Conference Center. December 9 - 14, 2012

This was the first reunion conference for participants of the spring 2011 long program "Navigating Chemical Compound Space for Materials and Bio Design." It was a timely get-together to continue some of the collaborations that were started during the long program. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

REUNION CONFERENCE: Climate Modeling Reunion at Lake Arrowhead Conference Center. December 9 - 14, 2012

This was the second reunion conference for participants of the spring 2010 long program "Model and Data Hierarchies for Simulating and Understanding Climate." It was a timely get-together to continue some of the collaborations that were started during the long program and at the first reunion. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

WORKSHOP: Structure and Randomness in System Identification and Learning. January 15 - 18, 2013

Organizing Committee:

Maryam Fazel (University of Washington, Electrical Engineering)
Mehran Mesbahi (University of Washington, Aeronautics and Astronautics)
Nathan Srebro (University of Chicago, Computer Science, Toyota Technological Institute)
Lieven Vandenberghe (University of California, Los Angeles (UCLA), EE)

Scientific Overview:

Machine learning and system identification communities are faced with similar problems where one needs to construct a model from limited or noisy observations. The challenge lies in solving an ill-posed inverse problem, where the number of available measurements is much smaller than the dimension of the model to be estimated. However, typically two ingredients, (i) simple model structures and (ii) random observations, go hand in hand to allow learning or recovery guarantees.

For example, in applications, model complexity can be expressed as the cardinality of a vector, the rank of a matrix or tensor, or more generally, the number of simple units or "atoms" needed to build a model consistent with the observations. This general notion of complexity covers recently-studied problems in compressed sensing, low-rank matrix and tensor recovery, matrix completion, recovering low-rank structures corrupted by outliers, and sparse graphical models. Considering time-dynamics requires notions of (temporal) model structure such as the McMillan degree (the order of the minimal realization) of a linear system representing given input-output observations.

Exploiting the structure in a system often leads to significant computational efficiency, and this workshop examined the role of structured convex optimization.

This workshop brought together researchers from machine learning and control theory, as well as high dimensional statistics and convex optimization, to explore this research area.

WORKSHOP: Adaptive Data Analysis and Sparsity. January 28 - February 1, 2013

Organizing Committee:

Laura Balzano (University of Michigan, Electrical and Computer Engineering)
Ingrid Daubechies (Duke University, Applied Harmonic Analysis)
Tom Hou (California Institute of Technology, Applied and Computational Mathematics)
Norden Huang (National Central University)
Haomin Zhou (Georgia Institute of Technology, School of Mathematics)

Scientific Overview:

Data analysis is important and highly successful throughout science and engineering, indeed in any field that deals with time-dependent signals. For nonlinear and nonstationary data (i.e., data

generated by a nonlinear, time-dependent process), however, current data analysis methods have significant limitations, especially for very large datasets. Recent research has addressed these limitations for data that has a sparse representation (i.e., for data that can be described by a only a few nonzero parameters) by exploiting methods such as compressed sensing, TV-based denoising, multiscale analysis, synchrosqueezed wavelet transform, nonlinear optimization, randomized algorithms and statistical methods. This workshop brought together researchers from mathematics, signal processing, computer science and data application fields to promote and expand this research direction. Determination of trend and instantaneous frequency for nonlinear and non-stationary data are examples of the topics that the workshop addressed.

WORKSHOP: Convex Relaxation Methods for Geometric Problems in Scientific Computing. February 11 - 15, 2013

Organizing Committee:

Xavier Bresson (City University of Hong Kong)
Antonin Chambolle (École Polytechnique)
Tony Chan (Hong Kong University of Science and Technology)
Daniel Cremers (Technische Universtitat München)
Stanley Osher (University of California, Los Angeles (UCLA))
Thomas Pock (Technische Universität Graz, Institute for Computer Graphics and Vision)
Gabriele Steidl (Universität Kaiserslautern)

Scientific Overview:

Convex relaxation methods are studied and applied within a variety of disciplines in computer science and mathematics. They aim at providing exact or tight approximations of solutions of difficult problems. In the last few years, they have played a major role in designing efficient algorithms for compressed sensing and level set method. In addition to the substantial impact of convex relaxation methods in applied areas, they also are connected to various branches of mathematical sciences including optimization, functional analysis, geometry, graph theory and combinatorics.

This workshop brought together an interdisciplinary community from mathematics, computer vision, engineering and machine learning to discuss the latest progress and highlight various mathematical questions and algorithmic challenges.

The workshop discussed the following topics:

a. connections between convex relaxation methods and nonsmooth/nonlinear optimization algorithms based on L^1 and total variation
b. relationships between graph theory, combinatorial and continuous optimizations via convex relaxation techniques
c. relaxation methods to spectral and inference data models in machine learning
d. opportunities of convex relaxation techniques for novel applications in signal processing, image processing, machine learning, computer vision, and graph theory

WORKSHOP: Multimodal Neuroimaging. March 4 - 8, 2013

Organizing Committee:

Tülay Adali (University of Maryland Baltimore County)
Mark Cohen (University of California, Los Angeles (UCLA))
Klaus-Robert Müller (Technische Universität Berlin)

Scientific Overview:

Computational neuroscience has become an attractive multi-disciplinary endeavor aimed at a better understanding of the brain and its information processing. Technical advances enable researchers to measure neural activity over a broad range of space, time, and energetic spectrum. As no single data set is on its own comprehensive, it has become standard practice to combine multiple imaging modalities. These new data require novel and specialized analysis methods. Thus, the emphasis of the workshop was placed on the timely topic of analysis of multimodal neuroimaging data. The goal of this workshop was to facilitate cross fertilization of ideas among leading international thinkers drawn from the disciplines of neuroimaging and computational neuroscience, mathematics, statistics, modeling, and machine learning. Theory, neuroscientific and clinical application perspectives as well as the brain computer interfacing point of view were discussed.

PUBLIC LECTURE: Toward Brain Computer Interfacing. March 4, 2013.

Presented by Klaus-Robert Müller, Technical University Berlin

Abstract:

Brain Computer Interfacing makes use of brain signals for the control of objects (e.g., wheel chairs), spelling, computer gaming, and other applications. This talk provided a brief overview of current Brain Computer Interface technology. In particular, it showed the wealth, complexity and difficulties of the data available. The challenge is enormous: Neuro-electric activities provide a high dimensional, very strongly noise contaminated data stream. This data stream needs to be processed and decoded accurately and in real time, so that (metaphorically speaking) thoughts can be translated into actions.

The talk then reported in more detail about the Berlin Brain Computer Interface that is based on Electroencephalography (EEG) signals, and took the audience all the way through the processing chain. Finally, Brain Computer Interfacing application examples ranging from clinical studies where 'locked-in' patients achieve communication to non-clinical applications where, for instance, complex cognitive states while driving a car are analyzed, were presented.

Speaker Bio:

Klaus-Robert Müller is Professor of Computer Science at Technical University (TU) Berlin and Director of the Bernstein Focus on Neurotechnology Berlin. Since 2012, he also holds a

Distinguished Professorship for Neurotechnology at Korea University, Seoul. He studied physics and obtained his PhD in Computer Science at TU Karlsruhe in 1992. Starting in 1995, he built up the Intelligent Data Analysis (IDA) group at GMD FIRST (later Fraunhofer FIRST) and served as department head until 2008. He was also a Professor at University of Potsdam from 1999-2006. He was awarded the Olympus Prize by the German Association for Pattern Recognition DAGM in 1999, and the SEL Alcatel Communication Award in 2006. In 2012 he was elected to be a member of the German National Academy of Sciences - Leopoldina. His research interests are intelligent data analysis, machine learning, signal processing and Brain Computer Interfaces.

LONG PROGRAM: Interactions between Analysis and Geometry. March 11 - June 14, 2013.

Organizing Committee:

Mario Bonk (University of California, Los Angeles (UCLA), Mathematics)
John Garnett (University of California, Los Angeles (UCLA), Mathematics)
Ursula Hamenstädt (University of Bonn, Mathematics Institute)
Pekka Koskela (University of Jyväskylä)
Eero Saksman (University of Helsinki)

Scientific Overview:

Within mathematics, as within science in general, there is a need for greater communication between workers from different research specialties. The purpose of this program was to promote the interaction between two core areas of mathematics---analysis and geometry.

Sophisticated methods have been developed in complex analysis, harmonic analysis, partial differential equations, and other parts of analysis; many of these analytic techniques have found applications in geometry. However, research in analysis is often driven by intrinsic motives rather than by potential applications to other parts of mathematics. Geometers can give analysts new perspectives and focus for their research.

On the other hand, analysts often use ideas and tricks that are well-known to themselves, but mysteries to researchers in other areas; so geometers can benefit from an exchange of ideas with analysts by becoming more familiar with the powerful tools of their field.

Such fruitful interactions should not be left to serendipity. This program enhanced communications between analysts and geometers by focusing on recent developments on the borderline of these subjects.

Here are a few quotes from participants of the program that comment on the impact of the program on their careers and research.

“The program has affected my career greatly. I met many famous mathematicians, learnt several mathematics topics. Talking to young people was great too. Our friendship has been growing, even though we couldn't solve any problems. My work has been recognized by Professor Mario Bonk and he supported me to do postdoc in UCLA.”

-Huy Tran, University of Washington

“I have learned about a whole new world of mathematics and had the opportunity to discuss it with people from all over the world. One of my papers came out as a result of such a collaboration. Currently, I am invited to visit my new collaborators in Europe, at the University of Bergen, Norway, which will probably result in further collaboration.”

-Melkana Brakalova, Fordham University

“I was a Full Professor when the [long program] took place. However, I was able to give a lecture in front of A. Zorich and A. Eskin, and there is currently a synergy of areas of interest between complex dynamics and Teichmueller dynamics; nothing formal as of yet, but certainly 'in the air' and of interest to many. I did discover a natural research question during my visit there which will make a good master's or REU project. Related to this, I had several productive interactions with Mario Bonk and some of his graduate students.”

-Kevin Pilgrim, Indiana University

WORKSHOP: Interactions between Analysis and Geometry Tutorials. March 12 - 15, 2013

Organizing Committee:

Mario Bonk (University of California, Los Angeles (UCLA), Mathematics)
John Garnett (University of California, Los Angeles (UCLA), Mathematics)
Ursula Hamenstädt (University of Bonn)
Pekka Koskela (University of Jyväskylä)
Eero Saksman (University of Helsinki)

Scientific Overview:

The long program "Interactions between Geometry and Analysis" started with two tutorials on the "Geometry of negatively curved spaces" by Juan Souto, University of British Columbia, and on "Analysis on metric spaces" by Nages Shanmugalingam, University of Cincinnati. Each tutorial consisted of four lectures and introduced non-experts to these subjects. This provided some common ground for communications between geometers and analysts during our program.

WORKSHOP: Analysis on Metric Spaces (IAG Workshop I). March 18 - 22, 2013

Organizing Committee:

Luigi Ambrosio (Scuola Normale Superiore)
Pekka Koskela (University of Jyväskylä)
Nages Shanmugalingam (University of Cincinnati)
Karl Sturm (Universität Bonn)

Scientific Overview:

The last few decades have seen the trend to extend the scope of classical analytic and geometric theories from the familiar Euclidean space or manifold setting to more general metric spaces, often of a non-smooth or fractal nature. Recently there has been spectacular progress on the development of a theory of general metric spaces resembling manifolds with Ricci curvature bounds by the work of Lott, Villani and Sturm. Their approach is based on convexity properties of an entropy functional in optimal transport. Other approaches include the use of Bochner type formulas by Baudoin and Garofalo and the use of heat kernels by Koskela, Rajala and Shanmugalingam and by Ambrosio, Gigli and Savare. However, many of the underlying analytic and geometric questions are still poorly understood. This workshop further explored these approaches and related challenging issues, and fostered new collaborations among various groups of researchers.

WORKSHOP: Dynamics of Groups and Rational Maps (IAG Workshop II). April 8 - 12, 2013

Organizing Committee:

Giovanni Forni (University of Maryland)
Ursula Hamenstädt (University of Bonn)
Misha Lyubich (SUNY Stony Brook)
Vlad Markovic (California Institute of Technology)

Scientific Overview:

In recent years, dynamical properties of group actions have seen many applications to areas as diverse as rational maps, geometry, low dimensional and geometric topology, number theory. Such applications have motivated a rapid development of new tools within the area of dynamical systems, which in turn were used as essential ingrediences in solutions to long-standing open conjectures in seemingly unrelated areas of mathematics. The most recent such application is the solution of the virtual fibred conjecture for closed hyperbolic 3-manifolds.

This workshop brought together leading contributors to these recent developments in the theory of dynamical systems as well as young researchers who are interested in exploring the interplay between different fields from the viewpoint of dynamical systems.

WORKSHOP: ¿Así Que Quieres Ser un Matemático? A Panel Discussion with Latino/a Mathematicians. April 22, 2013

IPAM welcomed five Latino mathematicians at various stages in their careers to UCLA for a panel discussion. The panelists discussed their respective roads to having become mathematicians, and offered advice to students and others starting their careers. We invited Latino undergraduate and graduate students in mathematics, statistics and related fields to join the group, along with faculty, postdocs, and student services professionals.

The panelists were members of the planning committee for a Latinos in Mathematics Conference that will be held at IPAM in 2015. The panelists included:

Rodrigo Bañuelos, Purdue University
Dr. Bañuelos was raised on a farm in rural Mexico before moving to Pasadena, CA at age 15. He was the first in his family to attend college. He holds a Ph.D. in mathematics from UCLA, a Masters in Teaching from UC Davis, and a B.A. from UC Santa Cruz. He is now a professor at Purdue University where he works on probability, harmonic analysis, and spectral theory.

Angela Gallegos, Loyola Marymount University
Dr. Gallegos works on applications of mathematics to biology, especially physiology and epidemiology. She received her Ph.D. in applied math from UC Davis in 2005 and her B.A. from NYU in 1999. She is now a professor at Loyola Marymount University.

Nancy Rodriguez, Stanford
Dr. Rodriguez is interested in understanding biological and sociological phenomena using partial differential equations, particularly ones that model crime patterns. She received her Ph.D. in applied mathematics from UCLA in 2011 and her B.S. at the University of San Diego in 2006. She is currently a postdoc at Stanford University.

Joseph Teran, UCLA
Dr. Teran's research is focused on numerical methods for computational mechanics, as well as applications such as virtual surgery and visual effects. He received his Ph.D. in mathematics from Stanford University in 2005 and his B.S. from UC Davis in 2000. He has been a professor at UCLA since 2007.

Tatiana Toro, University of Washington
Dr. Toro's research is in analysis and geometric measure theory. She received her Ph.D. in mathematics from Stanford University in 1992 and her B.S. from Universidad Nacional de Colombia, Bogotá. She is a professor at University of Washington and serves on IPAM's Board of Trustees.

WORKSHOP: Non-Smooth Geometry (IAG Workshop III). April 29 - May 3, 2013

Organizing Committee:

Mario Bonk (University of California, Los Angeles (UCLA), Mathematics)
Marianna Csörnyei (University of Chicago)
Bruce Kleiner (New York University)
Jeremy Tyson (University of Illinois at Urbana-Champaign)
Stefan Wenger (Université de Fribourg)

Scientific Overview:

Many contemporary investigations in geometry lead to analytic questions on non-smooth and fractal spaces different from the usual Euclidean setting. This can be traced back to Mostow's influential work on the rigidity of negatively curved rank-one symmetric spaces. Here one needs

analytic machinery in a non-classical (sub-Riemannian) setting in order to treat problems of quasiconformal geometry on the boundary at infinity of such spaces. This work inspired many subsequent investigations such as the delevopment of the theory of quasiconformal mappings on Heisenberg or general Carnot groups (Koranyi-Reimann) or on general metric spaces (Heinonen-Koskela). In his seminal work on hyperbolic groups Gromov developed a general theory of spaces that are negatively curved in the large. These spaces have an associated boundary at infinity, and one can study their quasiconformal geometry with the associated analytic problems. This analytic trend culminated in the creation of a new field of mathematics, the Analysis on Metric Spaces, which has found many applications in geometry. For example, the work by Bourdon and Pajot on the rigidity of Fuchsian buildings relies on such tools.

A theory related to this field of quasiconformal analysis but with a different flavor can be loosely described as Lipschitz analysis. Its orgins go back to classical results such as Rademacher's theorem on the differentiability of Lipschitz functions, Whitney's geometric integration theory, or the theory of rectifiability and currents. Since the notion of a Lipschitz function is meaningful for arbitrary metric space, it is tempting to base generalizations of classical theories on this concept. For example, when Ambrosio and Kirchheim recently extended the classical Federer-Fleming theory of currents in R^n to general metric spaces they defined a "metric current" to be a certain functional acting on Lipschitz functions. Similarly, a theory of cotangent bundles for general metric spaces has been developed recently by Cheeger and by Weaver using two different approaches, but both of them use Lipschitz functions. In these studies it is often important to investigate the finer properties of Lipschitz functions and maps. Even in R^n many questions here are far from being understood. In this workshop, the intention was to pursue some of these directions with an emphasis on more geometric aspects (another workshop in this program on "Analysis on Metric Spaces" has a more analytic bias). Topics included analytic problems that arise in geometric group theory or for expanding dynamical systems, differentiablity properties of Lipschitz functions, currents and isoperimetric problems on metric spaces, quasiconformal geometry of fractals, and sub-Riemannian geometry.

WORKSHOP: Quasiconformal Geometry and Elliptic PDEs (IAG Workshop IV). May 20 - 24, 2013

Organizing Committee:

John Garnett (University of California, Los Angeles (UCLA), Mathematics)
Tadeusz Iwaniec (Syracuse University)
Steffen Rohde (University of Washington, Mathematics)
Eero Saksman (University of Helsinki)
Tatiana Toro (University of Washington, Mathematics)

Scientific Overview:

The theories of quasiconformal mappings and elliptic partial differential equations have classical connections dating back the work of Vekua, Bers, Bojarski, and others. During the last ten years these connections have been revitalized through new methods and breakthroughs and surprising applications that merge geometric and analytic methods. These include the solution of

Calderón's problem of impedance tomography in the plane by Astala and Paivarinta. Current research suggests that the methods of geometric analysis will also be applicable to problems in materials sciences, such as in elasticity and stochastic homogenization. Another development is the extension of the theory to degenerate elliptic equations, through the work of David, Iwaniec, Koskela, Martin and many others. Here the geometric counterpart is the theory of mappings of finite distortion, which played a vital role in recent work on random geometry. The workshop also studied the conformal geometry related open problems in SLE and quantum gravity.

With support from the Finnish government, part of the workshop commemorated the 60th birthday of Professor Kari Astala and his many important contributions to its topics.

PUBLIC LECTURES: Green Family Lecture Series. June 6-7, 2013

Presented by Wendelin Werner, University of Paris-Sud and ETH Zurich

Speaker Bio:

Wendelin Werner is a French mathematician working at the interface of probability theory with complex analysis and mathematical physics.

After a childhood acting career with a role in the 1982 film La Passante du Sans-Souci, he studied mathematics at École Normale Supérieure (ENS) and Université Pierre-et-Marie-Curie, where he completed his PhD under Jean-François Le Gall. Werner has been a professor at University of Paris-Sud (and ENS) since 1997, and will move to ETH Zurich in 2013.

At the 25th International Congress of Mathematicians in 2006, Werner received the Fields Medal for his work on stochastic Loewner evolution and the geometry of two-dimensional Brownian motion. His other awards include the Fermat Prize, the Loève Prize, and SIAM's George Pólya Prize, shared with his collaborators Gregory Lawler and Oded Schramm. He became a member of the French Academy of Sciences in 2008.

Abstracts:

Public Lecture: Drawing Pictures at Random
Thursday, June 6, 2013

This lecture gave an introduction to angle-preserving transformations (the so-called conformal transformations) and their connections to random fractal curves in the plane. In particular, the presentation described the random curves known as Schramm-Loewner Evolutions, which were introduced by Oded Schramm in 1999. They appear in various natural settings and have been the subject of numerous research works.

Research Lecture: Random Mountains
Friday, June 7, 2013

The lecture was an introduction to the natural generalization of one-dimensional Brownian motion, when the time-parameter becomes two-dimensional. Known in the literature as the Free Gaussian Field, this object models (for instance) the natural fluctuations of a random surface

away from its deterministic flat limit. This presentation gave an informal description of its properties, in particular somewhat surprising "topographic maps" and geometric features that Scott Sheffield, Jason Miller, Hao Wu and the speaker presented in their recent work.

WORKSHOP: Interactions between Analysis and Geometry Culminating Workshop at Lake Arrowhead Conference Center. June 9 - 14, 2013

The culminating workshop was organized by the long program organizing committee.

The final workshop in the long program, held at Lake Arrowhead Conference Center, provided an opportunity for the program's core participants to report on their work during the past three months and to discuss future projects. Many of the collaborations and interactions that were formed during the program had a chance to deepen.

REUNION CONFERENCE: High Throughput Genomics Reunion at Lake Arrowhead Conference Center. June 9 - 14, 2013

This was the first reunion conference for participants of the fall 2011 long program "Mathematical and Computational Approaches in High-Throughput Genomics." It was a timely get-together to continue some of the collaborations that were started during the long program. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

REUNION CONFERENCE: Modern Trends in Optimization at Lake Arrowhead Conference Center. June 9 - 14, 2013

This was the second reunion conference for participants of the fall 2010 long program "Modern Trends in Optimization and Its Application." It was a timely get-together to continue some of the collaborations that were started during the long program and at the first reunion. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

SUMMER PROGRAM: Research in Industrial Projects for Students (RIPS)-Hong Kong 2013. June 9 - August 9, 2013.

IPAM offered RIPS-Hong Kong for the third time in 2013. In collaboration with Hong Kong University of Science and Technology, eight U.S. students and eight Hong Kong/Chinese students worked on cross-cultural teams on four projects, each sponsored by a company based in the region. The basic format of the program is the same as RIPS-LA.

RIPS students from the United States and Hong Kong form close professional and personal relationships and live, work and socialize together over the summer. The students have offices on the HKUST campus. The HKUST math department provides technical support as well as some social activities, informal Chinese lessons, and occasional guest lectures. The students reside in dormitories on campus.

IPAM covers the U.S. students' expenses, including round-trip travel to Hong Kong, accommodations, and most meals. In addition, students also received a stipend. English is the only language required for participation.

RIPS-Hong Kong 2013: Sponsors, Projects and Academic Mentors	
Sponsor	**Title of Project**
Baidu	Doubly Ensemble Movie Prediction with Social Media Data Using TBEEF
BGI	Improved Contig Filtration for De Novo Genome Assembly
eBroker	Quantitative portfolio construction using various optimization methods
Microsoft	Robust Low-rank Matrix Factorization

Here are a few comments from RIPS-Hong Kong 2013 students, collected at the end of the program:
"RIPS has changed my life. Before I was aimlessly doing math and science but now I know where I want to go and what I want to do with it, and that is invaluable. My new life goal is to get my PhD and use the ideas to make a biomedical startup and then later go back to academia. Thank you for letting me take part in this program." - Chris Rackauckas, Oberlin College
"We got some stuff done, all of us learned a ton, we have an opportunity to attempt to publish, we made a little money, we made new friends and colleagues ... Cool!" -Sam Potter, University of Washington

SUMMER PROGRAM: Research in Industrial Projects for Students (RIPS) 2013. June 23 - August 23, 2013.

RIPS Program Director: Michael Raugh

The Research in Industrial Projects (RIPS) Program provides an opportunity for high-achieving undergraduate students to work in teams on a real-world research project proposed by a sponsor from industry or the public sector. Each RIPS team is comprised of four students, an academic mentor, and an industrial sponsor. The research problem is developed by the industrial sponsor in consultation with IPAM; it is always a real problem of serious interest to the sponsor and that offers a stimulating challenge to students. Most of these projects involve both analytic and computational work. The students, with direction from their academic mentor and industrial sponsor, spent nine weeks learning about the problem, mastering the latest analytical and computational approaches and techniques to solve it, and developing report-writing and public-speaking skills to be able to make professional presentations about the progress and results of their work to a scientific audience. Industry mentors provided regular contact between the team and the sponsor, monitoring and helping to guide student work. Ultimately, RIPS provides valuable real-world technical and managerial experience for students as well as valuable R&D for sponsors.

RIPS 2013: Sponsors and Projects	
Sponsor	**Title of Project**
The Aerospace Corporation	Fast Generation and Tracking of GPS Dilution of Precision Regions Using Level Sets
Google	Statistical topic models
HRL	Information reconciliation for multi-mode optical communication
Intel Corporation	Evaluate Phases and Orientations of Given Atomic Structures
Los Angeles Police Department (LAPD)	Linking Social Media to Crime & Disorder
Los Alamos National Laboratory	Simulating the formation of fuzz on the wall of a fusion reactor
Oversee.net	Mapping domain names to categories
The Shoah Foundation	Improving Search Quality through Log Analysis
Symantec	Cryptanalysis of Encrypted Search with Lucene Transform

SUBWORKSHOP: RIPS 2013 Projects Day. August 16, 2013

Organizing Committee: N/A

The nine RIPS-LA teams presented their industry-sponsored research on the projects listed above. Representatives of the industry sponsors attend, and the event was open to the public. Math students and faculty from East Los Angeles College, family members of the students, IPAM supporters, and members of UCLA's math and science community attended.

Here are a few comments from RIPS-LA 2013 students, collected at the end of the program:
"My time in the program turned out to be one of the biggest moments of personal growth. I learned the challenges of working in an industrial project (the formality of the research and the restrictions on the research made by studying a commercial product). I also developed writing and presentation skills that will surely help me in my future." - Ana Victoria Ponce Bobadilla (National Autonomous University of Mexico)
"It was an extremely advantageous experience for me. I learned valuable information about applying to PhD programs, working for a national lab, how to conduct myself in a professional environment, as well as learning and improving my computational skills." - Amethyst Radcliffe (California State University, Long Beach)

“One word: outstanding. At the start of the program I knew next to nothing about crystallography but during my site visit I was able to discuss complex ideas with experts in the field, and hold my own! Also the insight that get about the subtleties of working in industry is invaluable.” - Verne Edward (Grambling State University)
“I'd say that RIPS was the first time I got to see an open problem through from the start to finish. I was pleasantly surprised by how much my team accomplished in the time span.” -Bridget Toomey (Grinnell College)

WORKSHOP: Women in Shape (WiSh): Modeling Boundaries of Objects in 2- and 3-Dimensions (in cooperation with AWM). July 15 - 19, 2013

Organizing Committee:

Kathryn Leonard (California State University, Channel Islands (CSU Channel Islands))
Luminita Vese (University of California, Los Angeles (UCLA), Mathematics)

Scientific Overview:

This workshop was designed to strengthen the shape modeling community by bringing together women researchers at various stages in their careers (from graduate student to senior researcher) to foster research collaboration and mentorship. We welcomed applications from women with active research programs from smaller teaching schools as well as from research-oriented institutions.

Participants spent one week working together in small groups to solve one of four open questions in shape modeling. Instead of the more typical workshop structure where participants watch presentations of established results, WiSH participants generated new results in collaboration with other participants.

Topics for the problems were as follows:

1. **Simultaneous spectral and spatial analysis of shape:** This project investigated a new distance-like shape operator from the spectral point of view, adopting signatures developed in the spectral literature and solving similar symmetry detection problems. Also developed was a connection to image segmentation and registration using the yet unclear connection of the new operator to the Ambrosio-Tortorelli functional

2. **Dimensionality reduction and visualization of data in tree-spaces:** This project studied dimensionality reduction in shape spaces where the shapes have the structure of a tree, such as classes of anatomical trees like airways and blood vessels, medial axes of 2D shapes, or phylogenetic trees. Also developed were techniques for low-distortion embedding into open books and hyperbolic spaces whose geometric structure is similar to that of tree-space.

3. **Geometric shape segmentation:** This project explored shape segmentation from a Gestalt perspective, using information from the Blum medial axis of edge fragments in the image. Participants combined existing edge saliency measures together with medial data to increase support for or against hypothesized edge interpolation. Also developed were techniques for considering related appearance cues.

4. **Representing and editing self-similar details on 3D shapes:** Shape deformation and editing techniques, such as elongating or compressing parts of a shape while maintaining local style, copy-pasting details from one shape to another, or changing the scale of details without changing lower resolution geometry, are essential for interactive shape design. Blending properties of implicit surfaces, and the fact that they can be generated from skeletons of lower dimension (also used for shape animation), makes them good candidates for solving this problem. The extension of multi-resolution analysis to these surfaces and their deformations were explored, enabling the characterization of repetitive details through skeleton self-similarities, and the development of methods for filtering details out and generating them again, possibly at a different scale, after low resolution shape editing. An extension was the study of multi-resolution editing of animated shapes.

SUMMER PROGRAM: Graduate Summer School: Computer Vision. July 22 - August 9, 2013

Organizing Committee:

Don Geman (Johns Hopkins University, Applied Mathematics and Statistics)
Fei Fei Li (Stanford University)
Deva Ramanan (University of California, Irvine (UCI))
Stefano Soatto (University of California, Los Angeles (UCLA), Computer Science)
Zhuowen Tu (University of California, Los Angeles (UCLA), School of Medicine)
Alan Yuille (University of California, Los Angeles (UCLA), Psychology)

Scientific Overview:

The summer school involved leaders from Computer Vision and experts from Mathematics, Statistics, Engineering and Computer Science who are interested in Vision. Computer Vision is a rapidly developing interdisciplinary field with an increasing number of practical applications such as automated cars, visual surveillance, and aids for the visually impaired. Its main goal is the automatic understanding and interpreting of images and image sequences. The school presented the core techniques in Computer Vision, illustrated the large range of visual tasks they can be applied to, and described the conceptual and theoretical foundations that underlie them. These techniques include filtering, geometry, differential equations, harmonic analysis, probabilistic methods, machine learning, and many more. The school described real-world applications and discussed interactions with related disciplines such as image processing, machine learning, and biological vision.

OUTREACH ACTIVITIES, 2012-2013

IPAM participated in the **Modern Math Workshop,** a one-day program for undergraduate and graduate students held the day before the official start of the national meeting of SACNAS, on Oct. 10, 2012. IPAM was not the lead organizer this year, so the participants of the program, mostly Hispanic students, are not included in our report. IPAM provided one speaker and encourage former participants of our programs, especially RIPS, to participate.

Also in 2012-2013, IPAM began to develop partnerships with two-year schools and MESA Programs in the Los Angeles area in order to increase the representation of minorities and women in its programs. Last summer, the Asst. Director and Outreach Coordinator met with representatives of East Los Angeles College (ELAC) including the Director of the Math Engineering & Science Achievement (MESA) program to discuss opportunities for their students and faculty to participate in IPAM programming. Since that meeting, we have actively kept in contact with ELAC members, hosted a group of their students at RIPS Projects Day, and encouraged attendance at our public lectures and other events.

IPAM's Outreach Coordinator has also strengthened its relations with the UCLA SACNAS Chapter. The outreach coordinator attends quarterly meetings and encourages them to participate in IPAM programs. In spring 2013, the chapter utilized our facilities for a K-12 educational event and their year-end banquet. In the coming year, IPAM will continue to demonstrate its support for the chapter.

IPAM Diversity Events, 2012-2013

- Two women's luncheons (one during each long program)
- Women in Shape: Modeling Boundaries of Objects in 2- and 3-Dimensions, July 2013 (in association with AWM)
- A Panel Discussion with Latino/a Mathematicians, April 2013

Other outreach activities, 2012-2013:

- An IPAM representative attended the Nebraska Conference for Undergraduate Women in Math (NCUWM) in 2013 to talk to undergraduate women about opportunities in math
- IPAM's outreach coordinator attended the national meeting of SACNAS to talk to students about IPAM programs.
- IPAM announced the open Associate Director position through AWM and SACNAS
- IPAM advertised RIPS (summer research program) through minority institutions and organizations
- RIPS students presented their research at SACNAS and NCUWM
- With the other NSF math institutes, IPAM supported the AWM Mentor Network Program.
- IPAM offered two Berland child care grants to two female participants of our programs.

K. PROGRAM CONSULTANT LIST

IPAM consulted a variety of scholars and practitioners in the scientific planning of each program. The list is organized by program (referenced by the program code), in chronological order, starting with the Materials Defect long program (MD2012). We have also included 2013-2014 programs, as the planning for these programs had begun by August 2013. See also *Section O: Committee Membership* for members of our Science Advisory Board and Board of Trustees.

MD2012

Vasily V. Bulatov, Lawrence Livermore National Laboratory

Jiun-Shyan Chen, University of California, Los Angeles (UCLA), Civil & Environmental Eng.

Kristen Fichthorn, Pennsylvania State University

Nasr Ghoniem, University of California, Los Angeles (UCLA), Mechanical & Aerospace Engr.

Mitchell Luskin, University of Minnesota, Twin Cities

Michael Ortiz, California Institute of Technology, Aeronautics and Applied Mechanics

Tim Schulze, University of Tennessee, Math

Vivek Shenoy, Brown University

Axel Voigt, Technishche Universtitat Dresden

MDTUT

Jiun-Shyan Chen, University of California, Los Angeles (UCLA), Civil & Environmental Eng.

Mitchell Luskin, University of Minnesota, Twin Cities

Tim Schulze, University of Tennessee, Math

Axel Voigt, Technishche Universtitat Dresden

MDWS1

Eric Cances, École Nationale des Ponts-et-Chaussées, Applied Mathematics

Kristen Fichthorn, Pennsylvania State University

Graeme Henkelman, University of Texas at Austin, Department of Chemistry

Nick Kioussis, California State University, Northridge (CSU Northridge)

Axel Voigt, Technishche Universtitat Dresden

MDWS2

Vasily V. Bulatov, Lawrence Livermore National Laboratory

Wei Cai, Stanford University

Marisol Koslowski, Purdue University

Talat Rahman, University of Central Florida

Tim Schulze, University of Tennessee, Math

Ellad Tadmor, University of Minnesota, Twin Cities

Axel Voigt, Technishche Universtitat Dresden

MDWS3

Nasr Ghoniem, University of California, Los Angeles (UCLA), Mechanical & Aerospace Engr.

David Kinderlehrer, Carnegie-Mellon University

John Lowengrub, University of California, Irvine (UCI), Mathematics

Nele Moelans, Katholieke Universiteit Leuven

Vivek Shenoy, Brown University

MDWS4

Jiun-Shyan Chen, University of California, Los Angeles (UCLA), Civil & Environmental Eng

Jacob Fish, Columbia University

Mitchell Luskin, University of Minnesota, Twin Cities

Michael Ortiz, California Institute of Technology, Aeronautics and Applied Mechanics

Axel Voigt, Technishche Universtitat Dresden

SI2013

Maryam Fazel, University of Washington, Electrical Engineering

Mehran Mesbahi, University of Washington, Aeronautics and Astronautics

Nathan Srebro, TTI-Chicago, Computer Science, Toyota Technological Institute

Lieven Vandenberghe, University of California, Los Angeles (UCLA), Electrical Engineering

ADA2013

Laura Balzano, University of Michigan, Electrical and Computer Engineering

Ingrid Daubechies, Duke University, Applied Harmonic Analysis

Tom Hou, California Institute of Technology, Applied and Computational Mathematics

Norden Huang, National Central University

Haomin Zhou, Georgia Institute of Technology, School of Mathematics

CRM2013

Xavier Bresson, City University of Hong Kong

Antonin Chambolle, École Polytechnique

Tony Chan, Hong Kong University of Science and Technology

Daniel Cremers, Technische Universtitat München

Stanley Osher, University of California, Los Angeles (UCLA)

Thomas Pock, Technische Universität Graz, Institute for Computer Graphics and Vision

Gabriele Steidl, Universität Kaiserslautern

MN2013

Tülay Adali, University of Maryland Baltimore County

Mark Cohen, University of California, Los Angeles (UCLA)

Klaus-Robert Müller, Technische Universität Berlin

IAG2013

Mario Bonk, University of California, Los Angeles (UCLA), Mathematics

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Ursula Hamenstädt, University of Bonn, Mathematics Institute

Pekka Koskela, University of Jyväskylä

Eero Saksman, University of Helsinki

IAGTUT

Mario Bonk, University of California, Los Angeles (UCLA), Mathematics

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Ursula Hamenstädt, University of Bonn, Mathematics Institute

Pekka Koskela, University of Jyväskylä

Eero Saksman, University of Helsinki

IAGWS1

Luigi Ambrosio, Scuola Normale Superiore

Pekka Koskela, University of Jyväskylä

Eero Saksman, University of Helsinki

Nages Shanmugalingam, University of Cincinnati

Karl Sturm, Universität Bonn

IAGWS2

Giovanni Forni, University of Maryland

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Ursula Hamenstädt, University of Bonn, Mathematics Institute

Pekka Koskela, University of Jyväskylä

Misha Lyubich, SUNY Stony Brook

Vlad Markovic, California Institute of Technology

Eero Saksman, University of Helsinki

IAGWS3

Mario Bonk, University of California, Los Angeles (UCLA), Mathematics

Marianna Csörnyei, University of Chicago

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Bruce Kleiner, New York University

Pekka Koskela, University of Jyväskylä

Eero Saksman, University of Helsinki

Jeremy Tyson, University of Illinois at Urbana-Champaign

Stefan Wenger, Université de Fribourg

IAGWS4

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Tadeusz Iwaniec, Syracuse University

Steffen Rohde, University of Washington, Mathematics

Eero Saksman, University of Helsinki

Tatiana Toro, University of Washington, Mathematics

IAGLA

John Garnett, University of California, Los Angeles (UCLA), Mathematics

Ursula Hamenstädt, University of Bonn, Mathematics Institute

Pekka Koskela, University of Jyväskylä

Eero Saksman, University of Helsinki

AWM2013

Kathryn Leonard, California State University, Channel Islands (CSU Channel Islands)

Luminita Vese, University of California, Los Angeles (UCLA), Mathematics

GSS2013

Don Geman, Johns Hopkins University, Applied Mathematics and Statistics

Fei Fei Li, Stanford University

Deva Ramanan, University of California, Irvine (UCI)

Stefano Soatto, University of California, Los Angeles (UCLA), Computer Science

Zhuowen Tu, University of California, Los Angeles (UCLA), School of Medicine

Alan Yuille, University of California, Los Angeles (UCLA), Psychology

DFT2013

Kieron Burke, University of California, Irvine (UCI)

Eric Cances, École Nationale des Ponts-et-Chaussées, Applied Mathematics

Hardy Gross, Max Planck Institute of Microstructure Physics

Igor Rodnianski, Massachusetts Institute of Technology

MSE2013

Martin Bazant, Massachusetts Institute of Technology

Giulia Galli, University of California, Davis (UC Davis), PAT

Graeme Henkelman, University of Texas at Austin, Department of Chemistry

Keith Promislow, Michigan State University, Mathematics

Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft

MSETUT

Martin Bazant, Massachusetts Institute of Technology

Giulia Galli, University of California, Davis (UC Davis), PAT

Graeme Henkelman, University of Texas at Austin, Department of Chemistry

Keith Promislow, Michigan State University, Mathematics

Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft

MSEWS1

Claudia Draxl, Humboldt-Universität

Jeff Neaton, Lawrence Berkeley Laboratory

Keith Promislow, Michigan State University, Mathematics

MSEWS2

Rupert Klein, Freie Universität Berlin, Mathematics

Jens Norskov, Stanford University

Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft

MSEWS3

Martin Bazant, Massachusetts Institute of Technology

Graeme Henkelman, University of Texas at Austin, Department of Chemistry

Kristin Persson, Lawrence Berkeley Laboratory, EETD

Keith Promislow, Michigan State University, Mathematics

MSEWS4

Giulia Galli, University of California, Davis (UC Davis), PAT

Richard James, University of Minnesota, Twin Cities

Jennifer Lukes, University of Pennsylvania

Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft

SL2014

Santo Fortunato, Aalto University

James Fowler, University of California, San Diego (UCSD)

Kristina Lerman, University of Southern California (USC)

Michael Macy, Cornell University

Cosma Shalizi, Carnegie-Mellon University

MCO2014

Jean-Pierre Hubschman, UCLA

Joseph Teran, UCLA

Emanuele Trucco, University of Dundee

Irena Tsui, UCLA

RP2014

Marek Biskup, University of California, Los Angeles (UCLA), Mathematics

Dan Crisan, Imperial College

Peter Friz, Technische Universität Berlin and WIAS Berlin

Massimiliano Gubinelli, Université de Paris IX (Paris-Dauphine)

Martin Hairer, University of Warwick

CDM2014

Gyan Bhanot, Rutgers University, The Cancer Institute of New Jersey

Tom Chou, University of California, Los Angeles (UCLA), Mathematics

Doron Levy, University of Maryland

SGM2014

Leon Bottou, Microsoft Research, CS

Yann LeCun, New York University, Canadian Institute for Advanced Research

Angelia Nedich, University of Illinois at Urbana-Champaign

Ben Recht, University of California, Berkeley (UC Berkeley)

Stephen Wright, University of Wisconsin-Madison, Computer Science

CCG2014

Jordan Ellenberg, University of Wisconsin-Madison, Mathematics

Nets Katz, California Institute of Technology

Micha Sharir, Tel Aviv University

Jozsef Solymosi, University of British Columbia, Mathematics

CCGTUT

Alex Iosevich, University of Rochester

Nets Katz, California Institute of Technology

Misha Rudnev, University of Bristol

CCGWS1

Haim Kaplan, Tel Aviv University

Jiri Matousek, Charles University, Prague

Micha Sharir, Tel Aviv University

Terence Tao, University of California, Los Angeles (UCLA), Mathematics

CCGWS2

Saugata Basu, Purdue University

Igor Dolgachev, University of Michigan

Jordan Ellenberg, University of Wisconsin-Madison, Mathematics

Nets Katz, California Institute of Technology

Joseph Landsberg, Texas A&M University - College Station

Marie-Francoise Roy, Université de Rennes I

Micha Sharir, Tel Aviv University

MOP2014

Jacob Foster, University of California, Los Angeles (UCLA), Sociology

Vwani Roychowdhury, University of California, Los Angeles (UCLA), Professor, Electrical Engineering

Don Saari, University of California, Irvine (UCI)

CCGWS3

Larry Guth, Massachusetts Institute of Technology

Alex Iosevich, University of Rochester

Nets Katz, California Institute of Technology

Izabella Laba, University of British Columbia

CCGWS4

Emmanuel Breuillard, Université Paris-Sud (Orsay), Mathematics

Ben Green, University of Oxford, Mathematics

Nets Katz, California Institute of Technology

Jozsef Solymosi, University of British Columbia, Mathematics

Terence Tao, University of California, Los Angeles (UCLA), Mathematics

Julia Wolf, University of Bristol, Mathematics

CCGLA

Jordan Ellenberg, University of Wisconsin-Madison, Mathematics

Nets Katz, California Institute of Technology

Jozsef Solymosi, University of British Columbia, Mathematics

GSS2014

Volker Blum, Duke University

Christian Carbogno, Fritz-Haber-Institut der Max-Planck-Gesellschaft

Oliver Hofmann, Fritz-Haber-Institut der Max-Planck-Gesellschaft

Matthias Scheffler, Fritz-Haber-Institut der Max-Planck-Gesellschaft

L. PUBLICATIONS LIST

The following publications are the participants' responses to "Please list up to three publications of the past year (including preprints and technical papers) that were a result of or influenced by your participation at the IPAM program" which was part of a survey conducted in the spring of 2014. For this 2012-2013 annual report, we surveyed participants of the 2012 summer programs and the two long programs in 2012-2013, Materials Defects and Interaction between Analysis and Geometry. Note that some papers with multiple authors are listed twice (reported by two different participants). As these publications are self-reported, the formatting of the citations is inconsistent.

RESEARCH IN INDUSTRIAL PROJECTS FOR STUDENTS (RIPS) – SUMMER 2012

Needell, Deanna, Mathematics, Claremont McKenna College

B. Cung, T. Jin, J. Ramirez, A. Thompson, C. Boutsidis and D. Needell. "Spectral Clustering: An empirical study of Approximation Algorithms and its Application to the Attrition Problem", SIAM Undergraduate Research Journal, vol. 5, pp. 283-303.

D. Needell, R. Zhao, A. Zouzias. "Randomized Block Kaczmarz Method with Projection for Solving Least Squares." arXiv:1403.4192. Submitted March 17, 2014

R. Zhao, D. Needell, J. Grenard, C. Johansen. "A Comparison of Clustering and Missing Data Methods for Health Sciences." arXiv:1404.5899. Submitted April 22, 2014.

Serna, Susana, Mathematics, Autonomous University of Barcelona

S. Leung, J. Qian and S. Serna, "Fast Huygen Sweeping Methods for Schrodinger Equations in the Semi-Classical Regime", Methods and Applications of Analysis, 21(1), 47-82, 2014

S. Serna, A.Marquina, "Anomalous wave structure in magnetized materials described by non-convex equations of state", Physics of Fluids, 26, 016101 (2014)

RESEARCH IN INDUSTRIAL PROJECTS FOR STUDENTS (RIPS)-HONG KONG - SUMMER 2012

Korkut, Leyla, University of Maryland

Korkut, Leyla; Luo, Siyi; Perkins, Raymond; Wang, Mengxue. "Quantitative Modeling of Operational Risk." Joint Risk Management Newsletter, The Society of Actuaries, December 2013, page 27-31.

GRADUATE SUMMER SCHOOL: DEEP LEARNING, FEATURE LEARNING (GSS2012) - SUMMER 2012

Amin, MD. Faijul, System Design Engineering, Fukui University

Sazal, M.M.R.; Biswas, S.K.; Amin, M.F.; Murase, K. “Bangla handwritten character recognition using deep belief network,” Electrical Information and Communication Technology (EICT), 2013 International Conference on 13-15 Feb. 2014, pp. 1-5.

Hossain, S.I.; Hossain Chowdhury, M.F.; Amin, M.F.; Murase, K. “Speech enhancement using modified magnitude and phase spectra, ” Electrical Information and Communication Technology (EICT), 2013 International Conference on 13-15 Feb. 2014, pp. 1-4.

Austerweil, Joseph, Psychology, University of California, Berkeley (UC Berkeley)

Joseph Austerweil and Thomas Griffiths. (2013). A nonparametric Bayesian framework for constructing flexible feature representations. Psychological Review, 120 (4), 817-851.

Yangqing Jia, Joshua Abbott, Joseph Austerweil, Thomas Griffiths, and Trevor Darrell. (2013). Visual Concept Learning: Combining Machine Vision and Bayesian Generalization on Concept Hierarchies. Advances in Neural Information Processing Systems.

Ba, Lei, Department of Electrical and Computer Engineering, University of Toronto

Ba, Lei Jimmy; Frey, Brendan. Adaptive dropout for training deep neural network. Advances in Neural Information Processing Systems 26 (NIPS 2013).

Chi, Eric, Human Genetics, University of California, Los Angeles (UCLA)

Chi and Lange, “Splitting Methods for Convex Clustering,” arXiv: 1304.0499 [stat.ML]

Chi, Allen, Zhou, Kohannim, Lange, and Thompson, “Imaging genetics via sparse canonical correlation analysis,” Biomedical Imaging (ISBI), 2013 IEEE 10th International Symposium.

Cho, KyungHyun, Department of Information and Computer Science, Helsinki University of Technology

Kyunghyun Cho, “Simple Sparsification Improves Sparse Denoising Autoencoders in Denoising Highly Corrupted Images,” Proceedings of the International Conference on Machine Learning (ICML 2013)

Kyunghyun Cho, Tapani Raiko, Alexander Ilin, Juha Karhunen, “A Two-stage Pretraining Algorithm for Deep Boltzmann Machines,” Proceedings of the International Conference on Artificial Neural Networks and Machine Learning - ICANN 2013

Hannes Schulz, Kyunghyun Cho, Tapani Raiko, Sven Behnke, “Two-Layer Contractive Encodings with Linear Transformation of Perceptrons for Semi-Supervised Learning,” Proceedings of the International Conference on Neural Information Processing - ICONIP 2013

Dieleman, Sander, Electronics and Information Systems, Ghent University

van den Oord, Aäron; Dieleman, Sander; Schrauwen, Benjamin. Deep content-based music recommendation, Advances in Neural Information Processing Systems 26 (2013)

Dieleman, Sander; Schrauwen, Benjamin. Multiscale approaches to music audio feature learning, Proceedings of the 14th international society for music information retrieval conference (2013)

Dieleman, Sander; Schrauwen, Benjamin. End-to-end learning for music audio, ICASSP 2014 (to appear)

Eigen, David, Computer Science, New York University

OverFeat: Integrated Recognition, Localization and Detection using Convolutional Networks, ICLR 2014

Restoring an Image Taken Through a Window Covered with Dirt or Rain, ICCV 2013

Understanding Deep Architectures using a Recursive Convolutional Network, ICLR Workshops 2014

Goroshin, Ross, Computer Science, Courant Institute of Mathematical Sciences

Saturating Auto-Encoders, Goroshin, LeCun. ICLR 2013 Scottsdale, AZ

Gulcehre, Caglar, Computer Science and Operations Research, University of Montreal

Pascanu, R., Gulcehre, C., Cho, K., & Bengio, Y. (2013). How to Construct Deep Recurrent Neural Networks. arXiv preprint arXiv:1312.6026.

Gulcehre, C., Cho, K., Pascanu, R., & Bengio, Y. (2013). Learned-norm pooling for deep neural networks. arXiv preprint arXiv:1311.1780.

Gulcehre, C., & Bengio, Y. (2013). Knowledge matters: Importance of prior information for optimization. ICLR 2013, Arizona Nevada.

Harris, David, Environmental Science and Policy, University of California, Davis (UC Davis)

Building realistic assemblages with a Joint Species Distribution Model (preprint posted April 9, 2014): http://biorxiv.org/content/early/2014/04/09/003947

Hausler, Chris, Biology, Freie Universität Berlin

Natural image sequences constrain dynamic receptive fields and imply a sparse code, C Häusler, A Susemihl, MP Nawrot - Brain research, 2013

Johnson, Leif, Computer Science, University of Texas at Austin

L Johnson, DH Ballard. "Efficient codes for inverse dynamics during walking." AAAI 2014.

L Johnson, DH Ballard. "Classifying movements using efficient kinematic codes." CogSci 2013.

L Johnson, J Cooper, DH Ballard. "Unified loss functions for multi-modal pose regression." IJCNN 2013.

Kerr, Wesley, Biomathematics, University of California, Los Angeles (UCLA)

Kerr WT, Hwang ES, Raman KR, Barritt SE, Patel AB, Le JM, Hori JM, Davis EC, Braesch CT, Janio EA, Lau EP, Cho AY, Anderson A, Silverman DHS, Salamon N, Engel J, Jr., Stern JM, Cohen MS.

Multimodal diagnosis of epilepsy using conditional dependence and multiple imputation. 4th International Workshop Pattern Recognition in Neuroimaging (Tuebingen, Germany: Conference Publishing Services), 2014.

Kerr WT, Nguyen ST, Cho AY, Lau EP, Silverman DH, Douglas PK, Reddy NM, Anderson A, Bramen J, Salamon N, Stern JM, Cohen MS. Computer aided diagnosis and localization of lateralized temporal lobe epilepsy using interictal FDG-PET. Frontiers in Neurology. 4:31. 2013.

Murray, Iain, University of Edinburgh

Benigno Uría, Iain Murray, and Hugo Larochelle. RNADE: The real-valued neural autoregressive density-estimator, Advances in Neural Information Processing Systems 26, 2013.

Benigno Uría, Iain Murray, and Hugo Larochelle. A Deep and Tractable Density Estimator (to appear), International Conference on Machine Learning, 2014.

Olshausen, Bruno, Canadian Institute for Advanced Research, University of California, Berkeley (UC Berkeley)

Olshausen BA (2013) Perception as an inference problem. In: The Cognitive Neurosciences V, M. Gazzaniga, R. Mangun, Eds. MIT Press. (in press)

Olshausen BA (2013) Highly overcomplete sparse coding. In: SPIE Proceedings vol. 8651: Human Vision and Electronic Imaging XVIII, (B.E. Rogowitz, T.N. Pappas, H. de Ridder, Eds.), Feb. 4-7, 2013, San Francisco, California.

Sussillo, David, Electrcial Engineering, Stanford University

D Sussillo, O Barak. Opening the black box: low-dimensional dynamics in high-dimensional recurrent neural networks, Neural computation 25 (3), 626-649

V Mante, D Sussillo, KV Shenoy, WT Newsome. Context-dependent computation by recurrent dynamics in prefrontal cortex, Nature 503 (7474), 78-84

Uria, Benigno, Informatics, University of Edinburgh

Benigno Uria, Iain Murray, Hugo Larochelle. RNADE: The real-valued neural autoregressive density-estimator. Advances in Neural Information Processing Systems 26:2175-2183, 2013. arXiv:1306.0186

Benigno Uria, Iain Murray, Hugo Larochelle. A deep and tractable density-estimator. arXiv:1310.1757

Xie, Jianwen, statistics, computer science, University of California, Los Angeles (UCLA)

J Xie, W Hu, SC Zhu, and Y Wu (2014) Learning inhomogeneous FRAME models for object patterns. Proceedings of IEEE Conference on Computer Vision and Pattern Recognition (CVPR).

Yang, Yanchao, Geometric Modeling and Scientific Visualization Center, Electric, King Abdullah University of Science and Technology (KAUST)

Yanchao Yang, Ganesh Sundaramoorthi. Modeling Self-Occlusions in Dynamic Shape and Appearance Tracking. Computer Vision (ICCV), 2013 IEEE International Conference on
1-8 Dec. 2013. pp. 201-208

Yanchao Yang, Ganesh Sundaramoorthi. Shape Tracking With Occlusions via Coarse-To-Fine Region-Based Sobolev Descent. arXiv:1208.4391

Yanchao Yang, Ganesh Sundaramoorthi. Matching Through Features and Features Through Matching. arXiv:1211.4771

Zhao, Yulong, Mathematics, City University of Hong Kong

Learning performance of elastic-net regularization, Mathematical and Computer Modeling, 2013

MATERIALS DEFECTS: MATHEMATICS, COMPUTATION, AND ENGINEERING (MD2012) – FALL 2012

Bao, Weizhu, Mathematics, National University of Singapore

W. Jiang, W. Bao, C. V. Thompson and D. J. Srolovitz, Phase field approach for simulating solid-state dewetting problems, Acta Mater., Vol. 60, pp. 5578-5592, 2012.

W. Bao and Q. Tang, Numerical study of quantized vortex interaction in the Ginzburg-Landau equation on bounded domains, Commun. Comput. Phys., Vol. 14, pp. 819-850, 2013.

W. Bao and Q. Tang, Numerical study of quantized vortex interaction in nonlinear Schroedinger equation on bounded domains, Multiscale Modeling and Simulation: a SIAM Interdisciplinary Journal, to appear.

Boateng, Henry, Mathematics, University of Michigan

H. Boateng, T. Schulze, and P. Smereka, Approximating Off-Lattice Kinetic Monte Carlo, Multiscale Modeling and Simulation, 12(1), 181-199.

Ehrlacher, Virginie, CERMICS, Ecole des Ponts Paristech

V. Ehrlacher, C. Ortner, and A. V. Shapeev. “Analysis of boundary conditions for crystal defect atomistic simulations.” ArXiv e-prints, 1306.5334, 2013.

Elder, Ken, Oakland University

"Capturing the complex physics behind universal grain size distributions in thin metallic films" Acta Materialia vol 64, pg 72-77 (2014)

Gao, Wang, Theory Department, Fritz-Haber-Institut der Max-Planck-Gesellschaft

W. Gao and A. Tkatchenko, Phys. Rev. Lett. 111, 045501 (2013).

Hennig, Richard, Cornell University

A. K. Singh and R. G. Hennig. Scaling Relation for Thermal Ripples in Single and Multilayer Graphene. Phys. Rev. B 87, 094112 (2013).

H. L. Zhuang, A. K. Singh, and R. G. Hennig. Computational Discovery of Single-Layer III-V Materials. Phys. Rev. B 87, 165415 (2013).

H. L. Zhuang and R. G. Hennig. Single-Layer Group-III Monochalcogenide Photocatalysts for Water Splitting. Chemistry of Materials 25, 3232 (2013).

Huang, Jian, Department of Civil and Environmental Engineering, University of California, Los Angeles (UCLA)

'The Influence of (Al, Fe, Mg) Impurities on Triclinic Ca3SiO5: Interpretations from DFT Calculations', Crystal Growth & Design (accepted), 2014

Hudson, Thomas, Maths Institute, University of Oxford

Thomas Hudson, Christoph Ortner, Existence and stability of a screw dislocation under anti-plane deformation. arXiv:1304.2500

Thomas Hudson, Christoph Ortner, Analysis of stable screw dislocation configurations in an anti-plane lattice model. arXiv:1403.0518

Kioussis, Nick, California State University, Northridge (CSU Northridge)

Hua Peng, Nicholas Kioussis, J. Snyder. Elemental tellurium as a chiral p-type thermoelectric material, Phys. Rev. B (in press, May 2014)

Lu, Chun-Yaung, Los Alamos National Laboratory

Chun-Yaung Lu, Arthur F. Voter and Danny Perez, "Extending Atomistic Simulation Timescale in Solid/Liquid Systems: Crystal Growth from Solution by a Parallel-Replica Dynamics and Continuum Hybrid Method", J. Chem. Phys, 140, 044116 (2014)

Luskin, Mitchell, University of Minnesota, Twin Cities

Atomistic-to-continuum coupling (with Christoph Ortner). Acta Numerica, 22:397–508, 2013

Hyper-QC: An accelerated finite-temperature quasicontinuum method using hyperdynamics (with Woo Kyun Kim, Danny Perez, Ellad Tadmor, and Art Voter). Journal of the Mechanics and Physics of Solids, 63:94–112, 2014

Theory-based benchmarking of the blended force-based quasicontinuum method (with Xingjie Helen Li, Christoph Ortner and Alexander V Shapeev). Computer Methods in Applied Mechanics and Engineering, Computer Methods in Applied Mechanics and Engineering, 268:763–781, 2014

Makridakis, Charalambos, University of Crete

Charalambos Makridakis, Dimitrios Mitsoudis, and Phoebus Rosakis. On Atomistic-to-Continuum Couplings without Ghost Forces in Three Dimensions Appl Math Res Express (2014) Vol. 2014 87-113 doi:10.1093/amrx/abt005

Makridakis, Charalambos; Süli, Endre. Finite element analysis of Cauchy-Born approximations to atomistic models. Arch. Ration. Mech. Anal. 207 (2013), no. 3, 813–843.

Margetis, Dionisios, Mathematics, and Institute for Physical Science & Technology, University of Maryland

Patrone, P. N., and D. Margetis (2014), “Connection of kinetic Monte Carlo model for surfaces to one-step flow theory in 1+1 dimensions", (SIAM) Multiscale Modeling Simulation, Vol. 12(1), pp. 364-395.

Patrone, P. N., T. L. Einstein, and D. Margetis (2014), “From atoms to steps: the microscopic origins of crystal evolution", Surface Science, Vol. 625, pp. 37-43.

Nakamura, K., and D. Margetis (2013), ``Phase field model for reconstructed stepped surface", Physical Review E, Vol. 88(1), art. 014401 (4pp).

Perez, Danny, Theoretical Division T-1, Los Alamos National Laboratory

WK Kim, M Luskin, D Perez, AF Voter, EB Tadmor. Hyper-qc: An accelerated finite-temperature quasicontinuum method using hyperdynamics, Journal of the Mechanics and Physics of Solids 63, 94-112

CY Lu, AF Voter, D Perez. Extending atomistic simulation timescale in solid/liquid systems: Crystal growth from solution by a parallel-replica dynamics and continuum hybrid method, The Journal of Chemical Physics 140 (4), 044116

Todorova, Mira, Computational Materials Design**,** Max-Planck-Institut für Eisenforschung

Mira Todorova and Jörg Neugebauer. “Extending the Concept of Defect Chemistry from Semiconductor Physics to Electrochemistry,” Phys. Rev. Applied 1, 014001, published February 27, 2014.

Topuz, A. Ilker, Micromechanics, Rijksuniversiteit Groningen

Ilker Topuz, Erik Van der Giessen. Dimension reduction of irradiation-induced defect properties for application in 2D Dislocation Dynamics.

Voigt, Axel, Technishche Universtitat Dresden

Backofen et al. Acta Materialia, 64 (2014), 72-77

INTERACTIONS BETWEEN ANALYSIS AND GEOMETRY (IAG2013) - SPRING 2013

Azzam, Jonas, Mathematics, University of Washington

Jonas Azzam, Matthew Badger, and Tatiana Toro. Quasiconformal Planes with Bi-Lipschitz Pieces and Extensions Of Almost Affine Maps. arxiv:1403.2991

Jonas Azzam, Quantitative Differentiation of Quasisymmetric Maps In Euclidean Space. arxiv:1308.0558

Jonas Azzam, Hausdorff Dimension of Wiggly Metric Spaces. arxiv:1303.7305

Bacak, Miroslav, Max-Planck-Institut für Mathematik in den Naturwissenschaften

Convex Analysis and Optimization in Hadamard Spaces, De Gruyter Series in Nonlinear Analysis and Applications, Vol. 22, to be published October 2014.

Miroslav Bacak and Simeon Reich, “The asymptotic behavior of a class of nonlinear semigroups in Hadamard spaces,” arXiv:1405.6637. Submitted May 24, 2014.

Badger, Matthew, Mathematics, SUNY Stony Brook

Matthew Badger and Raanan Schul, Multiscale analysis of 1-rectifiable measures: necessary conditions, submitted, arXiv:1307.0804

Jonas Azzam, Matthew Badger, and Tatiana Toro, Quasiconformal planes with bi-Lipschitz pieces and extensions of almost affine maps, submitted, arXiv:1403.2991

Brakalova, Melkana, Mathematics, Fordham University

M. Brakalova, Local behavior of solutions to the Beltrami equation with degeneration, in "Complex Analysis and Applications '13" (Proc. Intern. Conf., Sofia, 2013) - Electronic Book (Full Length Papers), 345 pp.; Institute of Mathematics and Informatics, Bulg. Acad. Sci., Sofia, 2013.

Durand Cartagena, Estibalitz, Matemática Aplicada, UNED

E. Durand-Cartagena, J. A. Jaramillo and N. Shanmugalingam. Geometric characterizations of p-Poincaré inequalities. Preprint at http://cvgmt.sns.it/paper/2345/

E. Durand-Cartagena, J. Tyson. Erratum to: Rectifiable curves in Sierpinski carpets, volume 60:1 (2011), 285-309. Indiana Math. 62 (2013), 355-356

E. Durand-Cartagena, J. A. Jaramillo and J. Gong. Sierpinski type fractals are differentiably trivial. Preprint

Eskin, Alex, Mathematics, University of Chicago

Alex Eskin and Carlos Matheus. Semisimplicity of the Lyapunov spectrum for irreducible cocycles, 2013, arXiv:1309.0160.

Alex Eskin, Howard Masur, and Kasra Rafi. Large scale rank of Teichmuller space, 2013, arXiv:1307.3733.

Alex Eskin, Maryam Mirzakhani, and Amir Mohammadi. Isolation, Equidistribution, and Orbit Closures for the SLl(2,R) action on Moduli space, 2013, arXiv:1305.3015.

Fu, Xinchu, Department of Mathematics, Shanghai University

Bei Lin, Guanghu Zhu, Zhenlong Sun and Xinchu Fu*, Spreading dynamics of a disease-awareness SIS model on complex networks. International J. of Biomath. 6 (4), Jul. 2013, 1350025.

Rongzhong Yu and Xinchu Fu*, Tangent-free property for periodic cells generated by some general piecewise isometries. Discrete Dynamics in Nature and Society, 2013 (2013) 704962.

Zhen Jia, Xinchu Fu, Guangming Deng and Kezan Li, Group synchronization in complex dynamical networks with different types of oscillators and adaptive coupling schemes. Commun. Nonl. Sci. Numer. Simulat. 18 (10), October 2013, 2752-2760.

Garnett, John, Mathematics, University of California, Los Angeles (UCLA)

Square functions and uniform rectifiability. Vasilis Chousionis, John Garnett, Triet Le, Xavier Tolsa. Subjects: Classical Analysis and ODEs (math.CA) arXiv:1401.3382 [pdf, ps, other]

Kelleher, Daniel, Mathematics, University of Connecticut

Alonso-Ruiz P., Kelleher D., Teplyaev A. "Energy and Laplacian on Hanoi-type fractal quantum graphs," 2014, (submitted).

Lacey, Michael, Mathematics, Georgia Institute of Technology

Amirkhanyan, Gagik; Bilyk, Dmitriy; Lacey, Michael T. Dichotomy results for the L^1 norm of the discrepancy function. J. Math. Anal. Appl. 410 (2014), no. 1, 1–6.

Gagik Amirkhanyan, Dmitriy Bilyk, Michael T Lacey, Estimates of the Discrepancy Function in Exponential Orlicz Spaces, arXiv:1306.1766

Michael T Lacey, The Two Weight Inequality for the Hilbert Transform: A Primer, arXiv:1304.5004

Le Donne, Enrico, University of Jyväskylä

Le Donne, Enrico; Capogna, L. Smoothness of subRiemannian isometries, available on arXiv.org, 2013 (preprint)

Le Donne, Enrico. A metric characterization of Carnot groups. Proceedings of the American Mathematical Society, available on arXiv.org (accepted).

Li, Xining, Mathematical department, University of Cincinnati

Preservation of bounded geometry under sphericalization and flattening (preprint), with Nages Shanmugalingam (https://www.mittag-leffler.se/preprints/files/IML-1314f-16.pdf**)**

Liu, Zhenxin, School of Mathematics, Jilin University

Liu, Zhenxin; Sun, Kai; Almost automorphic solutions for stochastic differential equations driven by Levy noise. J. Funct. Anal. 266 (2014), 1115-1149.

Caraballo, T.; Jara, Juan C.; Langa, J. A.; Liu, Zhenxin Morse decomposition of attractors for non-autonomous dynamical systems. Adv. Nonlinear Stud. 13 (2013), 309-329.

Mishchenko, Andrey, Mathematics, University of Michigan

Three techniques for obtaining algebraic circle packings. (Joint with Larsen Louder and Juan Souto.) Accepted for publication in the Michigan Math Journal.

Pilgrim, Kevin, Indiana University

Christopher J. Bishop and Kevin M. Pilgrim, "Dynamical dessins are dense". Submitted and provisionally accepted pending revisions, Revista Math. Iberoam.

Poggi-Corradini, Pietro, Mathematics, Kansas State University

Effective resistance on graphs and the Epidemic quasimetric, with Josh Ericson and Hainan Zhang, Involve 7, no.1, 97–124, 2014.

Modulus of families of walks on graphs (preprint), with Nathan Albin, Max Goering and Faryad Darabi Sahneh.

The Rickman-Picard Theorem (preprint), with M. Bonk and J. Heinonen.

Prause, Istvan, Mathematics and Statistics, University of Helsinki

On a Hölder constant in the theory of quasiconformal mappings, Comput. Mehtods. Funct. Theory F.W. Gehring Memorial Volume (to appear) 2014

Schul, Raanan, mathematics, SUNY Stony Brook

An upper bound for the length of a Traveling Salesman path in the Heisenberg group. (Joint with Sean Li) http://arxiv.org/abs/1403.3951

Multiscale analysis of 1-rectifiable measures: necessary conditions. (Joint with Matthew Badger) http://arxiv.org/abs/1307.0804

The traveling salesman problem in the Heisenberg group: upper curvature bound. (Joint with Sean Li) http://arxiv.org/abs/1307.0050

Shanmugalingam, Nages, University of Cincinnati

Dewey Estep, Nageswari Shanmugalingam. Geometry of prime end boundary and the Dirichlet problem for bounded domains in metric spaces. arXiv:1405.2444

X. Li and N. Shanmugalingam. Preservation of bounded geometry under sphericalization and flattening, (2013)

E. Durand-Cartagena, J. Jaramillo and N. Shanmugalingam. Geometric characterizations of p-Poincare inequalities in the metric setting, preprint. (https://www.mittag-leffler.se/preprints/files/IML-1314f-15.pdf)

Soto, Tomás, Department of Mathematics and Statistics, University of Helsinki

Pointwise and grand maximal function characterizations of Besov-type and Triebel-Lizorkin-type spaces (arXiv:1304.1587, submitted)

Uriarte-Tuero, Ignacio, Mathematics, Michigan State University

M. J. Martín, E. Sawyer, I. Uriarte-Tuero, D. Vukotic. "The Krzyz conjecture revisited", arXiv:1311.7668

Xie, Xiangdong, Mathematics, Bowling Green State University

Quasiconformal maps on model Filiform groups –preprint, arXiv:1308.3027

Rigidity of quasiconformal maps on Carnot groups –preprint, arXiv:1308.3028

Quasiconformal maps on non-rigid Carnot groups –preprint, arXiv:1308.3031

Zhou, Yuan, Department of Mathematics and Statistics, University of Jyväskylä

P. Koskela, J. Xiao, Y. Zhang and Yuan Zhou, A quasiconformal problem for Q-spaces, submitted.

P. Koskela, Y. Zhang and Yuan Zhou, The Morrey-Sobolev extension domains, submitted.

J. Siljander, C. Wang, and Yuan Zhou, Everywhere differentiablity of infinity harmonic function with variable cofficients, preprint.

M. INDUSTRIAL AND GOVERNMENTAL INVOLVEMENT

We have significant involvement of industry and government labs in our summer program, Research in Industrial Projects for Students (RIPS). See the program description for RIPS-LA (Section J) for a complete list of sponsors.

We also offered RIPS-Hong Kong for the third time in the summer of 2013. Our partner, Hong Kong University of Science and Technology, recruited the sponsors. See the program description (Section J) for more information. IPAM has a three-year IRES grant from the NSF OISE to support this program.

IPAM received a grant from the National Geospatial-Intelligence Agency to support the Women in Shape Modeling Workshop in July 2013. A representative of NGA spoke to the participants, and separately, to RIPS students, about careers in intelligence.

Out of 1,692 participants in 2012-2013, 19 held positions in government or military, and 35 worked in industry. Several researchers from Los Alamos National Laboratory participated in the Materials Defects long program or one of its workshops. A member of Sandia National Lab attended the Climate Modeling reunion conference. Several researchers from industry participated in the Structure and Randomness in System Identification and Learning workshop and the summer school on Computer Vision. Microsoft Research was well represented this year. Other companies represented on our list of participants include Exxon, Intel, Siemens, Google, the Aerospace Corporation, Symantec, and HRL. Of course, many representatives of industry and government participate in RIPS and attend RIPS Projects Day.

Our Board of Trustees includes Al Hales (CCR West), Jeff Saltzman (AstraZeneca), Pieter Swart (Los Alamos National Lab), David Balaban (Amgen), Alan Lee (AMD). Tanya Beder (SBCC Group Inc.) and Bill Coughran (Sequoia Capital) joined in fall 2013. Our Science Advisory Board includes two members from Microsoft Research.

Vasily Bulatov from Lawrence Livermore National Laboratory (Physical and Life Sciences Directorate) was an organizer of the Materials Defects long program and one of the workshops in that program.

Here are a few comments from representatives of industry and government labs who participated in IPAM programs in 2012-2013.

"The stay strengthen a collaboration on multiscale techniques with Mitchell Luskin at UMN. We hosted a student from his group over the summer and are writing up his work. I also formed a collaboration with Virginie Erlacher on some aspects of KMC…

"The program has a very positive impact on my career and research. It significantly widened my horizon to include meso-scale and macro-scale modeling, and enabled me to form a contact network with experts in these fields. I expect the benefits from my stay to grow in the coming years."

> -Danny Perez, Los Alamos National Laboratory, Theoretical Division T-1 (Materials Defects program, 2012)

"The [RIPS] students went into the project with very little knowledge of how research was done within an industrial environment. By the end of the program, it was clear that the students had developed essential (communication, research, and team dynamics) skills that would not only help them in an industrial research setting, but in any research-related activities that they may pursue in the future."

> -Don Metzler, Senior Software Engineer, Google (RIPS 2013 industry mentor)

N. EXTERNAL SUPPORT

In addition to the funding listed in Table N below, IPAM receives substantial in-kind financial support from UCLA. The Director's entire salary and administrative stipend are paid directly by UCLA. The Director of Special Projects is released from two courses at the cost of replacing him by a junior person. IPAM is not charged for the use of its building or for custodial care. The value of these items is considerable. Additionally, senior long-term participants from other universities are usually funded on a teaching replacement-buyout basis, by which they are released from teaching for the cost of hiring a junior person as a replacement.

Table N: Other Funding Support, 2012-2013	
Federal Funding	**Amount**
NSF-IRES: RIPS-Hong Kong	$50,000
National Geospatial-Intelligence Agency	10,000
Sub-total	60,000
University Funding Support	
Dean Physical Sciences	134,554
Vice Chancellor for Research	126,108
Sub-total	260,662
Industrial Affiliates and Other Support	
Aerospace	15,000
HRL, Inc.	15,000
Microsoft	10,000
Symantec	15,000
Sub-total	55,000
Others	
Registration Fees-Programs	22,973
Green Family Lectureship Foundation Interest	6,835
Frontier's Society and Other Contributions	9,985
Berland Foundation	12,000
Sub-total	51,793
TOTAL	**$427,455**

O. COMMITTEE MEMBERSHIP

IPAM's committees include the Board of Trustees and Science Advisory Board. The members of each during the 2012-2013 academic year are listed below. (Some of them have since finished their term.) The IPAM directors are *ex officio* members.

Science Advisory Board

Full Name	Discipline/Expertise	Institution
Green, Mark	Mathematics	UCLA
Hastings, Matthew	Physics	Microsoft Research
Jones, Peter Wilcox	Mathematics	Yale University
LeCun, Yann	Computer Science	New York University
Levermore, David	Applied Math	University of Maryland
Naor, Assaf	Mathematics	New York University
Schwartz, Richard	Mathematics	Brown University
Tao, Terence	Mathematics	UCLA

Thompson, Elizabeth	Biostatistics	University of Washington
Tomlin, Claire	Electrical Engineering	UC Berkeley
Wilkinson, Amie	Mathematics	Univ. of Chicago
Wright, Stephen	Computer Science	University of Wisconsin - Madison
Yu, Bin	Statistics	UC Berkeley

Since September 1, 2013, Robert Calderbank, Emmanuel Candes, Cynthia Dwork and Alexei Borodin joined the Science Advisory Board. David Levermore is Chair.

Board of Trustees

Name		Department or Title	Institution
David	Balaban	Research Informatics Department	Amgen
Tony	Chan	President	HKUST
Mark	Green	Mathematics	UCLA
Alfred	Hales	Director	CCR West
Sallie	Keller	Professor of Statistics, Director	Virginia Tech University
Bryna	Kra	Mathematics	Northwestern University
Alan	Lee	Corporate Vice President, R&D	AMD Research
William	Massey	Mathematics	Princeton
Juan	Meza	High Performance Computing Research	UC Merced
Jeffrey	Saltzman	Senior Director, R&D	AstraZeneca
Ronald	Stern	Mathematics	UC Irvine
Pieter	Swart	Mathematical Modeling and Analysis (T-7)	Los Alamos National Lab
Tatiana	Toro	Mathematics	Univ. of Washington

Al Hales will serve a second term as chair of the Board of Trustees. Since September 1, 2013, Karina Edmonds, Bill Coughran, and Tanya Beder joined the Board of Trustees.

P. CONTINUING IMPACT OF PAST IPAM PROGRAMS

In an effort to fully describe and evaluate the impact of a long program, IPAM has designed an online survey. In 2013, we conducted the survey with participants of our "Bridging Time and Length Scales in Materials Science and Bio-Physics" long program, held in the fall of 2005. In 2014, we used the same survey with the participants of our 2010 long program on Optimization. I have included some of the results of these surveys below. The complete and final reports of the surveys are available upon request. The reports include a list of publications related to the program, as reported by the participants which we did not include here.

"Bridging Time and Length Scales in Materials Science and Bio-Physics" Summary Report

32 out of 55 participants responded to the online survey, conducted in 2013. Out of the 32 respondents, 22 are in physical sciences, 9 in mathematical sciences, and one in life sciences. Two-thirds of the respondents were graduate students or postdocs at the time of the program. All ten of the graduate students have finished their PhD.

All respondents (n=31) are currently employed in a math/science field.

Nearly all of the respondents indicated that the program influenced their research interests, and many said that the program introduced them to collaborators and was useful preparation for their career. 86% of the respondents have recommended IPAM or one of its programs to a colleague or student.

The respondents reported the following fellowships, scholarships and awards:

Robin Hayes
- AAAS Science and Technology Policy Fellow

Mark A. Jack
- ASEE AFRL Summer Faculty Award 2008, 2009
- NSF TeraGrid Summer Faculty Fellowship 2010
- NSF XSEDE Research Allocation 2012

O.A. von Lilienfeld
- Harry S. Truman Fellowship from Sandia National Laboratories
- Professorship Grant, Swiss National Science Foundation (similar to early career award)

Dionisios Margetis
- NSF CAREER Award

Petr Plechac
- NSF-DMS single PI award
- NSF-CMMI CDI Type II collaborative grant

Gabriel Stoltz
- Best PhD Prize for Ecole des Ponts, 2007

Yi Sun
- NSF Postdoctoral fellowship

Alexander Tkatchenko
- Alexander von Humboldt Postdoctoral Fellowship, Berlin (2007-2009)
- Volker Heine Award (2010)
- Gerhard Ertl Young Investigator Award (2011)
- European Research Council Starting Grant (2011)
- Distinguished Visiting Researcher in POSTECH, Korea (2012)

Select responses to “Please use this space to tell us what other impact or influence the IPAM program has had on your career.”

Veronika Brazdova: In addition to the education, it's given me a wider perspective on the field. I have since published a book, which was partly inspired by my stay at IPAM.

Ralf Drautz: IPAM manages to bring together the leading researchers from different disciplines. During my stay at IPAM collaborations with some of the researchers were initiated, most of them are still active today.

Mark A. Jack: Positive engaging workshop environment in a small, familiar setting. Unique and rare experience for a minority faculty member (African-American). Recommended to other faculty members (Ray O'Neal, Roselyn Williams) who then participated in IPAM events. Was able to recommend and get into the RIPS undergraduate summer research program one undergraduate physics/math major in summer 2012 (Sasha Matthews).

Kurt Kremer: My participation in the program initiated a fruitful collaboration with the group of Cecilia Clementi on adaptive resolution simulations.

Dionisios Margetis: This program helped me: (i) develop new collaborations that are still ongoing; (ii) identify research groups and universities that I would like to join; and (iii) develop a firm research plan that boosted my career.

Petr Plechac: The program and contacts I developed during the program encouraged my move to accept a joint position between University of Tennessee, Knoxville and Oak Ridge National Laboratory.

Alexandre Tkatchenko: I have met many collaborators at IPAM. I have also expanded my research interests in a significant way.

Mira Todorova: Broaden my knowledge about various methods used in materials' science, some of which I have started using since attending the IPAM program.

Dimitri Vvedensky: The main documentable impact is that I began to be invited to mathematics conferences. This, in turn, has provided me with a broader perspective on my research.

“Modern Trends in Optimization and Its Application” Summary Report

40 out of 69 participants (see attached list) responded to the online survey. Out of the 40 respondents, 33 are in mathematical sciences, and 5 in engineering. Seventeen of the respondents were graduate students or postdocs at the time of the program (see chart). Eight of the 11 graduate students have since finished their PhD. The remaining three graduate students expect to complete their PhD degrees soon.

All respondents (n=31) are currently employed in a math/science field. See table of titles and organization of the respondents.

Nearly all of the respondents indicated that the program influenced their research interests (see attached table), and many said that the program introduced them to collaborators and was useful preparation for their career. 86% of the respondents have recommended IPAM or one of its programs to a colleague or student.

The respondents reported the following fellowships, scholarships and awards:

- Grigoriy Blekherman - Sloan Fellowship
- Masakazu Kojima: Grant-in-Aid for Scientific Research
- Stephen Becker: Fellowship from the Fondation Scientific Mathematiques de Paris

35 of the respondents are currently employed in a math/science field.

Select responses to "Please use this space to tell us what other impact or influence the IPAM program has had on your career."

Bala Krishnamoorthy	Interacting with some of the top researchers in the subject area was very influential. I got large amounts of motivation from many the long program participants - from graduate students to senior faculty - as to how to proceed in my research career, and aim for success.
Lieven Vandenberghe	One specific outcome was the plan to organize a follow-on workshop Structure and Randomness in System Identification and Learning, with Maryam Fazel, in January 2013.
Cordian Riener	The Program gave me a very good overview of the applications that Optimization has outside its own domain. I found this very fascinating and in fact, this further motivated me to stay in academia.
Grigoriy Blekherman	The IPAM program was excellent in introducing me to many different aspects of optimization and broadening my research horizons.
Jean Bernard Lasserre	Invitation at such programs have increased my visibility in the optimization and applied math research community.
Stephen Becker	I was a graduate student at the time, and it was extremely helpful to meet other researchers, especially since it wasn't as condensed in time as a usual conference. It was very key for me to meet these people.

IPAM plans to continue to use this survey. We will pick one long program to study in this manner each year.

APPENDIX 1: Meeting of Institute Directors, Minutes and Report

Minutes of the Math Institute Directors (MIDs) Meeting

May 3–4, 2013
Institute for Mathematics and its Applications
Minneapolis, MN

Submitted by Fadil Santosa

Attendees:
Helene Barcelo, Mathematical Sciences Research Institute (MSRI)
Robert Bryant, Mathematical Sciences Research Institute (MSRI)
Russ Caflisch, Institute for Pure and Applied Mathematics (IPAM)
Luca Capogna, Institute for Mathematics and its Applications (IMA)
Brian Conrey, American Institute of Mathematics (AIM)
Robbert Dijkgraaf, Institute for Advanced Study (IAS)
Marty Golubitsky, Mathematical Biosciences Institute
Katherine Cramer, Institute for Mathematics and its Applications (IMA)
Jill Pipher, Institute for Computational and Experimental Research in Mathematics (ICERM)
Fadil Santosa, Institute for Mathematics and its Applications (IMA)
Cheri Shakiban, Institute for Mathematics and its Applications (IMA)
Richard Smith, Statistical and Applied Mathematical Sciences Institute (SAMSI)
Jiaping Wang, Institute for Mathematics and its Applications (IMA)

May 3. The meeting began at 1 p.m. and was chaired by Claudia Neuhauser, a member of the Board on Mathematical Sciences and their Applications.

1. Jill Pipher, ICERM/Brown University, proposed that the institutes interact and engage with STPI, which is charged with assessing the DMS Math Institute portfolio. It was suggested that a subcommittee be formed to work with the Science and Technology Policy Institute (STPI) on their assessment efforts and develop a checklist of aspects to be considered by the external evaluator. Someone suggested that an NSF representative should be part of the committee and that it would be helpful to have access to the STPI proposal. The MIDs expressed interest in this proposal and remarked on its timeliness given an incoming new DMS director.
2. Jill Pipher initiated a discussion regarding the structure of NSF site visits and the composition of the visit teams. It would be preferable to have NSF's general guidelines for expectations and schedules, rather than relying on anecdotal evidence. MIDs questioned whether the site visit teams for the renewal process will be given access to the previous site visit teams' reports.
3. Brian Conrey gave an extensive update on the international project "Mathematics of Planet Earth (MPE) 2013," highlighting the diversity of activities involved. A lack of high-level publicity for the efforts (e.g., in *The New York Times*) was noted. Conrey reported that plans are underway to continue this initiative past 2013 in a sustainable way.
4. The Simons Lecture Series was a great success; Brian Conrey, Helene Barcelo, Robert Bryant, and Richard Smith gave detailed descriptions of the advertisement strategies used at MSRI, AIM, and SAMSI.
5. Fadil Santosa presented the Math Institutes video project, outlining the structure of the data and how it was going to be used. The first step in the process has been carried out and now the project is ready for the input of the metadata from the institutes.
6. Robert Bryant described a library project for book sharing, as well as strategies for donations. MIDs agreed to share a google doc of titles from all institutes.
7. Fadil Santosa and Russ Caflisch discussed plans to write a Math Institutes column for SIAM. The general agreement is that the institutes would take turns in preparing the columns.

8. The first day's meeting was concluded by a discussion of the agenda items for Saturday and a revisit of items from last year: African Math Center; PCAST report response; and the timing of visitor selection with the Simons Sabbatical program.

May 4. The meeting continued at 9 a.m. The MIDs were joined by the following NSF representatives: Mary Ann Horn, Joanna Kania-Bartoszynska, Sastry Pantula, Christopher Stark, Gabor Szekely, and Henry Warchall.

1. Sastry Pantula presented an update on the DMS budget, ongoing programs, and new solicitations.
2. Chris Stark discussed the STPI project, indicating it would lead to a bid for an external evaluation of the Math Institutes portfolio. The NSF welcomed input of a MIDs subcommittee.
3. Both Hank Warchall and Sastry Pantula outlined the importance of providing research highlights for the Math Institutes website, advocating for their role as potential budget-drivers.
4. The directors were asked if a sufficient number of proposals were submitted and the general reply was that although there is a large number of workshop proposals, it is more challenging to find commitment for longer programs.
5. Cheri Shakiban reported on the Math Institutes diversity committee, offering an overview of past and upcoming programs. She also reminded the MIDs of the institutes' financial commitments.
6. The site visit timeline for renewal was discussed. March 15, 2014, was announced as the deadline for renewal proposal submissions. It is expected that the subsequent site visits take place in fall 2014. The request for more directions from NSF for the site visits was welcomed by the NSF team and there was a general agreement that it would be provided in the future. Regarding renewal proposals, the NSF team noted that the format is the one in the original solicitation.
7. The NSF pointed out that to reflect criticism from the NSF COV, a new timeline for new competition is needed. The proposal is to switch to a six-year/four-year cycle from the current eight-year/two-year cycle. The actual timeline for implementation of the new cycle was not finalized, but several proposals were described.
8. Fadil Santosa gave a brief update of the Math Institute video project.
9. The meeting was adjourned shortly after noon.