# Institute for Pure and Applied Mathematics, UCLA Annual Progress Report for 2015-2016 Award #1440415 August 10, 2016

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## Institute for Pure and Applied Mathematics, UCLA Annual Progress Report for 2015-2016 Award #1440415 August 10, 2016

#### EXECUTIVE SUMMARY

The first year of our grant officially covers our activities from September 1, 2015 to August 31, 2016. This report, however, covers our activities from **January 1, 2016, to May 31, 2016** (which I will refer to as the *reporting period*). The activities of the first four months of our grant (through Dec. 31) will be included in our final report of our previous five-year grant (#0931852), because we received a no-cost extension that covered about a third of our expenses for the year. The final three months of this fiscal year (June 1 – August 31, 2016) will be included in next year's report for this grant.

IPAM held one long program in the reporting period:

• Culture Analytics

IPAM held the following workshops in the reporting period:

- Optimization and Equilibrium in Energy Economics
- Uncertainty Quantification for Multiscale Stochastic Systems and Applications
- Partial Order: Mathematics, Simulations and Applications
- Shape Analysis and Learning by Geometry and Machine
- Algebraic Geometry for Coding Theory and Cryptography

No reunion conferences of long programs, summer research programs, or summer schools took place during the reporting period.

IPAM offered the following public lectures during the reporting period:

- The fifth annual Green Family Lecture Series featured Ingrid Daubechies (Duke): "The Master's Hand: Can Image Analysis Detect the Hand of the Master" and "Bones, Teeth and Animation
- Tadashi Tokieda (Cambridge): "A World from a Sheet of Paper"

Other significant activities during the reporting period include:

- One women's luncheon
- IPAM's 15<sup>th</sup> anniversary fundraising campaign
- Ongoing program evaluation, including a report on the outcomes of our 2011 long program "High Throughput Genomics"
- Board of Trustees annual meeting

#### A. PARTICIPANT LIST

A list of all participants in IPAM programs will be provided to NSF in electronic form (Excel). The list will include participants for programs whose start dates fall between September 1, 2015 and August 31, 2016.

#### B. FINANCE SUPPORT LIST

A list of participants that received support from IPAM will be provided to NSF in electronic form (Excel). The list includes all funded participants of programs that occurred between September 1, 2015 and August 31, 2016.

#### C. INCOME AND EXPENDITURE REPORT

This table covers the period from September 1, 2015, when we received the first annual increment from NSF for grant #1440415, through May 31, 2016.

	А	В	С	D	E	F
			A-B=C		B+D=E	A-E=F
Budget Category	Appropriation	Actual Expenses through May	Current Balance	Encumbered Expenses	Total & Encumbered Expenses at	Encumbered Balance
A Operations	Teal I	2010	Way 2010	as of May 2010	Way 2010	as 01 May 2010
Fund	\$1,637,790	\$724,820	\$912,970	\$18,568	\$743,388	\$894,402
B. Participant Costs	\$2,020,000	\$18,464	\$2,001,536	\$813	\$19,277	\$2,000,723
C. Indirect Costs	\$852,210	\$389,550	\$462,660	\$0	\$389,550	\$462,661
Totals	\$4,510,000	\$1,132,834	\$3,377,166	\$19,381	\$1,152,215	\$3,357,786

IPAM received funding of \$4,510,000 for the first year of this grant. Expenditures in year 1 totaled \$1,132,834 and \$19,381 is encumbered for a total of \$1,152,215 in expenses. The encumbered grant balance is \$19,381 at May 31, 2016.

Expenditures for the nine-months ended May 31, 2016:

A. The Operational Fund (salaries, benefits, equipment, supplies, and travel) total \$724,820. Included are \$92,500 in expenses for the sub award with California State University Northridge for Associate Director Jorge Balbas. The appropriation for the Operational Fund is \$1,637,790.

B. Participant Support Costs have an appropriation of \$2,020,000 with total expenditures of \$18,464.

C. Facilities and Administration cost (indirect cost) have an appropriation of \$852,210 and actual expenditures \$389,550.

The reason for the relatively low level of expenditures on grant #1440415 through May 31, 2016 is because we had a carryforward of \$1,503,000 from grant # DMS 0931852 at September 1, 2015. IPAM received a no time cost extension from DMS 0931852 to spend the \$1,503,000 carryforward. The majority of the expenditures of the carryforward have been participant support cost.

We will report on expenditures starting on June 1, 2016 in next year's report.

## D.POSTDOCTORAL PLACEMENT LIST

IPAM did not appoint postdoctoral fellows in 2015-16, so we have no data to report in this section.

## E. MATH INSTITUTE DIRECTORS' MEETING REPORT

## Meeting of Institute Directors April 29-30, 2016 at MBI

Attendees: AIM – Brian Conrey, Estelle Basor IAS – Tom Spencer ICERM – Jill Pipher, Brendan Hassett IMA – Daniel Spirn IPAM – Russ Caflisch MBI – Marty Golubitsky, Tony Nance, Greg Rempala MSRI – David Eisenbud, Helene Barcelo SAMSI – Richard Smith, Sujit Ghosh NSF (Friday dinner and Saturday) – Mary Ann Horn, Jennifer Pearl, Hank Warchall

# Friday April 29

## A. Math Institutes website

Suggestions were made regarding various aspects of the look and functionality of the website, and Jill/Brendan agreed to look into the feasibility of making such changes. Suggestions fall in four categories:

- 1) Highlights page (display, including thumbnail previews)
- 2) Events page (two tabs per institute, Upcoming Events and Recent Events)
- 3) Videos page (randomized display of most recent video from each institute)

4) Diversity page (explore how to organize this page – will be discussed with the Diversity Committee)

## B. Status of Video Indexing project & media library database grant

This project is funded by a \$200K grant, administered by MSRI. The expectation is to complete grant activity by October. The remaining funds will be spent in two areas:

- 1) More powerful media servers
- 2) Assessment efforts, including reporting and analysis of traffic and usage and the creation and analysis of a user survey (in consultation with the IT committee)

Methods to address searchability of the video database were discussed. Some institutes have students and machines pulling out keywords from videos. For videos that have accompanying abstracts, it was suggested that these abstracts would be good source material for both appropriate keywords and for optimizing searches.

## **THREE ACTION ITEMS:**

1) MSRI will invite BIRS, Fields, Newton and the Simons Center to participate in the video database.

2) A link to the video database should be present on each institute's website.

3) The Directors should decide how best to promote the site to the mathematics community.

## C. Report on the Math Institutes Diversity Grant proposal

The Math Institutes Diversity Grant (MIDG) proposal was submitted in February and is still pending. The proposal is for a 4-year time span and did include MMW/SACNAS. SACNAS cannot fund MMW for 2016. If MIDG is delayed or unsuccessful, \$25K would be needed from other sources. Can the institutes collectively pitch in to bridge the gap? **NOTE:** Per NSF on Saturday, we will withdraw the February proposal, add data and information, and then resubmit.

## D. Math Institutes "future programs" form and report

We will continue with the spreadsheet format and only include long programs.

## **ACTION ITEM:**

Institutes will submit info in response to an email from MSRI.

## E. Math Institutes Diversity Committee

Via Jill, Ulrica Wilson of the Institutes Diversity Committee asked the Directors to explore and discuss what they would like the Diversity Committee to do moving forward. Though nothing concrete was decided at this meeting, a healthy discussion touched on the following areas to discuss further:

- Promotion of events and opportunities
- Workforce, and not only in universities
- Stimulating participation
- Other funding agencies and opportunities

- Identification of researchers that can participate in programs (perhaps internal to each institute, or in conjunction with them)

- Highlights that focus on diverse participants (perhaps focus on people; make them more biographical)

# **ACTION ITEM:**

There will be more discussion by the Directors and Diversity Committee.

## F. Topics to bring to the NSF representatives on Saturday

See F1 – F5 below

## Saturday April 30

## F. Topics the institutes brought to the NSF representatives for discussion

## F1. Structure of NSF, including

- DMS Director, Deputy Director, Senior Advisor
- MPS Assistant Director
- Budget of DMS programs, by percentage

Michael Vogelius' term could go through Jan 2017 or Jan 2018. The creation of the Senior Advisor position largely results from the job of Deputy Director growing to be too much for one person.

The term of the current MPS Assistant Director goes through Jan 2017.

The approximate DMS budget breakdown:

- 75% disciplinary research (and some interdisciplinary, but a small amount)
- 12% workforce programs (postdocs, RTG, REU, enriched doctoral)
- 13% institutes

# F2. Targeted email from NSF

Some Directors had heard about institute participants receiving an email survey from NSF. NSF personnel clarified that the email survey was neither DMS-sponsored nor DMS-specific; it was a general cross-NSF commissioned survey of the broad NSF community.

## F3. Review/Renewal/Recompetition

An open competition for institutes is expected to have proposals due in Feb 2019 with awards starting in 2020. The solicitation is not yet released. Every institute will be up for competition at the same time, and competitions will take place every 5 years after that. If a new institute is founded, that institute could conceivably have a 5<sup>th</sup> year renewal possibility rather than be part of an open competition.

Third year reviews/visits will still take place, but will hopefully be far less onerous on the institute (e.g. likely no external visitors will need to be brought in).

Regarding evaluation and assessment:

- Stories are still important.

-The IPAM White Papers were very nice. (IPAM/Russ distributed these via email after MID.)

-The IPAM post-report (including follow-up interviews) in Genomics was also nice.

- Jill mentioned 2-year follow-ups to all ICERM events, but NSF agreed they don't want to make/require more work for the institutes.

- It is also effective, when possible, to document how particular topics/events/collaborations develop over time.

- For the new (not yet released) solicitation for institutes, there will be a formal requirement for certain participant data – hopefully less than the 33 fields in the current spreadsheet, but also perhaps containing new fields.

- DMS will form an ad hoc working group about data (including nitty gritty details), including one representative from each institute; email to come.

# F4. Math Institutes Diversity Grant (Fully addressed in item C above.)

NSF requested that we withdraw the February proposal, add data and information, and then resubmit.

# F5. Can institutes use core funds for family support?

No, per NSF policy.

# G. Some NSF updates

There is collaboration between DMS and CISE. For example, an NSF workshop "Fundamentals of Data Science" took place on the same weekend as the MID. NSF is expecting recommendations from this workshop, and a public report will result.

DMS is also exploring ways to get DMS and BIO to partner with each other, especially regarding science at the cellular level.

EHR has mentioned that there could/should be more EHR submissions from the math community. The math community is encouraged to talk to EHR program officers. Note that almost all EHR programs have an Education Research (ER) component, and proposals will probably need experts/partners (or advice) from the ER community.

Regarding international collaborations and opportunities, Hank pointed out that OISE is organized by regions of the world, and it is best to talk to the Program Directors of each region. Also, PIRE is issuing a new program soon.

# H. Open discussion

Are there ways to address how young researchers grapple with NSF? Two ideas mentioned:

- 1) Outreach session at JMM
- Informational Webinars; David mentioned possibly trying one aimed at postdocs on 9/26/2017

## **I.** Future Meetings of Institute Directors

1) JMM 2017 - ICERM will organize.

2) Spring 2017 - SAMSI will host, currently proposed for April 28-29, 2017.

## F. PARTICIPANT SUMMARY

In this report, we are only reporting on participants of programs that took place between January 1, 2016 and May 31, 2016.

Table F-	Table F-1: All Participants' Gender and Ethnicity by Program Type (Jan 1 - May 31, 2016)						
		G	ender*	Underrepresented Ethnic Grou			Groups*
Program Type	Total Participants	Female	No. Reporting Gender	America n Indian	Black	Hispanic	No. Reporting Ethnicity
Long Program	55	21	55	0	0	4	49
Workshops							
	743	230	738	1	11	39	663
Public							
Lecture	1	0	1	0	0	0	1
Total	799	251	794	1	11	43	713
Percent of No.							
Reporting		31.6%		0.1%	1.5%	6.0%	
*gender and ethnicity is self-reported		all underi eth	epresented	55	7.71%		

There were 520 <u>unique participants</u> for this same period. (Some of the participants attended more than one program—usually multiple workshops within a long program.) Out of those reporting gender, 28.5% were women. Out of those reporting ethnicity, 8.3% reported that they are a member of an underrepresented ethnic group.

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 (Jan 1 - May 31, 2016)				
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent	
Long Programs	34	55	5%	
Workshops	382	715	53%	
Public Lecture	0	1	0%	
Total	416	716	58%	

The majority (92%) of the reporting period's participants hold academic positions (faculty, postdoc, or graduate student). Of the remaining participants, 12 held positions in government or military, 49 worked in industry, and 2 did not fit in any category.

The following sections provide summary data for the requested sub-groups: postdocs, graduate students, and undergraduate students.

## G. POSTDOCTORAL PROGRAM SUMMARY

Postdocs participated in IPAM's workshops and long programs during the reporting period (January 1, 2016 and May 31, 2016). See tables H-1 and H-2.

Tabl	Table G-1: Postdocs' Gender and Ethnicity by Program Type (Jan 1 - May 31, 2016)						
		Ge	nder*	Underrepresented Ethnic Groups*			roups*
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Long Program	12	4	12	0	0	1	10
Workshops							
	117	34	117	0	1	9	105
Total	129	38	129	0	1	10	115
Percent of No. Reporting		29.5%		0.0%	0.9%	8.7%	
*gender and ethnicity is self-reported		all underr eth	epresented	11	9.57%		

Table G-2: Postdocs' Citizenship by Program Type (Jan 1 - May 31, 2016)				
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent	
Long Programs	7	12	6%	
Workshops	50	116	43%	
Total	57	116	49%	

## H. GRADUATE STUDENT PROGRAM SUMMARY

In this report, we are only reporting on participants of programs that took place between January 1, 2016 and May 31, 2016.

Graduate students participated in IPAM's workshops and long programs during the reporting period. 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 (Jan 1 - May 31, 2016)							
		G	ender*	Underrepresented Ethnic Groups*			: Groups*
Program Type	Total Participants	Female	No. Reporting Gender	America n Indian	Black	Hispani c	No. Reporting Ethnicity
Long							
Program	14	3	14	0	0	0	13
Workshops							
	224	70	223	0	5	4	205
Total	238	73	237	0	5	4	218
Percent of No. Reporting		30.8%		0.0%	2.3%	1.8%	
rioporting	<u> </u>	00.070		0.070	2.070	1.070	
*gender and ethnicity is self-reported		ail underr eth	epresented inic groups:	9	4.13%		

Table H-2: Graduate Students' Citizenship by Program Type (Jan 1 - May 31,2016)				
V.S. Citizens &No. Reporting Citizenship &Program TypePermanent ResidentsResidency				
Long Programs	5	14	2%	
Workshops	88	223	39%	
Total	93	223	42%	

# I. UNDERGRADUATE STUDENT PROGRAM SUMMARY

In this report, we are only reporting on participants of programs that took place between January 1, 2016 and May 31, 2016. There were no undergraduate student participants in IPAM programs during this period.

## J. PROGRAM DESCRIPTION

The programs are listed in chronological order by start date. The list includes all IPAM programs from January 1, 2016 through May 31, 2016, which includes:

- One long program, and the workshops associated with it
- Five independent workshops
- Three public lectures

Most IPAM workshops include poster sessions; all participants are invited to present a poster, and graduate students are especially encouraged to participate. Most of IPAM's lectures, including lectures during workshops and public lectures, are available online.

We conduct evaluation of all IPAM programs. We administer an online, anonymous survey to all workshop participants. Long programs have pre-program and post-program surveys, which can be matched to compare responses before and after to some questions. We also conduct "exit interviews" with the junior participants of long programs. The reports are available upon request, and some anonymous quotes from the workshop surveys are included below.

#### WORKSHOP: Optimization and Equilibrium in Energy Economics. January 11-15, 2016

#### Organizing Committee:

Antonio Conejo (Ohio State University) Michael Ferris (University of Wisconsin-Madison) Benjamin Hobbs (Johns Hopkins University, Engineering) Andy Philpott (University of Auckland) Claudia Sagastizabal (Institute of Pure and Applied Mathematics (IMPA))

#### Scientific Overview:

Design and decision problems in electrical power systems and markets can be addressed effectively only when tools from several disciplines are brought to bear. At the core of these problems is a physical system – the power grid – whose intricacies, potentialities, and limitations are understood best by power systems engineers. Power markets determine efficient operational levels for the power system, matching generation and demand at each point in time.

Effective market design requires economic expertise, including an appreciation of current market practice and the treatment of uncertainties arising from the increased use of renewable energy sources (such as wind and solar) within the system, as well as an understanding of the physical, engineering, and regulatory constraints of the grid. Successful design and operation of the electrical power grid and the market for electrical power can lead to billions of dollars in savings, but they require expertise in optimization, data analysis, economics and computational mathematics, as well as close interaction with power systems engineers and energy economists. This workshop aims to bring together experts in each of these domains, as well as key researchers who work at the intersection of these disciplines.

#### Anonymous quotes from workshop survey:

- Probably the most interesting workshop of the year. Excellent organization.
- Thank you for the opportunity to see what experts in energy economics optimization are doing.
- This was an outstanding meeting, and I am very grateful for IPAM's sponsoring of it.

# **WORKSHOP: Uncertainty Quantification for Multiscale Stochastic Systems and Applications.** January 19 - 22, 2016

## Organizing Committee:

Paul Dupuis (Brown University) Peter Glynn (Stanford University) Markos Katsoulakis (University of Massachusetts Amherst, Mathematics & Statistics) Petr Plechac (University of Delaware)

## Scientific Overview:

The principal topic of the workshop will be algorithm development and mathematical analysis of computational probability in the context of complex systems. The aim is for a focused workshop, and we do not plan to cover all approaches to uncertainty quantification. The main methodology will be Monte Carlo methods, and themes will be sensitivity analysis with respect to modeling error, and the role of rare and extreme events. Topics include the analysis of Monte Carlo algorithms using tools from information theory, various methods and approaches to sensitivity analysis, and coarse graining and related methods for model approximation and simplification. Applications include, but are not limited to, problems in materials science, stochastic networks, finance, and risk management.

The workshop is supported in part by the U.S. Department of Energy Office of Science, Office of Advanced Scientific Computing Research, Applied Mathematics program under Award "Mathematical Foundations for Uncertainty Quantification in Materials Design" Number DE-SC-0010539 and the Institute for Pure and Applied Mathematics. The current NSF grant covered some of the expenses as well.

## Anonymous quote from workshop survey:

• I had some excellent discussions with Andy Majda, Tom Chou, and Andrew Stuart. There is potential for new collaborations from those discussions.

# **WORKSHOP: Partial Order: Mathematics, Simulations and Applications.** January 25 - 29, 2016

# Organizing Committee:

Patricia Bauman (Purdue University) Chun Liu (Penn State University, Mathematics) Apala Majumdar (University of Bath) Daniel Phillips (Purdue University)

# Scientific Overview:

Partially ordered materials, between the conventional solid and liquid phases of matter, are ubiquitous in nature. Examples include liquid crystals and complex fluids, glassy matter, the cell cytoskeleton, and vibrated granular media. The theory of partial order not only presents cutting-edge mathematical challenges but can also be transformative for materials science and nano-technology. This workshop has three central themes: the mathematics, modeling, and simulation of (i) liquid crystals and complex fluids, (ii) bio-materials, and (iii) nano-materials and will feature invited talks in equilibrium and non-equilibrium phenomena for these materials, their singularities, numerical methods, and new experiments. As such, the workshop promises to be a unique platform for consolidating new and exciting ideas from different research communities in the field and formulate new plans for long-lasting collaboration.

## Anonymous quotes from workshop survey:

- Thank you so much for everything, the conference was so very intellectually stimulating and the logistics were perfect.
- This conference was very useful for my research. I enjoyed the long talks for their depth and the spacious venue with enough time between talks to meet and discuss with the participants.
- Speakers from non-mathematical background were performed very well and made proper synergies with the lectures of speakers from mathematical background.
- Speakers from mathematical background were influential, well-prepared and enthusiastic about their research. They delivered really well.

## Unsolicited message of thanks from a workshop organizer, received January 29, 2016

I would like to thank all of you for your help with putting this workshop together, It has been a pleasure working with all of you and I personally learnt a great deal from the talks and feel that the workshop has been very beneficial for my research programme and future scientific directions. I found the environment at IPAM very conducive for scientific exchanges.

Apala Majumdar Department of Mathematical Sciences University of Bath

# **WORKSHOP: Shape Analysis and Learning by Geometry and Machine.** February 8 - 12, 2016

## Organizing Committee:

Ron Kimmel (Technion - Israel Institute of Technology, Computer Science) Rongjie Lai (Rensselaer Polytechnic Institute)

## Stanley Osher (University of California, Los Angeles (UCLA)) Olga Sorkine-Hornung (ETH Zürich) Hong-Kai Zhao (University of California, Irvine (UCI), Mathematics)

#### Scientific Overview:

Fast acquisition and routine use of 3D data due to the advance of modern technology and computer power makes 3D description of the real world imminent and practical in many applications such as 3D cameras, 3D printing and prototyping, etc. Although many effective techniques and efficient computational tools are well developed for 2D images from acquisition to processing, analysis and understanding, their counterparts for 3D shape space are more challenging and less developed. There are still many important technological, mathematical and computational issues that need to be addressed: for example, how to obtain, represent and reconstruct 3D models for complicated objects and scenes routinely as we do for images. Another question is how to make computers learn, analyze and understand shapes and geometries like human vision and intelligence for the purpose of registration, comparison, recognition, classification and indexing. This becomes more and more important and urgent for efficient processing and intelligent use of a large variety of 3D data.

At the same time there are many profound mathematical theories and tools for general embedded manifolds and especially for 2D surfaces, from their intrinsic geometric quantities and topologic structures to classification of all Riemannian surfaces. A lot of progress has been made recently in developing computational models and tools based on these geometric theories. In particular, these developments provide efficient computational techniques for extracting local and global intrinsic quantities and structures that are invariant under various transformations or embeddings. On the other hand, many recent advances in machine learning techniques, supervised or non-supervised, for data analysis can be very effective in learning robust and distinctive features and can be used for data or application specific tasks such as recognition and classification. For the very specific goal of 3D modeling and shape analysis, we believe that combining mathematical theory and understanding of surfaces with machine learning techniques, i.e., learning geometry from geometry, will provide more powerful and effective ways of training a computer to learn application specific features based on intrinsic geometric quantities and structures.

#### Anonymous quotes from workshop survey:

- I really enjoyed the workshop: great speakers and a lot of opportunities to interact.
- I really like the fact that you try to be environmentally friendly at your facility here.
- The scientific quality of the meeting and speakers was excellent. The poster sessions were quite useful.
- The program was very well done, most of the lectures were interesting and well delivered. I learned a lot.
- I learned a few things and came away with new ideas and some deeper insight. I can't ask for more than that.

# **WORKSHOP: Algebraic Geometry for Coding Theory and Cryptography.** February 22 - 26, 2016

#### Organizing Committee:

Everett Howe (Center for Communications Research) Kristin Lauter (Microsoft Research) Judy Walker (University of Nebraska-Lincoln)

#### Scientific Overview:

Coding theory and cryptography are important in everyday life, because they form some of the building blocks of e-commerce. Error-correction via coding theory protects information as it is stored or sent, and efficient error-correction may provide significant benefits and cost-savings for enterprise. Cryptographic systems are necessary to secure information in storage, transmission, and interaction, and provide both confidentiality and authenticity guarantees. While there has always been significant and fruitful interaction between algebraic geometry and both coding theory and cryptography, new directions in coding theory — such as locally decodable codes, codes for distributed storage systems, and network coding — suggest the possibility of new connections with algebraic geometry. This workshop will focus on questions such as: What new practical problems arising in applications lead to new questions or directions in algebraic geometry? How can new results in algebraic geometry advance the state of applications and practice in error-correction and cryptography?

Participants will spend one week working together in small groups on one of six projects related to the theme of the workshop. Instead of the typical workshop structure where participants watch presentations of established results, participants will begin generating new results in collaboration with other participants. Participation is by invitation only.

This participants of this workshop were intentionally selected to achieve gender parity. The organizers--Kristin Lauter in particular--designed the program and assigned working groups.

#### Anonymous quotes from workshop survey:

- To me the whole event was a very positive experience, both on a scientific and a social level. It was the first time I participated in an event of this kind, and hope that more opportunities of this kind show up in the future.
- Please run more workshops like this. I work in a very abstract part of algebraic geometry on a daily basis, on subjects that are seemingly far-removed from the ``real world". I got the opportunity to interact with electrical engineers, who have a keen sense for what is important and what is not, from a long-term applications point of view.
- This was the best workshop I participated to up to now. The organization in groups was very interesting and stimulating, and we worked well. This is due also to the two co-leaders of my group, who were experts in the subject and really did a good job. The

gender balance was approximately 50% - 50% ... and that was a very interesting experience. The IPAM staff is wonderful.

- Instead of leaving with some new connections and a hope of future collaboration, I am leaving with an active collaboration and meaningful relationships with senior members of my field. These relationships are based not just on conversations about potential commonalities of interest but on shared time and shared work.
- I loved the format of this workshop. As a junior faculty member, it allowed me to work with people who I have never had the opportunity to approach for a collaboration before. I think this will have a significant positive impact on my research career.

#### Unsolicited message of appreciation from a workshop speaker, received February 26, 2016

#### Dear Stacy,

Let me take the opportunity of this mail to congratulate you and the IPAM staff for the great competence you show in the organization of meetings and the operation of a meeting center.

As a previous director of CIRM in Marseilles, I know that this requires a variety of skills, especially in relationships with participants, and everything was perfect during this workshop.

Gilles LACHAUD Emeritus Research Director, CNRS Institute of Mathematics of Marseilles Aix-Marseille University

## LONG PROGRAM: Culture Analytics. March 7 - June 10, 2016

#### Organizing Committee:

Tina Eliassi-Rad (Rutgers University, Computer Science) Mauro Maggioni (Duke University, Mathematics and Computer Science) Lev Manovich (The Graduate Center, CUNY, Computer Science) Vwani Roychowdhury (University of California, Los Angeles (UCLA), Electrical Engineering) Timothy Tangherlini (University of California, Los Angeles (UCLA), Germanic Languages and Literatures, Scandinavian Section)

#### Scientific Overview:

The explosion in the widespread use of the Internet and social media and the ubiquity of low cost computing have increased the possibilities for understanding cultural behaviors and expressions, while at the same time have facilitated opportunities for making cultural artifacts both accessible and comprehensible. The rapidly proliferating digital footprints that people leave as they crisscross these virtual spaces offer a treasure trove of cultural information, where culture is

considered to be expressive of the norms, beliefs and values of a group. This program encourages the exploration of the unsolved mathematical opportunities that are emerging in this cultural information space. Many successful approaches to the analysis of cultural content and activities have been developed, yet there is still a great deal of work to be done. In this program, we aim to promote a vigorous collaboration across disciplines and devise new approaches and novel mathematics to address these problems of culture analytics, by bringing together leading scholars in the social sciences and humanities with those in applied mathematics, engineering, and computer science.

## TUTORIALS: Culture Analytics Tutorials. March 8 - 11, 2016

#### Organizing Committee:

Tina Eliassi-Rad (Rutgers University, Computer Science) Mauro Maggioni (Duke University, Mathematics and Computer Science) Lev Manovich (The Graduate Center, CUNY, Computer Science) Vwani Roychowdhury (University of California, Los Angeles (UCLA), Electrical Engineering) Timothy Tangherlini (University of California, Los Angeles (UCLA), Scandinavian Languages)

#### Scientific Overview:

The tutorial session will bring participants up to speed on various methodologies that will be presented in the coming workshops. These intensive sessions taught by leaders in each area will focus on web crawling and scraping; natural language processing including named entity detection and sentiment detection; GIS; network analysis; supervised and unsupervised machine learning; audio and visual analysis; and library systems. These tutorials will have a series of target data sets that will be used as challenge data. As there will be core participants from the social sciences and humanities who may not have substantial experience in general statistical methods or general concepts in computation (such as data structures, programming languages, and APIs), additional evening classes will be held during this first tutorial week to allow these participants greater access to the vocabulary of the ensuing workshops. We expect participants from the humanities, social sciences, computer science, and applied mathematics. There is no registration fee for tutorials, to encourage broad participation.

#### Anonymous quotes from survey:

• Thank you for putting together this exceptional program; it's been such a privilege to participate in this very inclusive, interdisciplinary series of talks on cultural analytics. My background is in humanities, and so I attended with the objective of becoming better acquainted with the methods and approaches of mathematicians. While I was hoping for more "hands on" entry-level tutorials in cultural analytics, such as offered by Emilio Ferrara, it was nonetheless very informative to hear mathematicians talk about their work, even if some of it went over my head. I also very much appreciated the chance to socialize with mathematicians which helped ease some of the disciplinary boundaries.

• One can see that IPAM team has put a lot of efforts into this program. You are a great team!

# **WORKSHOP I: Culture Analytics Beyond Text: Image, Music, Video, Interactivity and Performance.** March 21 - 24, 2016

## Organizing Committee:

Alfred Bruckstein (Technion - Israel Institute of Technology) Mauro Maggioni (Duke University, Mathematics and Computer Science) Lev Manovich, Chair (The Graduate Center, CUNY, Computer Science) Isabel Meirelles (OCAD University) Vwani Roychowdhury (University of California, Los Angeles (UCLA), Professor, Electrical Engineering) Maximilian Schich (University of Texas at Dallas)

## Scientific Overview:

This workshop focuses on developing computational and mathematical techniques for the analysis of large sets of cultural artifacts beyond text, and includes considerations of material and graphic design, architecture, fashion, interactive media, games, film, photography, music, painting, sculpture, performance, and the kinesthetic dimensions of culture. The analysis of audio and visual data requires a different set of quantitative techniques than those devised for textual analysis. This challenge has become all the more acute, as every day individuals and institutions produce and publish hundreds of millions of digital cultural artifacts that are not text. The big data revolution is not only a text-based one, and these enormous new resources of non-text culture require equally revolutionary techniques for meaningful analysis.

The event will highlight novel methods for examining the multidimensional aspects of these cultural expressive forms. Aspects include structural configuration, dynamics in time and space, the changing social implications of artistic production and reception, and the cognitive multiplicity of perception and action, from genesis to memetic diffusion. The workshop aims to provide a point of reference for future research. By identifying and addressing pain-points, conceptual differences, and radical opportunities across the disciplines, our conversation has the potential to facilitate new scholarship in the arts, design, computation, information science, applied mathematics, and the physics of culture.

#### Anonymous quotes from survey:

- The Workshop was very well organized and most of the speakers had great talks. It's my privilege to be here.
- Overall a great experience. Met interesting people, and already discussing interdisciplinary future research collaboration.
- This a wonderful event that engages and facilitates interdisciplinary conversation and stimulates new ideas. Thank you for the opportunity.

• I enjoyed the opportunity to meet participants from a variety of backgrounds and disciplines, and I liked how the structure of the workshop allowed for a lot of informal discussion between presentations.

# WORKSHOP II: Culture Analytics and User Experience Design. April 11 - 15, 2016

# Organizing Committee:

Cecilia Aragon (University of Washington, Human Centered Design & Engineering) Katy Börner (Indiana University) Peter Leonard (Yale University, Library) Timothy Tangherlini, Chair (University of California, Los Angeles (UCLA), Scandinavian Languages)

# Scientific Overview:

Culture analytics concerns itself with the highly interwoven and complex interactions among individuals, society, and technology that are catalyzed by the enormous growth in data that characterizes the current age. User experience design requires more than a thin interface veneer on top of an algorithmic layer. The shape of the user experience must be rooted in the computational structure from the beginning and co-designed along with the statistical and machine learning algorithms for data exploration and analysis.

In order to best design the next generation of technologies to enhance communication, collaboration, and cultural understanding, and to prepare for unintended consequences, we need to incorporate a robust understanding of human and social capabilities with deep technical and mathematical skills. To accomplish this, researchers, developers, and designers must demonstrate a willingness to transcend disciplinary concerns. Questions of ethics, privacy, and sustainability are essential components of this process as more and more people spend increasing amounts of time in technology-rich environments.

This workshop will bring together experts from industry and academia to consider these relatively unexplored but highly influential threads of study that place the user experience at the center of the design of analytic technologies.

# Anonymous Quotes from survey:

- These are important workshops on emerging topics that will be increasingly important. I hope UCLA supports expanding these kinds of events in the future.
- Very exciting speakers and a terrific interdisciplinary community. This workshop was engaging and sparked many ideas for my own work. It also looks like a couple of new research collaborations/proposals may arise from this meeting. Thank you so much for a fruitful and innovative workshop!

- I really appreciated the interdisciplinary atmosphere and felt warmly welcomed even as a non-mathematician/non-scientist. I was deeply inspired by the excellent speakers and engaging presentations (as well as the wide variety of topics).
- I thank IPAM for making it possible for me to attend the presentations throughout the week. Being exposed to the many projects, ideas and research by some of the top scholars in culture analytics is sure to have an impact in my ongoing research in the field.

Unsolicited message of thanks from a participant, received on April 27, 2016:

Dear Professor Balbás, Professor Tangherlini and IPAM staff,

I write to thank you for making it possible for me to attend the second Workshop of Culture Analytics. It was quite a unique experience for me to present my current research as a poster. The feedback I got throughout the week was quite insightful, and it's already reshaping my thinking about what form my research will take in the future.

The workshops were really unique, and I learned so much from everyone who presented. I came back to my university with renewed energy to keep looking deeper into the many questions I share with the presenters and participants I met throughout the week. And the staff at IPAM is simply great. Everyone does an excellent job in making visitors feel welcome.

Thank you for funding my trip to Los Angeles to attend the workshops. The ideas and projects I was exposed to in just one week are sure to make a lasting mark in what I will be producing in the coming months, if not years.

Many thanks again,

Eduardo Navas, Ph.D. Assistant Professor New Media Program Interdisciplinary Digital Studio Program School of Visual Arts The Pennsylvania State University

#### WORKSHOP III: Cultural Patterns: Multiscale Data-driven Models. May 9 - 13, 2016

#### Organizing Committee:

Lada Adamic (Facebook) Edoardo Airoldi (Harvard University) Tina Eliassi-Rad, Chair (Northeastern University, Computer Science & Network Science) Eitan Hersh (Yale University) Jure Leskovec (Stanford University) Johan Ugander (Stanford University)

# Scientific Overview:

The proliferation of cultural data has given data-driven approaches a significant edge in modeling various cultural phenomena. This workshop focuses on such approaches that make use of mathematical tools in machine learning, data mining, network science, and computational social science. We are particularly interested in presenting methods, both normative and descriptive, that offer a gestalt or structure-first approach to culture analysis and that provide a multi-layered summarization of these phenomena suitable for exploration at multiple scales. These models are applied to various datasets such as social and information networks, social media, narrative and story detection in texts, group dynamics or behavior, and collaboration and competition leading to emergent behavior.

## Anonymous quotes from surveys:

- The format of the workshop, with frequent breaks and lots of time for questions was great!
- The discussion panel format for Thursday afternoon was very nice and a good point to have more exchanges.
- IPAM workshop are an excellent opportunity to connect students, academic employees and experts for discussion.

# **PUBLIC LECTURE: Green Family Lecture Series: "The Master's Hand: Can Image Analysis Detect the Hand of the Master?"** by Ingrid Daubechies. May 9, 2016

## Abstract:

The talk will describe wavelets, a mathematical tool used for the analysis and compression of images (including for digital cinema), and how they have been used recently for the study of paintings by Van Gogh, Goossen van der Weyden, Gauguin, Giotto and others. The presentation describes image processing tools used to decide whether a painting is an original, or whether several parts of a painting were painted by the same person—or not.

# Speaker's Bio:

Ingrid Daubechies earned her Ph.D. in theoretical physics from Vrije Universiteit Brussel. In addition to seminal advances in time-frequency analysis, she is best known for her breakthroughs in wavelet research and contributions to digital signal processing. Some of the wavelet bases and other computational techniques she developed were incorporated into the JPEG2000 standard for image compression.

Daubechies' career has seen many impressive firsts: the first female full professor of mathematics at Princeton; the first woman to receive the National Academy of Sciences Award in Mathematics in 2000; the first woman president of the International Mathematical Union in 2010; and she is very likely the first and only mathematician to have been granted the title of Baroness by Belgium's King Albert II.

Daubechies continues to break new ground in mathematics research, focusing on signal analysis and inverse problems, with applications ranging from fMRI and geophysics to paleontology and fine art painting.

# **PUBLIC LECTURE: Green Family Lecture Series: "Bones, Teeth and Animation,"** by Ingrid Daubechies. May 10, 2016

### Abstract:

The talk describes new distances between pairs of two-dimensional surfaces (embedded in threedimensional space) that use both local structures and global information in the surfaces. These are motivated by the need of biological morphologists to compare different phenotypical structures, and to study relationships of living or extinct animals with their surroundings and each other. This is typically done from carefully defined anatomical correspondence points (landmarks) on bones, for example.

Unlike other algorithms presented for morphological correspondences, this approach does not require any preliminary marking of special features or landmarks by the user. It also differs from other seminal work in computational geometry in that the algorithms are polynomial in nature and thus faster, making pairwise comparisons feasible for significantly larger numbers of digitized surfaces. The approach is illustrated using three datasets representing teeth and different bones of primates and humans, which leads to highly accurate results.

## Speaker's Bio:

Ingrid Daubechies earned her Ph.D. in theoretical physics from Vrije Universiteit Brussel. In addition to seminal advances in time-frequency analysis, she is best known for her breakthroughs in wavelet research and contributions to digital signal processing. Some of the wavelet bases and other computational techniques she developed were incorporated into the JPEG2000 standard for image compression.

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Daubechies continues to break new ground in mathematics research, focusing on signal analysis and inverse problems, with applications ranging from fMRI and geophysics to paleontology and fine art painting.

## MINI-WORKSHOP: Diasporas Lab Day. May 17 - 18, 2016

## Organizing Committee:

Dana Diminescu (Telecom ParisTech I3 CNRS) Maria D'Orsogna (California State University, Northridge (CSU Northridge), Math) Leon Gurevitch (Victoria University of Wellington, Digital Media and Design Cultures) Roger Waldinger (UCLA)

#### Scientific Overview:

Migrants or non-migrants, today we all live in a digital world. As we travel, pay, communicate, learn and network on different digital and social platforms, our personal virtual networks keep growing and speak about us through the electronic signatures we leave every time we interface with ITC infrastructures.

The massive amount of data generated by digital tools offers new research opportunities, but it also poses new challenges for the established 'working' methods traditionally employed within the humanities and social sciences, such as novel methods, the categorization of the data, and new paradigms and ethical approaches.

How can we best make use of this new 'raw material' in our research on human migration? How can methods imported from the quantitative sciences such as statistical processing, graph theory, or mathematical modeling be used to find common ground with those employed within the qualitative social sciences with which they sometimes conflict? Finally, what epistemological concepts can we introduce to accompany the development of digitalization? Can we speak of a digital theory of migration?

As this new generation sociology emerges, it becomes imperative to be able to effectively analyze and interpret the newly available big and small databases and analyze the genesis of categories and categorization issues as new cognitive turning points in migration studies.

The goal of the Diasporas Lab Day workshop is to renew and/or adapt existing research methodologies and to promote the development and diffusion of new ones within the broad field of human migration studies. We will discuss tools for mapping migrant flows and dispersion, modeling cultural integration by data, and providing knowledge about migrant sentiment analysis. We will also attempt to explore new research fields within immersive sociology.

## PUBLIC LECTURE: "A World from a Sheet of Paper" by Tadashi Tokieda. May 18, 2016

## Abstract:

Starting from just a sheet of paper, by folding, stacking, crumpling, sometimes tearing, we will explore a variety of phenomena, from magic tricks and geometry to elasticity and the traditional Japanese art of origami. Much of the show consists of table-top demos, which you can try later with friends and family.

#### Speaker's Bio:

Tadashi Tokieda is the Director of Studies in Mathematics at Trinity Hall, Cambridge, and the Poincaré Visiting Professor in the Department of Mathematics, Stanford. He grew up as a painter in Japan, became a classical philologist in France, and has been an applied mathematician in the US and England. He is also active in outreach in the developing world, especially via the African Institute for Mathematical Sciences.

# **WORKSHOP IV: Mathematical Analysis of Cultural Expressive Forms: Text Data.** May 23 - 27, 2016

Organizing Committee:

David Blei (Columbia University) Cristian Danescu-Niculescu-Mizil (Cornell University) Kristina Lerman, Chair (University of Southern California (USC)) David Mimno (Cornell University) Vwani Roychowdhury (University of California, Los Angeles (UCLA), Professor, Electrical Engineering) Ted Underwood (University of Illinois at Urbana-Champaign, English)

Scientific Overview:

Comprehensive collections of texts stretching back in time to the beginning of writing have become increasingly available in machine actionable form — from corpora of cuneiform writing, to the vast collections of medieval texts from Europe and Asia, to the immense "sea of the unread" represented by the Hathi Trust and Google Books collections. Similarly, millions of "born digital" texts are flooding the virtual world on a daily basis, from tweets, to blog posts, to other cultural expressive forms. These developments represent an unprecedented opportunity to advance knowledge in the broad domain of the impact of writing on the dynamics of culture.

This workshop focuses on the leading approaches to (a) extracting entities, topics, or narrative patterns from large, unstructured collections of text and analyzing them to (b) derive meaning from textual data and (c) understand the dynamics of social interactions or historical change. These approaches include text mining tools, sentiment analysis, topic modeling, textual memes, cross-language information retrieval, trend analysis, information retrieval, recommendations, and predictions of whether something will go "viral". Mathematical tools include Bayesian models, supervised and unsupervised machine learning, optimization, and statistical language modeling techniques.

Anonymous quotes from surveys:

- This was a great opportunity for mathematicians to interact with humanists and social scientists. I hope IPAM will host other similar events, not only focusing on the connections of mathematics to the physical and biological sciences but also to social sciences and the humanities.
- Energizing blend of approaches and questions; interesting group of interlocutors who took every opportunity to connect across disciplines, corpora, research questions. Fantastic experience.
- This was a wonderful experience -- a great opportunity for truly interdisciplinary conversations. Having five days rather than the usual two or three of a conference was especially beneficial to allow for deeper connections to be made.
- I came with an unsolved problem, and left with new ideas for a solution that I couldn't have gotten from my usual network of collaborators -- so my satisfaction is very high.
- Two clear potential collaborations emerged from this workshop (one in my field of specialty, one across English/information science)

# **OUTREACH ACTIVITIES**

IPAM continued partnerships with two- and four-year schools in the Los Angeles area in order to increase the representation of minorities and women in its programs. IPAM invited students at East Los Angeles College, Santa Monica College, and Cal State Northridge to attend our public lectures. IPAM continues to support the UCLA chapter of SACNAS: The outreach coordinator attends quarterly meetings and encourages them to participate in IPAM programs. The chapter used IPAM facilities for a K-12 educational event, their year-end banquet, and occasional other meetings and study sessions.

IPAM's assistant director attended the Nebraska Conference for Undergraduate Women in Math (NCUWM) in January to talk to undergraduate women about opportunities in math. Three RIPS students from the 2015 program also attended and presented their research; IPAM paid for their travel.

IPAM awarded Berland Foundation scholarships to two women participating in the Culture Analytics program, to help pay for child care and other expenses, allowing them to fully participate in the program.

# Other diversity-related activities during this reporting period:

- IPAM advertised its RIPS (undergraduate) program through minority institutions and organizations.
- With the other NSF math institutes, IPAM supported the AWM Mentor Network Program.
- IPAM held a women's luncheon during the spring program on Culture Analytics.

# K. PROGRAM CONSULTANT LIST

IPAM consulted a variety of scholars and practitioners in the scientific planning of its programs. The list below includes program organizers for the programs that took place during this reporting period (Jan. 1, - May 31, 2016). The list excludes our own scientific staff (directors). Not included are members of IPAM's Science Advisory Board, who are listed in section O, Committee Membership.

Name	Institution
Lada Adamic	University of Michigan
Edoardo Airoldi	Harvard University
Cecilia Aragon	University of Washington
Patricia Bauman	Purdue University
David Blei	Columbia University
Katy Börner	Indiana University
Alfred Bruckstein	Technion - Israel Institute of Technology
Antonio Conejo	Ohio State University
Cristian Danescu-Niculescu-Mizil	Cornell University
Paul Dupuis	Brown University
Tina Eliassi-Rad	Rutgers University
Michael Ferris	University of Wisconsin-Madison
Peter Glynn	Stanford University
Eitan Hersh	Yale University
Benjamin Hobbs	Johns Hopkins University
Everett Howe	Center for Communications Research
Markos Katsoulakis	University of Massachusetts Amherst
Ron Kimmel	Technion - Israel Institute of Technology
Rongjie Lai	Rensselaer Polytechnic Institute
Kristin Lauter	Microsoft Research
Peter Leonard	Yale University
Kristina Lerman	University of Southern California (USC)
Jure Leskovec	Stanford University
Chun Liu	Pennsylvania State University
Mauro Maggioni	Duke University
Apala Majumdar	University of Bath
Lev Manovich	The Graduate Center, CUNY
Isabel Meirelles	OCAD University
David Mimno	Cornell University
Stanley Osher	University of California, Los Angeles (UCLA)
Daniel Phillips	Purdue University
Andy Philpott	University of Auckland
Petr Plechac	University of Delaware

Vwani Roychowdhury	University of California, Los Angeles (UCLA)
Claudia Sagastizabal	Institute of Pure and Applied Mathematics (IMPA)
Maximilian Schich	University of Texas at Dallas
Olga Sorkine-Hornung	ETH Zürich
Timothy Tangherlini	University of California, Los Angeles (UCLA)
Johan Ugander	Stanford University
Ted Underwood	University of Illinois at Urbana-Champaign
Judy L. Walker	University of Nebraska-Lincoln
Hong-Kai Zhao	University of California, Irvine (UCI)

## L. PUBLICATIONS LIST

It is too early to report on publications that resulted from our winter and spring 2016 programs. Since this is the first reporting period of a new five-year grant, we will not report on publications resulting from programs that took place before this year. We will report on publications that resulted from winter, spring, and summer 2016 programs in our <u>next</u> annual report, which will be due in one year.

We will ask the participants of the spring 2016 long program, Culture Analytics, and summer research programs (which will be included in the next annual report) to respond 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." We will send the survey in May 2017, collect their responses through July 2017, and include them in the annual report due in August 2017.

## 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) as well as RIPS-Hong Kong and Graduatelevel RIPS (GRIPS) Berlin. Companies and organizations such as Google, AMD, and Lawrence Livermore National Lab propose research projects. However, these programs did not fall in the reporting period that this report covers.

During this reporting period, the workshop "Uncertainty Quantification for Multiscale Stochastic Systems and Applications" was partly supported by the U.S. Department of Energy Office of Science, Office of Advanced Scientific Computing Research, Applied Mathematics program (DE-SC-0010539). IPAM also received some gifts and grants during this period from government and military agencies to support programs that took place in the summer or will take place in the next year. These will be included in the *next* annual report.

We also received gifts of various sizes from companies towards our 15<sup>th</sup> anniversary campaign.

We seek the advice of government and industry by recruiting corporate and government leaders to serve on our Science Advisory Board and Board of Trustees. Currently, David Balaban (Amgen), Tanya Beder (SBCC Group Inc.), Bill Coughran (Sequoia Capital), Al Hales (CCR West), Alan Lee (AMD), Monique Miller (Wilshire Funds Management), Nancy Potok (U.S. Census Bureau), and Leland Wilkinson (H2O.ai) serve on our Board of Trustees. Our 2015-16 Science Advisory Board includes Cynthia Dwork from Microsoft Research and Yann LeCun, who leads Facebook's artificial intelligence division. See section O for the complete list.

Out of 799 participants that attended our programs during this reporting period, 12 of them held positions in the government or military, and 49 worked in industry. All of our winter/spring 2016 workshops had at least one speaker from industry or government, and two workshops had industry representation on its organizing committee (who are marked with an asterisk below):

Optimization and Equilibrium in Energy Economics

- Richard O'Neill (Federal Energy Regulatory Commission)
- Jinye Zhao (ISO New England, an independent, not-for-profit company authorized by the Federal Energy Regulatory Commission)

Uncertainty Quantification

- Araz Hashemi (Wright-Patterson Air Force Base)
- Habib Najm (Sandia National Laboratories)

Shape Analysis and Learning by Geometry and Machine

- Vladlen Koltun (Intel Corporation)
- Arthur Szlam (Facebook)

Algebraic Geometry for Coding Theory and Cryptography

- Everett Howe\* (Center for Communications Research)
- Kristin Lauter\* (Microsoft Research)

Culture Analytics Workshops

- Adam Russell (DARPA)
- Miriam Redi (Yahoo! Research)
- Philip Beesley (Philip Beesley Architect Inc.)
- Sebastian Chan (Australian Centre for the Moving Image)
- Danyel Fisher and Hanna Wallach (Microsoft Research)
- Eric Rodenbeck (Stamen Design, a design and technology studio that develops creative mapping and online data visualization)
- Dan Russell (Google)
- Lada Adamic\* and Winter Mason (Facebook)
- Elian Carsenat (NamSor Applied Onomastics, a European designer of name recognition software)
- Ivana Coleman (Emblematic Group, a virtual reality company)

## 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, 2015-2016	
Federal Funding	Amount
NSF-IRES: RIPS-Hong Kong	\$72,950
Sub-total	\$72,950
Support from Foundations	
Berland Foundation	\$12 000
Sub-total	\$12,000
	ψ12,000
University Funding Support	
Dean Physical Sciences	\$135,829
Vice Chancellor for Research	\$135,302
Sub-total	\$271,131
Industrial Affiliates and Other Support	
	•
HRL, Inc.	\$25,000
Arete	\$25,000
GumGum	\$25,000
l witter	\$25,000
Aerospace	\$25,000
LOS Alamos	\$6,000
Sub-total	\$131,000
Others	
Registration Fees-Programs	\$16,950
Green Family Lectureship Foundation Investment Income	\$4,218
Frontier's Society and Other Contributions	\$101,096
Sub-total	\$122,264
TOTAL	\$609,345

# O. COMMITTEE MEMBERSHIP

IPAM's committees include the Board of Trustees and Science Advisory Board. The members during the 2015-2016 fiscal year are listed below. The IPAM directors are *ex officio* members.

# Science Advisory Board, 2015-2016 Membership

Name	Institution	Discipline/Expertise
Alexei Borodin	MIT	Mathematics
Michael Brenner	Harvard	Applied Math and Physics
Robert Calderbank	Duke University	Director, Information Initiative
Emmanuel Candes	Stanford University	Statistics
Cecilia Clemente	Rice	Chemistry
lain Couzin	University of Konstanz	Biology
Cynthia Dwork	Microsoft Research	Computer Science
Jordan Ellenberg	Univ of Wisconsin	Mathematics
Peter Wilcox Jones	Yale University	Mathematics
Michael Kearns	University of Pennsylvania	Computer Science
Yann LeCun	New York University/Facebook	Computer Science
David Levermore	University of Maryland	Applied Math
Assaf Naor	Princeton	Mathematics
Pablo Parrilo	MIT	Control and Dynamical Systems
Terence Tao	UCLA	Mathematics
Amie Wilkinson	Univ. of Chicago	Mathematics

# Board of Trustees, 2015-2016 Membership

Name	Institution	Title
David Palahan	Amgon	Technical Load
	Amgen	
Tanya Beder	SBCC Group Inc.	Chairman & CEO
Tony Chan	нкизт	President
Bill Coughran	Sequoia Capital	Partner
Karina Edmonds	Caltech	Executive Director for Corporate Partnerships
Mark Green	UCLA	Professor (Emeritus)
Alfred Hales	CCR West	Director (Retired)
Sallie Keller	Virginia Tech University	Professor and Director
Steven Koonin	New York University	Professor, Director
Alan Lee	AMD Research	Corporate Vice President, Research
Monique Miller	Wilshire Funds Management	Managing Director
Nancy Potok	U.S. Census Bureau	Deputy Director and Chief Operating Officer
Ronald Stern	UC Irvine	Dean (Emeritus)
Tatiana Toro	University of Washington	Professor
Leland Wilkinson	H20.ai	Chief Scientist

## APPENDIX A: Report on Impact of High Throughput Genomics

IPAM conducted a survey of participants of the 2011 long program, High Throughput Genomics, in January 2016. The purpose of the survey is to describe the impact of the program on the participants' careers and research. The timing of the survey, four years after its conclusion, allows for the graduate students to finish their PhDs and all participants to see results of collaborations that started at IPAM in 2011. The report, dated February 3, 2016, is presented as an appendix.



# "High Throughput Genomics" Long Program: Summary Report Date of report: February 3, 2016

The Genomics long program was held at IPAM in the fall of 2011. The program had 69 participants. See the attached list of participants (**Appendix A**).

Out of the 29 graduate students in the program, 25 of them completed their PhD programs, and four are still in PhD programs and intend to finish their degree in the next year.

Of those who finished their PhD since the 2011 program, 24 are currently employed in a math/science field. The current title and employer of one is unknown. All of the 11 postdocs from the 2011 program continue to work in a field related to their PhD. See **Appendix B** which lists the participants (grad students and postdocs) and their current job titles and affiliations.

The participants of the program received the following fellowships, scholarships and awards in the last five years (self-reported):

First Name	Last Name	Fellowships and Awards
Dustin	Cartwright	NSA Young Investigator Award
Nicholas	Furlotte	Northrup-Grumman Outstanding Graduate Student Research Award, 2012
David	Golan	Fulbright post-doctoral fellowship ; EMBO post-doctoral fellowship
Farhad	Hormozdiari	NIH Training Fellowship
Monica	Jackson	Provost research award
John	Novembre	MacArthur Fellow, 2015
Darren	Kessner	Dissertation Year Fellowship, UCLA
Jingyi	Li	Hellman Fellow, 2015-16
Paul	Medvedev	NSF CAREER Award
Emiliano	Pereira	NASA Planetary Biology Internship, 2012: DAAD PhD scholarship, 2013
Sebastien	Roch	NSF CAREER Award; Sloan Research Fellowship
Tandy	Warnow	ACM Fellow
Yi	Xing	Sloan Research Fellowship

## **Results of survey**

44 out of the 69 participants (see Appendix A) responded to an online survey conducted in November/December 2015. The respondents come primarily from three areas of study: Mathematical Sciences, Computer Science, and Life Sciences.



Twenty-four of the respondents (54.5%) were graduate students or postdocs at the time of the program (see chart).



Just over 88% of respondents indicated that the program influenced their research interests (see table), and a majority said that the program influenced their career goals, was useful preparation for their career, and introduced them to collaborators and/or PhD or postdoc advisors. 60% of them continue to collaborate with people they met at the program. Close to a third of participants (31%) say the program led them to collaboration outside of their discipline. Most of the respondents have recommended IPAM or one of its programs to a colleague or student.



Comments from participants on the impact of the program on their careers and research were collected in the post-program survey, in subsequent surveys administered 1-2 years after the program, and in the online survey administered at the end of 2015. See **appendix B**.

Additionally, participants reported collaborations with other participants, which are listed in appendix C.

Finally, see the attached list of self-reported publications (**appendix D**) that were a result of or influenced by participation in the long program "High Throughput Genomics."

#### Appendix A: Original List of Participants, Genomics Program (2011)

First Name	Last Name	Sex	Department	Institution	Status	Response
Orly	Alter	F	Bioengineering and Human Genetics	University of Utah	Faculty	у
Yael	Baran	F	Computer Science	Tel Aviv University	Grad Student	y
Franz	Baumdicker	М	Mathematisches Institut	Albert-Ludwigs-Universität Freiburg	Grad Student	у
Hadassa	Brunschwig	F	Statistics	The Hebrew University of Jerusalem	Grad Student	
Dustin	Cartwright	М	Mathematics	Yale University	Postdoc	у
Peter	Chi	М	Biostatistics	University of Washington	Grad Student	у
Charleston	Chiang	М		University of California, Los Angeles (UCLA)	Postdoc	
Francesca	Chiaromonte	F	Statistics	Pennsylvania State University	Faculty	
Chao	Dai	М	Molecular and Computational Biology	University of Southern California (USC)	Grad Student	у
Eleazar	Eskin	M	Computer Science	University of California, Los Angeles (UCLA)	Faculty	у
Susana	Eyheramendy	F	Statistics	Pontificia Universidad Catolica de Chile	Faculty	у
Simon	Foucart	M	Mathematics	Drexel University	Faculty	у
Nicholas	Furiotte	IVI N4	Computer Science	University of California, Los Angeles (UCLA)	Grad Student	
Christenher	Clarner	IVI N4		University of Shellield	Grad Student	у
David	Gidzner	M	Statistics and Operations Research		Grad Student	y V
Catherine	Grasso		Pathology	University of Michigan	Bostdoc	у
Fran	Halnerin	м	Computer Science & Molecular Microbiology		Faculty	v
Lian	naiperin	1.	and Biotechnology		lacuity	у
Euniung	Han	F	Biostatistics	University of California, Los Angeles (UCLA)	Grad Student	
or	Hardin	F	Mathematics	Pomona College	Faculty	v
David	Heckerman	М	Machine Learning and Applied Statistics Group	Microsoft Research	Industry	<i>'</i>
			6 FF		,	
Farhad	Hormozdiari	М	Computer science	University of California, Los Angeles (UCLA)	Grad Student	у
Valerie	Hower	F	Mathematics	University of California, Berkeley (UC Berkeley)	Postdoc	у
Monica	Jackson	F	Mathematics and Statistics	American University	Faculty	
Eun Yong	Kang	D	Computer Science	University of California, Los Angeles (UCLA)	Grad Student	
Darren	Kessner	М	Bioinformatics	University of California, Los Angeles (UCLA)	Grad Student	
Aaron	Kleinman	М	Mathematics	University of California, Berkeley (UC Berkeley)	Grad Student	
Carolin	Kosiol	F	Institute of Population Genetics	University of Veterinary Medicine	Faculty	у
David	Koslicki	М	Mathematics	Oregon State University	Grad Student	у
Martin	Kreidl	М	Institut fuer Experimentelle Mathematik	Universität Duisburg-Essen	Postdoc	
Jingyi	Li	F	Biostatistics	University of California, Berkeley (UC Berkeley)	Grad Student	
Wei	Li	М	Computer Science and Engineering	University of California, Riverside (UC Riverside)	Grad Student	у
David	Liberles	M	Department of Molecular Biology	University of Wyoming	Faculty	У
Jennifer	Listgarten	F		Microsoft Research	Industry	
Diana	LOW	F	Computer Science	Bioinformatics Institute	Postdoc	У
Sergnei	Marschall	IVI NA	Life Science	Georgia State University	Grad Student	y v
Camila	Mazzoni			Porlin Contar for Conomics in Riadiversity Research	Fostulty	y V
Paul	Medvedev	Г	Computer Science and Engineering	University of California, San Diego (UCSD)	Postdoc	y V
Vladimir	Minin	м	Statistics	University of Washington	Fostdoc	y V
Anand	Murugan	м	Physics	Princeton University	Grad Student	y
Nishanth	Nair	м	Computer and Communication Sciences	École Polytechnique Fédérale de Lausanne (EPEL)	Grad Student	v
Gro	Nilsen	F	Department of Informatics	University of Oslo	Grad Student	v
John	Novembre	м	Ecology & Evolutionary Biology	University of California. Los Angeles (UCLA)	Faculty	<i>'</i>
Vicente	Ortega Del Vecchyo	М	Bioinformatics	University of California, Los Angeles (UCLA)	Grad Student	v
Julia	Palacios Roman	F	Statistics	University of Washington	Grad Student	y
Matteo	Pellegrini	М	Molecular, Cell, and Developmental Biology	University of California, Los Angeles (UCLA)	Faculty	y
Emiliano	Pereira	м	Biomathematics	University of the Republic	Grad Student	у
Ben	Raphael	М		Brown University	Faculty	
Hugues	Richard	М	Computer Science / Biology	Université de Paris VI (Pierre et Marie Curie)	Faculty	у
Sebastien	Roch	М	Mathematics	University of California, Los Angeles (UCLA)	Faculty	у
Gregory	Ryslik	М	Biostatistics	Yale University	Grad Student	у
Alexander	schoenhuth	M		CWI (Center for Mathematics and Computer Science)	Faculty	у
Shihao	Snen	M	BIOSTATISTICS	University of Iowa	Grad Student	
iviyung Shin	SIM		BIOSTATISTICS	John wayne Cancer Institute, Saint John's Health Center	Facultar	
Sagi	Shir	IVI	Evolutionary Biology	Haira University	Faculty	У
		M	Diomathematics	University of California, Los Angeles (UCLA)	Grad Student	
Woi	Sun	M	Biostatistics	University of Carifornia, Los Angeles (UCLA)	Faculty	
Glenn	Tesler	M	Mathematics	University of California San Diego (UCSD)	Faculty	
Elizabeth	Thompson	F		University of Washington	Faculty	v
Bridgett	vonHoldt	F	Ecology and Evolutionary Biology	University of California, Irvine (UCI)	Postdoc	, v
Tandy	Warnow	F	, and Erolationary biology	University of Texas at Austin	Faculty	v
Yi	Xing	М		University of Iowa	Faculty	ý
Wen-Yun	Yang	М	Bioinformatics	University of California, Los Angeles (UCLA)	Grad Student	
Zhiyuan	Zhai	М	Mathematics	Shandong University	Grad Student	
Shihua	Zhang	М		Chinese Academy of Sciences	Faculty	у
Xianghong	Zhou	F	Biostatistics	University of Southern California (USC)	Faculty	
Piotr	Zwiernik	М	N/A	Mittag-Leffler Institute	Postdoc	у

#### Appendix B: Current Titles and Employers of Graduate Students and Postdocs

First Name	Last Name	Position (2011)	Institution (2011)	Current title or position:	Current Employer:
Franz	Baumdicker	Grad student	Albert-Ludwigs-Universität Freiburg	Postdoctoral Fellow	University of Freiburg
Hadassa	Brunschwig	Grad Student	The Hebrew University of Jerusalem	Quantitative Analyst Equity Strategies (Associate Director)	UBS Investment Bank
Dustin	Cartwright	Postdoc	Yale University	assistant professor	University of Tennessee
Peter	Chi	Grad student	University of Washington	Assistant Professor of Statistics	Ursinus College
Charleston	Chiang	Postdoc	UCLA	Postdoctoral Fellow	UCLA
Chao	Dai	Grad student	University of Southern California	Postdoctoral Fellow	Stanford
Nicholas	Furlotte	Grad Student	UCLA	Statistical Geneticist	23andMe
Nicolo	Fusi	Grad student	University of Sheffield	Research Scientist	Microsoft Research
Chris	Glazner	Grad student	University of Washington	Senior analyst	Fulcrum Analytics
David	Golan	Grad student	Tel Aviv University	Postdoctoral Fellow	Stanford University
Catherine	Grasso	Postdoc	University of Michigan	Senior Research Associate	Oregon Heath and Science University
Eunjung	Han	Grad Student	UCLA	Data Scientist/Computational Biologist	Ancestry.com
Valerie	Hower	Postdoc	UC Berkeley	Faculty	University of Miami
Eun Yong	Kang	Grad Student	UCLA	Research Scientist, Machine Learning	Human Longevity
Darren	Kessner	Grad Student	UCLA	Math and Computer Science Teacher	Marlborough School
Aaron	Kleinman	Grad Student	UC Berkeley	computational biologist	23andMe
David	Koslicki	Grad student	Oregon State University	Assistant Professor of Mathematics	Oregon State University
Martin	Kreidl	Postdoc	Universität Duisburg-Essen	professor	Masaryk University (Czech Rep.)
Jingyi	Li	Grad Student	UC Berkeley	professor, statistics	UCLA
Wei	Li	Grad student	UC Riverside	postdoc	Dana-Farber Cancer Institute, Harvard School of Public Health
Diana	Low	Postdoc	BioInformatics Institute	Senior Postdoctoral Fellow	Institute of Molecular and Cell Biology, Agency for Science, Technology and Research
Serghei	Mangul	Grad student	Georgia State University	Postdoctoral Fellow	UCLA
Tobias	Marschall	Postdoc	TU Dortmund	Assistent Professor	Center for Bioinformatics, Saarland University, Germany
Paul	Medvedev	Postdoc	UC San Diego	Assistant Professor	Penn State
Anand	Murugan	Grad Student	Princeton University	data scientist	Space-Time Insight
Nishanth	Nair	Grad student	École Polytechnique Fédérale de Lausanne	Postdoctoral Research Associate	University of Maryland, College Park
Gro	Nilsen	Grad student	University of Oslo	Data Scientist	Telenor Group
Julia	Palacios	Grad student	University of Washington	Postdoctoral Researcher	Harvard University and Brown University
Gregory	Ryslik	Grad student	Yale University	Senior Manager of Data Science	Tesla Motors
Shihao	Shen	Grad Student	University of Iowa	researcher	UCLA
Jae Hoon	Sul	Grad Student	UCLA	researcher	UCLA
Bridgett	vonHoldt	Postdoc	UC Irvine	Assistant Professor	Princeton University
Wen-Yun	Yang	Grad Student	UCLA	machine learning research scientist	Human Longevity
Zhiyuan	Zhai	Grad Student	Shandong University	unknown	unknown
Xianghong	Zhou	Postdoc	University of Southern California	professor	University of Southern California
Piotr	Zwiernik	Postdoc	Mittag-Leffler Institute	Assistant Professor	Universitat Pompeu Fabra, Barcelona

### Appendix C: Quotes from Genomics participants on the impact of the program

**Orly Alter,** USTAR associate professor of bioengineering and human genetics at the Scientific Computing and Imaging Institute, University of Utah:

"This IPAM program was a rare opportunity to meet very many researchers, some for the first time, and some with whom I keep in touch still, in the various fields that are related to my multi-disciplinary interests. I learned a lot in the IPAM program from the researchers, both scientifically and professionally, and even if I cannot quantify the learning as directly influencing my interests, goals or collaborations, I'm certain that the learning experience have had an impact and still does."

#### Yael Baran, PhD student, Tel Aviv University (finishing in 2016):

"I visited IPAM at an early stage of my graduate program. In addition to a broad introduction to the research in the field, the program gave me a crash course in how top-level, high-impact science is carried out. More concretely, the participation affected the choice of some of my research projects, and I used some of the acquaintances I made there to later exchange data and code."

**Franz Baumdicker,** Mathematisches, Institut Albert-Ludwigs-Universität Freiburg "The participation in the program gave me a good overview of the current state of knowledge and broadened my horizons. I heard a lot of interesting introductions to related research areas and had some very nice and detailed discussions with other participants. For example one such discussion pointed out a method, which was used to improve one of my papers."

**Peter Chi,** then a graduate student at the University of Washington, now an Assistant Professor of Statistics, Ursinus College:

"Through IPAM, I was able to connect with Dr. Johanna Hardin (of Pomona College), who helped shaped my goals and aspirations to enter academia at the liberal arts college level. I am currently in a visiting position at Temple University, in the Liberles Research Group of Dr. David Liberles (another IPAM highthroughput genomics long-program participant, who I did not know before attending IPAM)."

#### Eleazar Eskin, Professor of Computer Science and Human Genetics, UCLA:

"I have many new connections with other researchers because of the IPAM program. It also help increase the connections within our community of individuals. We then as a group applied for an NIH grant to establish a new program which we received. The grant was positively reviewed partly because of the success of our IPAM program. Additionally, I hired a post doc, Serghei Mangul, who was one of the participants, and UCLA hired two of the long term participants as faculty (Yi Xing and Jessica Li)."

#### Simon Foucart, Mathematics, Drexel University (now Texas A&M)

*On the impact of the program*: "As a mathematician, I can now work on biologically-inspired themes and that I now know the right persons to direct my inquiries to."

**Chris Glazner,** then a graduate student at the University of Washington, now a senior analyst at Fulcrum Analytics:

"I think the intensive research experience at IPAM was valuable for assessing my own interest in research. I learned a tremendous amount at IPAM and now feel comfortable working on genomics projects."

**David Golan,** then a graduate student at Tel Aviv University and now a post-doc at Stanford: "It is hard to describe the huge impact that the IPAM program had, and still has, on my career path. My time at IPAM benefited me greatly. The workshops helped me construct a solid understanding of the challenges faced by contemporary genomics and genetics research community and aided my transition from doing pure methods research, to tackling problems motivated by biological and medical interests. The unique nature of the IPAM program greatly facilitated my benefit from the program. While the workshops were indeed great, the unique "in-between" weeks gave ample time for ideas to sink in, and for me to establish relationships with other graduate and post-graduate students, as well as faculty from around the world. These relationships benefited me greatly so far, and I am sure will continue to do so in the future."

**Catherine Grasso**, a postdoctoral scholar at University of Michigan and now a Research Scientist at Oregon Health and Science University:

"I have not in my entire academic career had the opportunity to be at an event with so many people on both the clinical and biomedical side and the algorithms and math side. I think there is a perception that this goes on regularly in conferences, but it doesn't, in part, because the different fields on which genomics is based are very different in foundation and career advancement... [IPAM] had a large effect on my career. Ben Raphael helped me find my next postdoctoral fellowship in Paul Spellman's lab at Oregon Health & Science University that I did right after the program finished. That was a critical move and it helped me a great deal with career development, especially since Joe Gray, the investigator who invented FISH and array CGH, has been a mentor to me ever since. I also met Elaine Mardis during the program. She is the head of the cancer genomics effort for Wash. U., a top department in the field, and she has provided me consistent career mentorship, including extensive help with grant writing, including daily mentorship while writing up my five-year plan."

#### Hardin, Jo, Professor of Mathematics, Pomona College

"Participating in [the IPAM program] has helped me to jumpstart a new direction in my research. I left IPAM with new research questions and collaborators. Additionally, it helped me to understand the technology associated with new generations of high throughput data; of vital importance to statisticians who need to get all possible information out of the data."

**Valerie Hower**, then a postdoctoral scholar at UC Berkeley, now a faculty member at the University of Miami:

"The IPAM program had a big impact on my career. Before the program I was a postdoc at UC Berkeley and I transitioned to a faculty member at the University of Miami after the program. Specifically at the IPAM program, I made contacts in the genomics field and learned a lot of the background in the both the mathematical and biological side of computational genomics. Coupled with my interaction with applied topologists, I have been motivated to pursue my own research program in computational genomics. The IPAM program was invaluable in shaping my interests and knowledge in this subject area."

**David Koslicki**, then a graduate student and now a faculty member at Oregon State University: "This IPAM program is the reason why I am in my current position as a faculty member of the Mathematics Department at Oregon State University. Before the IPAM program, I was a graduate student at Pennsylvania State University with little experience in genomics. The IPAM program provided me focused, high-quality, and intensive training, and with networking opportunities. In fact, I obtained a Postdoc position at Drexel University with Simon Foucart, a senior participant of the program. Shortly thereafter, I applied for and received a tenure track faculty appointment with Oregon State University in Mathematical Genomics (but deferred for a year to stay at the Mathematical Biosciences Institute at Ohio State University for a year). The hiring committee at Oregon State University explicitly communicated to me that my participation in the IPAM program greatly strengthened my application. I still actively interact with participants of the program and the networking opportunities that resulted from the long program and reunions has been invaluable.

This kind of program is unique in that it provides participant with not only an opportunity to view the state of the art and current problems of the field (through high quality seminars and a variety of well-known speakers), but most importantly gives the participants the time and freedom to take this information, add their own expertise, and thereby advance the field itself. Traditional seminars and conferences do not allow participants with enough time to collaborate effectively and make real advancements. Traditional graduate programs do not attract the caliber, quality, and variety of speakers and participants, nor provide such varied networking opportunities."

**Jingyi Li**, then a graduate student at University of California Berkeley, now a faculty member at University of California Los Angeles:

"The program had a large effect on my career. Before the program, I, a PhD student back then, did not have a clear big picture of the cutting edge research in statistical genomics and never had a good chance to meet most top-notch researchers in the field. The IPAM program provided an excellent platform for international faculty, postdocs and graduate students in multiple disciplines related to computational biology to communicate and establish collaborations."

**Wei Li,** then a graduate student at UC Riverside, now a postdoc at the Dana-Farber Cancer Institute, Harvard School of Public Health:

After attending IPAM, I got my Ph.D. degree, became a postdoc at Harvard, and I am now working towards my goal of becoming an independent investigator. I think attending IPAM is a critical event on my career path, as I learned a lot of science, met a lot of excellent researchers, and shaped my future career goal. I would definitely attend an IPAM program again.

**David Liberles,** professor, University of Wyoming (now Temple University) "My visit to IPAM was a step towards building stronger statistical foundations for my research program, an ongoing development."

**Diana Low**, senior postdoctoral fellow, Institute of Molecular and Cell Biology, Agency for Science, Technology and Research (A\*STAR):

"The program has shown and encourage me to venture more into the math & quantitative side of biology, which was something I had long intended to pursue but did not have the exposure to, prior to IPAM."

**Serghei Mangul**, then a graduate student at Georgia State University, now a postdoc in UCLA's Computer Science Department:

"The IPAM program was a key for my decision to choose academic career and join UCLA as a postdoc. The program introduced me to Eleazar Eskin, who became my postdoc advisor. Additionally it allow me to build the network in the bioinformatics and Genetics community." **Tobias Marchall**, then a recent Ph.D. graduate, now a faculty member at the Max Planck Institute for Informatics at Saarbrucken:

"Unlike a regular conference, the IPAM program gave one the opportunity to have in-depth discussions with other participants over several days or even weeks. While being at IPAM, Alexander Schonhuth and I worked on an approach for variant finding based on clique enumeration. We gave a talk about the topic to fellow participants and frequently discussed the project with others over several weeks. The feedback we got was extremely valuable. In the meantime, this line of research has led to two Bioinformatics articles and one RECOMB paper. Since April 2014, I am an assistant professor... Large fractions of my application talk for that position was on projects started at IPAM in 2011."

**Camila Mazzoni,** Berlin Center for Genomics in Biodiversity Research (BeGenDiv) "It showed me the challenges of developing and adapting molecular evolution methods to large scale datasets in genomics. It prompted me to search for new algorithms or to adjust biological questions to the limitation of the current methods."

Paul Medvedev, then a postdoctoral scholar at UCSD, now a faculty at University of Pennsylvania:

"The IPAM program was instrumental in helping me in obtain a tenure-track faculty position. During IPAM, when I was a postdoc, I met faculty from Penn State who shared my research interests. As a result, they encouraged me to apply to Penn State for a faculty position, leading to several interviews and to my current Assistant Professor position. This would not have been possible without IPAM, as I would not have been aware of the position and Penn State would not have known about me and my research. Additionally, the IPAM program benefited my research by creating new collaborations and broadening my research horizons. I began a collaboration with another long-term participant, David Golan, to publish a paper dealing with statistical problems in biological data, problems that I could not tackle on my own; we still collaborate to this date. I also began a collaboration with long-term participant Catherine Grasso, leading me to visit her lab at OHSU for a month. This has been enlightening for me and has greatly influenced my research."

Julia Palacios, then a graduate student at the University of Washington, now a Postdoctoral Researcher, Harvard University and Brown University:

"My research involves many subjects I learned during the IPAM program. The IPAM program had a large effect on my current research agenda."

#### Emiliano Pereira, Biomathematics, University of the Republic

"My participation in GEN2011 was highly enriching. It fostered a collaboration and broadened my knowledge, experience and skills in bioinformatics."

Gregory Ryslik, then a graduate student at Yale, now a scientist at Genentech:

"The IPAM program had a tremendous impact on my career. Before the program I had just completed my qualifying examinations while after the program I had already developed the broad outlines of my thesis that I would then see to completion throughout the rest of my graduate school career. This research has now led to several publications, including authorships in high-ranking journals such as Nature, the creation of several software packages and ultimately a position at Genentech where I can continue to pursue further development of my work.

Furthermore, during my time at IPAM, I became associated to a large cohort of colleagues many of whom have become my peers, collaborators and mentors. Ultimately, IPAM provided both the tools and

connections I needed to complete my dissertation. Further, I truly believe that it is the collaborative nature of the program where you get to interact with a wide variety of scientists for a prolonged period of time that makes the program unique and extremely beneficial."

#### Sagi Snir, professor of bioinformatics, University of Haifa:

"IPAM was a unique opportunity to be exposed to leading figures in the area. During the workshop we wrote a quite influential paper that was accepted to RECOMB. I made several other connections that influenced me subsequently. Due to IPAM, I chose my current sabbatical here at UCLA, and I just recently submitted a big grant with one of IPAM program organizers, Matteo Pellegrini."

**Tandy Warnow,** then professor at the University of Texas at Austin, now Founder Professor of Engineering, University of Illinois at Urbana-Champaign:

"The collaboration with Sebastien Roch that resulted from my time at IPAM is a valuable one, and has resulted in a paper. There are also other collaborations that have begun as a result but have not yet resulted in any publications. The IPAM program on computational genomics led to me organizing a week-long program on multiple sequence alignment, which is leading to new collaborations."

**Shihua Zhang**, Academy of Mathematics and Systems Science, Chinese Academy of Sciences "The experience of participating in this program has expanded my research interests such as that about cancer genomics, helped me to build close connections with those who have common interests."

# Appendix D: Collaborations

Genomics program participants reported the following collaborations with other participants:

Yael Baran	A collaboration with Bogdan Pasaniuc (now at UCLA) resulted in a paper and another paper currently in press. We focus on methods for ancestry inference and geographic localization. In addition, I am in touch with the Eskin group (we worked on a methods project before and plan to collaborate again in the near future), and with Susana Eyheramendy (participating in a data analysis carried out in her group).
Simon Foucart	I met a graduate student (David Koslicki) who became my postdoc for 6 months and with whom I am likely to keep collaborating on problems at the interface of mathematics and genomics.
Nicolo Fusi	I met Eleazar Eskin at IPAM and we are now collaborators.
Christopher Glazner	Vladimir Minin has been advising me and is on my dissertation committeehe is at my institution, but IPAM cemented our collaborative relationship.
David Golan	I have a fruitful ongoing collaboration with Prof. Paul Medvedev whom I have met during my stay at IPAM. I also collaborated with Prof. Jo Hardin whom I met at IPAM.
Catherine Grasso	Ben Raphael and Fabio Vandin did a mutated pathway analysis that was included the Nature paper that we published in July on the mutational landscape of castration-resistant prostate cancer. I have also been working consistently with Paul Medvedev on whole genome copy number analysis. This has not yet resulted in a publication, but he did spend a month this summer building a pipeline for Paul Spellman's lab (core participant Ben Raphael introduced me to Spellman, which led to a job in his lab) and we use his pipeline routinely.
Jo Hardin	The reported manuscript is part of a collaboration with David Golan that was initiated at IPAM.
Carolin Kosiol	Darren Kessner and John Novembre (both UCLA) are working on pooled sequencing data as well and they have developed a program HARP to infer haplotypes of pooled sequence data. My student Agnes Jonas and I are currently testing this program on a data set of experimental evolution of Drosophila species.
	after I met him at the IPAM workshop. During the visit in Vienna we continued the discussion at the Vienna together with PhD student Pauline Charruau of our Institute of Population Genetics. Pauline Charruau has gained a fellowship to work on Asiatic wolves with Bob

	Wayne this spring. Pauline and I stay in contact and I am consequently more interested in working on conservation genetics data sets. I also collaborate with and advise Nicolo Fusi (then Univ. of Sheffield, now Microsoft Research) and Tandy Warnow (University of Texas), both of whom I met at the program.
David Koslicki	I met Simon Foucart (assistant professor, mathematics, Drexel University) during my stay at IPAM. He took me on as a postdoc for 9 months, and we have continued collaborating since then. I also met Gail Rosen (Drexel) during workshop 3, and we became collaborators.
Jingyi Li	I started a collaboration with Dr. Shihua Zhang from the Chinese Academy of Sciences during my stay at IPAM. We talked about a paper I recently published (Sparse linear modeling of next-generation mRNA sequencing) and came up with a new idea of extending the method to replicate data. We continued our collaboration after the IPAM program, and we both look forward to more collaborative opportunities in the future.
David Liberles	I developed a working discussion with Francesca Chiaromonte during my time at IPAM and also continued discussions towards a collaborative project with Marc Suchard. Neither has yet resulted in a submitted grant application or a publication.
Serghei Mangul	I met Eleazar Eskin at the program. He hired me as a postdoc after I finished my PhD.
Paul Medvedev	I collaborated with David Golan (Tel Aviv University) on a paper at the high profile ISMB conference dealing with statistical problems in biological data. Through interactions with Catherine Grasso (now at OHSU) during the program, we formed a collaboration which exposed me to the medical aspects of the field and led to me visiting her lab for a month.
	Since IPAM, I have moved to an Assistant Professor position at Penn State. This is entirely due to discussions I had with Francesca Chiaromonte (long-term program participant) during my stay at IPAM. She made me aware that there was a position available, encouraged me to apply, and hosted me for my interview.
Nishanth Nair	I started a collaboration with Matteo Pellegrini (UCLA) during the program.
Matteo Pellegrini	I have begun collaborating with the group of Eleazar Eskin on Genome Wide Associations
Emiliano Pereira	I started a collaboration with Prof. James Lake, and worked for 2

	months on a project titled "Rooting Large Genome Flows Deep within Trees and Graphs". Since the project seemed very promising and the collaboration very productive, I went back next year, to do an internship and finish the work.
Ben Raphael	I met Catie Grasso (OHSU) and Greg Ryslik (then Yale, now Genentech) at IPAM, which led to collaborations.
Sebastien Roch	New collaboration with Sagi Snir which resulted in a publication.
Alexander Schoenhuth	Collaborations with Paul Medvedev, Penn State, on new reference genomes, and with Alice McHardy, HHU Düsseldorf, on viral quasispecies.
Shihua Zhang	Collaborations with Louxin Zhang, National University of Singapore, and Jingyi Jessica Li, University of California, Berkeley.

#### **Appendix E: Publications reported by Genomics program participants**

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