SIAG Imaging Systems (IS)

Charter Renewal

This CHARTER RENEWAL applies to the SIAM Activity Group on Imaging Science (hereafter called SIAG/IS). The SIAG/IS to which this renewal applies was originally formed under the aegis of SIAM on December 11, 1999 by the SIAM Board of Trustees and via electronic voting by the SIAM Council in January 2000. SIAG/IS began its operations on January 21, 2000. Its charter has been renewed by the SIAM Council and Board eight times thereafter. The SIAG had 601 members as of Dec 2016. From those, 217 are student members.

According to its Rules of Procedure, the objective of the SIAG/IS responsible for:

1) Providing a forum for conferences and scientific interaction between imaging science researchers and practitioners in academia, industry, medicine and government;

2) Encouraging research that will provide a rigorous mathematical foundation for imaging science;

3) Fostering research in mathematics and computation that has the potential for solving real-world problems in imaging science, and leads to new methods and techniques useful in this subject;

4) Providing the means for rapid publication and dissemination of novel methods in imaging science.

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The SIAG complements SIAM's activities and supports its functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

1. **How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last [two/three] years?**

   The field of imaging science is quite strong and growing rapidly. It is a highly interdisciplinary area with valuable contributions from pure and applied mathematicians, engineers (electrical, optical, acustic among others), physicists, statisticians, etc. Over the last few years, we have seen a number of exciting advances including:

   1. Increased development of novel methods for addressing challenges associated with very large scale problems (especially inverse problems) including the use

and analysis of randomization methods, large scale optimization techniques, state-of-the-art numerical methods, etc.

2. Interest in and utility of uncertainty quantification ideas (Bayesian statistical methods) as applied to problems in imaging.
3. Continued rise of computational imaging methods combining novel hardware (e.g., optical systems) with computational reconstruction techniques to obtain new and highly application-relevant data that would never have been possible before.
4. The migration of methods and ideas from pure mathematics into applications including optimal transport, topological data analysis, and differential geometry

2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?

The SIAG is doing very well. Over the past couple of years we have seen strong growth in membership. The 601 members as of December 2016 was the highest since 2011 and represents the second year of increase. The 217 student members in December 2016 also marks the second year of increase. The SIAM Imaging Sciences Conference had 485 attendees in 2016, the second highest attendance of the eight times the meeting has run.

The activity group is keeping up with changes in the field in the following ways:

1. Through the planning of the biannual Imaging Sciences Conference. The IS 2016 program represented the full breadth of the discipline with 97 minisymposia organized over four days typically involving 10-12 parallel sessions.
2. By reaching out to other professional organizations with comparable interests. Specifically ASA and IEEE Signal Processing Society's Computational Imaging Special Interest Group both sponsored (CI-SIG) IS16 and will do so again for IS18. We are also in the process of developing a joint weekly electronic digest with CI-SIG to keep members of both groups abreast of news in the field including job opportunities, calls for papers, journal tables of contents, software resources etc.

3. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past three years, and give a brief (one sentence or phrase) indication of the success or problems with each.

1. **IS16** was very successful representing the second largest attendance in the eight times this meeting was run. There were close to 100 contributed minisymposia (up from 60 two years previously) devoted to topics spanning the SIAM universe and extending to fields and drawing participation from researchers well outside of industrial and applied mathematics. Of the six plenary lectures, two came from industry (Google and Chevron) and two were associated with paper prizes

including the first early career prize lecture. The business meeting was well attended (with approximately 50 attendees), and there was healthy discussion regarding the proposal for IS18 from the University of Bologna, the possibility for the SIAG to have a stronger presence on the web and in social media, and the role of inverse problems in the SIAG.

2. The SIAG is currently in the process of planning a **workshop in collaboration with the newly formed Texas Louisiana SIAM section for the Fall of 2017**. The effort is being led by Dr. Anusha Sekar from Chevron. Dr. Miller is serving as the representative from the SIAG on the planning committee. The meeting, which will last one or two days, will focus on biomedical and geophysical imaging (inverse) problems.

4. Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM annual meetings. When did the SIAG last organize a track at an annual meeting or meet jointly with the SIAM Annual Meeting?

1. As of the writing of this document (late April, 2017), SIAG/IS is in the process of proposing a minisymposium on advances in imaging science for the **Joint Mathematics Meeting** to be held in San Diego in January 2018.
2. At **AN17**, three of the plenary talks, including the AWM-SIAM Sonia Kovalevsky Lecture are to be delivered by members of SIAG/IS on imaging science related topics. In addition, a fourth plenary talk is also devoted to a problem in imaging science though the speaker is not a member of the SIAG. We also identify six mini-symposia focusing on imaging science topics. Half of these MS were organized by one or more members of the SIAG.
3. Imaging sciences were prominent at **AN16** with five mini-symposia (two organized by SIAG/IS members) and one contributed presentation section covering a range of topics in this area. We also note that Dr. Yan LeCun's plenary talk in Deep Learning focused largely on imaging science applications of this method
4. At **AN15 (ICIAM 2015)**, there were over 30 mini-symposia (eight organized by members of SIAG/IS) devoted to topics in imaging science as well as two Invited Lectures (Image Restoration: A Data-Driven Perspective by Zuowei Shen and Mathematical models and methods for noninvasive bio-impedance imaging by Jin Keun Seo)

5. Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?

The SIAG is engaged in a number of activities in addition to organization of the biannual meeting and sessions at the Annual Meeting. Specifically:

1. We have a very active listserv advertising primarily job opportunities. The average number of messages per month in 2016 was 4.5. As discussed in the answer to question 2, we are currently looking to expand the scope and coverage

of this resource in collaboration with the IEEE Signal Processing Society Computational Imaging Special Interest group

2. Over the summer of 2016, we updated and have been maintaining a new Wiki for the SIAG. Key changes include a new section on Conferences and Workshops and a new section on Jobs. More details and links are available regarding prizes and journals related to imaging science.
3. The SIAG/IS organizes two paper prizes at the biannual SIAM Imaging Science Meeting. The Best Paper prize has been offered three times (2012, 2014, 2016) while the Early Career Prize was initiated in 2016. Both are highly successful, recognizing truly exceptional contributions to imaging sciences with the latter specifically providing exposure to our best young researchers. Indeed, the plenary lectures at the Imaging Science meeting in 2016 were highly attended and appreciated by the breadth of folks at the meeting. Both of these prizes will continue into the future.
4. The current chair of the SIAG serves on the SIAM News Editorial Board. In this capacity, Dr. Miller has connected the Managing Editor, Karthika Swamy Cohen, with authors from a number of recent papers from the SIAM Journal on Imaging Sciences whose work would have broad appeal to the general SIAM community. As of the writing of this document (late-April 2017), three authors have agreed to contribute articles to SIAM News.

6. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.

The next biennial SIAM Conference on Imaging Science IS18 will be held in Bologna Italy. The general Co-chairs are Fiorella Sgallari and Omar Ghattas. More information will be posted at http://siam.org/meetings/IS18/.

7. How can SIAM help the activity group achieve its goals?

Over the past year and a half, the current set of officers have been trying to expand the on-line reach of services offered by the SIAG to its members. We have been talking with similar interest groups from IEEE and more recently OSA about ideas such as joint newsletters, improved web presence, social media outlets etc. At the same time, the SIAG/IS officers also sought to improve our own web presence, moving from the current wiki to something more dynamic such as the SIAG/LA website. These efforts take resources and support beyond what can be provided by the four officers of the SIAG; e.g, assistance with web development and an ability to host something like a joint SIAM/IEEE/OSA listserv. That none of these was forthcoming from SIAM has greatly limited the ability of the SIAG/IS officers to serve our members and, quite possibly expand both our membership and that of SIAM. Thus, the first and most important manner in which SIAM could assist SIAG/IS would be to provide substantive resources to support the efforts of the officers in these types of endeavors.

In addition to the type of assistance described in the previous paragraph, additional financial support would be welcome both to assist for young researchers to attend the IS conferences and to support activities such as the imaging symposium being organized by the joint Louisiana/Texas SIAM Chapter and SIAG/IS.

8. **How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?**

   As discussed in our answers to the first couple of questions of this application, SIAG/IS helps SIAM promoting applied and computational mathematics by virtue of the breadth of topics and application domains touched by imaging science. Our members (and potential new members) include pure and applied mathematicians, engineers, physicists, and statisticians. The continued rise of "big data" and the spread of this trend to new fields such as material science indicate the potential for SIAG/IS to expand interest in applied and computational sciences encouraging both seasoned researchers from industry, academia, and government as well as new students to join the field.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two year operating period beginning January 1, 2018 and ending December 31, 2019.

Signed

Eric Lawrence Miller , Chair of the SIAG on Imaging Sciences

May 30, 2017