SIAG Imaging Systems (IS)
Charter Renewal Application

This CHARTER RENEWAL APPLICATION 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 elven times thereafter. The SIAG had 502 members as of Dec 2022. From those, 185 are student members.

According to its Rules of Procedure, the objectives SIAG/IS are responsible for include:

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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List all current officers of the activity group (including advisory board, if relevant).

Chair, Hongkai Zhao
Vice Chair, Rebecca Willett
Program Director, Samuli Siltanen
Secretary, Angelica I Aviles-Rivero

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 years?

   The field of imaging science is broad and active. Its profound impact ranges from science discovery and engineering innovation to biomedical applications and everyday image processing tasks. The SIAG/IS community has a diverse composition of mathematicians in academia, as well as researchers and engineers in national labs and industries. They focused on the development and analysis of mathematical theories, models, and computational algorithms for imaging related inverse problems and processing, analysis, and understanding of image data. Imaging science is interdisciplinary and often requires cross-disciplinary collaboration. SIAG/IS provides a platform and community for advancing mathematical imaging science.

   In recent years, imaging science has witnessed several exciting developments. First of all, imaging science is naturally data-rich. Many recent trends and advances in imaging science are fueled by learning-based and data-driven approaches. For example, AI algorithms have been widely used for imaging analysis, such as automated image interpretation, object recognition, and image-based decision-making. AI-powered systems can assist in medical diagnostics, quality control in manufacturing, and object detection in autonomous vehicles, among other applications. Understanding, analyzing, and improving these algorithms and making them theoretically and practically sound is an urgent and challenging task that provides great opportunities and rewards for this community in mathematical imaging science. SIAG/IS is also actively looking to collaborate with other SIAGs to fulfill this goal.

   Finally, we note that among the 2022 SIAM Fellows are several mathematicians who are working at the interfaces of mathematics, inverse problems, and image processing, including Fioralba Cakoni (Rutgers University), Laurent Younes (Johns Hopkins University), and Yongjie Jessica Zhang (Carnegie Mellon University).

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 activity group for mathematics and image science is doing well! The group has remained vibrant, and its size has been stable over the years. Our SIAG currently has about 500 members in

2022, and with this membership is one of the medium-sized SIAGs. The demographics and diversity of the group are quite healthy, with about 37% student members, 26% female members, and 42% non-US members. IS2022, originally planned to be held in Berlin in person but changed to virtual, attracted 753 participants, the third largest attendance in history.

The SIAG has been keeping up with the changes in the field by actively engaging with new research and technologies in the areas of mathematics and image science, including deep learning. To stay abreast of these changes, the SIAG supports organized events such as the upcoming IS2024, which provides a forum for researchers to share their latest findings and collaborate on cutting-edge research. Additionally, the SIAG is committed to reflecting the broader interests of SIAM through its activities, which include organizing conferences, workshops, and other events that bring together researchers from various disciplines and backgrounds to exchange ideas and collaborate on research in the field. The SIAG also supports students and early-career researchers in mathematics and image science through initiatives such as awards and career development resources. Most recently, we have sought to elevate the impact of our group further by utilizing social media platforms like Twitter.

Overall, the SIAG for mathematics and image science is a dynamic and growing community dedicated to advancing the field through collaboration and innovation while providing support and resources for the next generation of researchers in the field.

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.

   IS20, which was virtual and co-located with the 2020 Annual Meeting - virtual, attended by the most participants ever (over 3000 registrations, thanks to the virtual format and free registration).
   IS22, which was also virtual, had 753 participants.
   To the best of our knowledge, they were both quite successful.

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?

   Annual meeting 2021 had a minisymposium “MS16 Wave Based Imaging in Complex Media”, which might have been directly organized by the activity group.

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?

   SIAG/IS sponsors two prizes, the early career prize, and the best paper prize, every two years. The two prizes in 2022 were awarded at IS22. The 2022 SIAM Activity Group on Imaging Science Early Career Prize was awarded to Nicolas Keriven for his novel and deep work in signal processing, imaging, optimization, learning, and data science. The 2022 SIAM Activity Group on Imaging Science Best Paper Prize was awarded to Lénaïc Chizat for his paper, "Sparse

optimization on measures with over-parameterized gradient descent," for laying out the mathematical foundations of particles-based methods for off-the-grid sparse regularization.

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

   The 2024 SIAM Conference on Imaging Science (IS24) will be held in Atlanta from May 28 - May 31, 2024.
   To promote common interests, interactions, and collaborations between imaging science and data science, SIAG/IS and SIAM/DATA have decided to co-locate IS26 and MDS 26. A joint committee of the two activity groups is working on the location and date of the co-located conference.

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

   As the parent organization of the activity group for mathematics and image science, SIAM plays a critical role in supporting the group's goals and activities. Some of the ways that SIAM can help the activity group achieve its goals include:

   1) Promoting the group's activities: SIAM is helping to promote our group's activities and events through its website and other communication channels. This promotion has helped raise awareness of the group and its work and attract more members and collaborators. This increased visibility helps attract more researchers to the group, which in turn fosters greater collaboration and innovation in the field.

   2) Providing administrative support: SIAM provides administrative support to the activity group, such as assistance with management and other logistical tasks (e.g., social media policies). This support can help the group focus on its core activities and goals without getting bogged down in administrative tasks.

   3) Facilitating collaborations: SIAM facilitates collaborations between the activity group and other SIAM groups, as well as with external organisations and industry partners -- for example, through SIAM Engage. This can help the group expand its reach and impact and bring new perspectives and expertise to its activities.

   4) Recognition & Funding: SIAM supports and helps the activity group via promoting and funding awards.

   Overall, SIAM plays a critical role in supporting our activity group for mathematics and image science and helping it achieve its goals. Through visibility, resources, and recognition, SIAM helps to promote collaboration, innovation, and growth in the field of mathematics and imaging science.

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

   Imaging science is multidisciplinary. The broad and diverse range of mathematical topics in imaging sciences demonstrates the true richness of this area for mathematical research and explains the attraction that imaging science has had to mathematicians from various fields in and outside academia. With the emergence of new imaging modalities, advances in technology and hardware, and a deluge of data and measurements, comes the urgent need for new mathematical theories and tools, from modeling and analysis to computational algorithms. The community of SIAG/IS can play an important and unique role and make a broad impact in this dynamic and vibrant field.

   Mathematical imaging science requires tools from diverse fields of mathematics that often interact in interesting ways, conversely influencing the mathematics development in those fields, such as harmonic analysis, partial differential equations and related variational methods, differential geometry, probability, and statistics, just to name a few. SIAG/IS has many common grounds and interests with other SIAGs, such as Computational Science and Engineering, Data Science, and Optimization.

   New trends and developments in mathematical imaging opened up new career perspectives for early career researchers, as the emergence of data science and artificial intelligence within mathematical imaging has opened up many industrial sectors for career opportunities.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2024.

Signed

Hongkai Zhao, Chair of the SIAG on Imaging Sciences

Date May 19, 2023