NSF 24-554: AIMing

Artificial Intelligence, Formal Methods, and Mathematical Reasoning

Webinar
April 11, 2024

Agenda

- AIMing Introduction and Motivation
- Overview of the AIMing Program
- Questions
  - from Registration
  - from Q&A
    - Submit your questions via the Q&A box at any point.
    - Questions can be submitted anonymously.

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Multi-directorate Solicitation

- MPS/DMS: Division of Mathematical Sciences
- CISE/IIS: Division of Information and Intelligent Systems
- CISE/CCF: Division of Computing and Communication Foundations

Synopsis

- The AIMing program seeks to support research at the interface of innovative computational and artificial intelligence (AI) technologies and new strategies/technologies in mathematical reasoning to automate knowledge discovery.

Proposal Due Date

- June 3, 2024 (February 5, 2025 and February 5, 2026 thereafter)

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NSF 24-554: AIMing
Management Team and Contact Information

Program Directors

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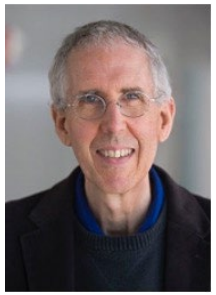
MPS/DMS

Yulia Gel
MPS/DMS



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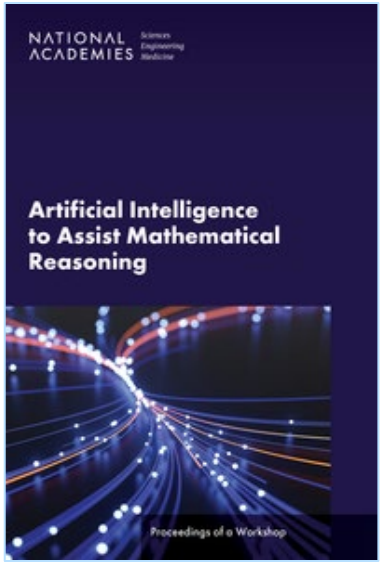
Motivation: National Academies of Science, Engineering and Medicine
AI to Assist Mathematical Reasoning, June 12-14, 2023



- Explored the state of the art, current challenges, and opportunities to advance research in using AI to Assist Mathematical Reasoning.
- Highlighted the growing potential and timeliness for AI, the formalization of mathematics, and synergies between these fields, to support rapid and eccentric exploration in mathematical discovery and to aid human understanding.
- Highlighted that the centrality of reasoning, which modern AI still struggles with, to the mathematical process makes mathematics an especially interesting and important area to test the power of AI.

https://www.nationalacademies.org/our-work/ai-to-assist-mathematical-reasoning-a-workshop

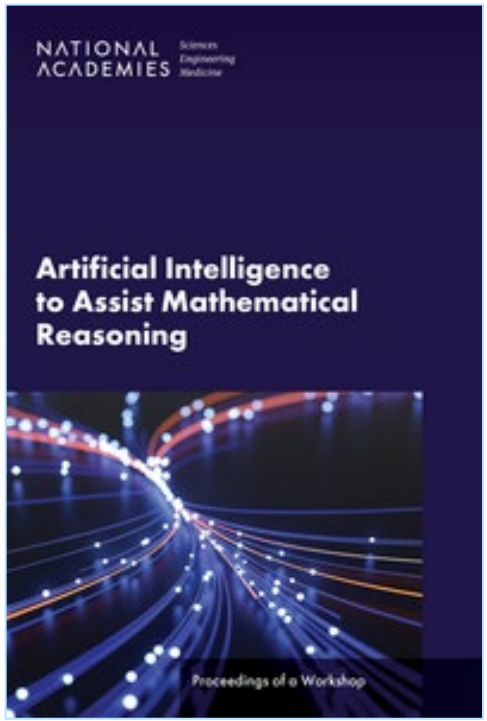
Upcoming NASEM webinars

AI to Assist Mathematical Reasoning

APRIL 23, 2024 @ 1:00PM - 2:00PM (ET)
Artificial Intelligence to Assist Mathematical Reasoning:
Webinar on Proof Assistants

APRIL 24, 2024 @ 1:00PM - 2:00PM (ET)
Artificial Intelligence to Assist Mathematical Reasoning:
Webinar on the Future of Collaboration

APRIL 25, 2024 @ 1:00PM - 2:00PM (ET)
Artificial Intelligence to Assist Mathematical Reasoning:
Webinar on Machine Learning Approaches to Mathematical Discovery



https://www.nationalacademies.org/our-work/ai-to-assist-mathematical-reasoning-a-workshop#sectionUpcomingEvents

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Scientific scope

- The goal of the AIMing program is to support research at the interface of AI, computer science, mathematics and statistics that assists and accelerates both mathematical discovery as well as discovery in related disciplines.

- Successful projects should demonstrate the potential to advance both the mathematical sciences as well as the computational models and methods used to attain these advancements.

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Scientific scope

- Expected advancements may include, but are not limited to:
  - advancing AI for mathematical conjecture, proof, verification
  - advancing interactive theorem provers for mathematical proof and verification, software/hardware verification, and related applications,
  - developing training data for AI algorithms for mathematical reasoning, both deterministic and under uncertainty, and novel approaches for infusing logic, mathematical reasoning, and compositionality into AI.

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Additional Considerations

- AIMing proposals must involve meaningful collaborations between researchers in the mathematical sciences with researchers in computational science. Each project is expected to clearly demonstrate substantial collaborative contributions across disciplines.

- Training through the research involvement of students, and/or postdoctoral associates from across this multi-disciplinary spectrum is an asset.

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Additional Considerations

- This program welcomes the submission of proposals that include the participation as e.g., PI, co-PI, senior/key personnel, postdoctoral scholars, graduate or undergraduate students, or other trainees from the full spectrum of diverse talent in STEM, including members of historically under-represented or under-served populations. It also includes diverse institutions including Minority-Serving Institutions (MSIs), Primarily Undergraduate Institutions (PUIs), and two-year colleges, and major research institutions.
- Proposals from EPSCoR (Established Program to Stimulate Competitive Research) jurisdictions are especially encouraged.

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Logistics

- Proposal deadline(s): June 3, 2024 (February 5, 2025 and February 5, 2026 thereafter)
- Anticipated total funding: $5,000,000 - $6,000,000 per year
- Anticipated number of awards: 6-10 per year
- Award size: expected to range between $500k - $1.2M
- Duration: up to 3 years

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Eligibility

Who May Submit Proposals:

- Proposals may only be submitted by the following:
  - Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members.
  - Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Limit on Number of Proposals per Organization:

- There are no restrictions or limits.

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Eligibility

Who May Serve as Principal Investigator (PI):

- As of the date the proposal is submitted, any PI, co-PI, or senior/key personnel must hold either:
  - a tenured or tenure-track position, *or*
  - a primary, full-time, paid appointment in a research or teaching position

  at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of U.S. institutions of higher education are not eligible.

Limit on Number of Proposals per PI or co-PI: 1

- A Principal Investigator (PI) or co-Principal Investigator (co-PI) can be part of no more than one proposal per deadline in response to this solicitation.

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Review Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

The review process will be managed by a cross-disciplinary team AIMing team spanning MPS/DMS, CISE/CCF, and CISE/IIS.

Proposals will be evaluated by the National Science Board Merit Review Criteria

- Intellectual Merit
- Broader Impacts
- Solicitation Specific Criteria

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Review Criteria

National Science Board Merit Review Criteria

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

Additional Solicitation Specific Review Criteria: In addition to the National Science Board merit review criteria, reviewers will be asked to review how well the proposal addresses the following aspects:

- Is there is a compelling collaboration plan which clearly articulates the added value and complementary expertise spanning the necessary areas of knowledge?
- Does the proposal clearly articulate the mathematical and computational innovations?

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Q&A

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Thank you!

- Contact: aiming@nsf.gov

- Program homepage:
  - https://new.nsf.gov/funding/opportunities/artificial-intelligence-formal-methods