Request for Proposals 2020-2021

1. SUMMARY AND TIMELINE

The MIT-IBM Watson AI Lab is a community of scientists from academia and industry collaborating to produce fundamental breakthroughs in artificial intelligence, and unlock the potential of AI in four key areas: AI Algorithms, Applications of AI, Next Generation AI Hardware and AI for Good.

This Request for Proposal welcomes three types of proposals:

• **Exploratory Projects** (1 year; up to $150,000 total cost)
• **Core Projects** (up to 3 years; $150,000-$250,000 per year, total cost)
• **Grand Challenge** (up to 3 years; $250,000-$500,000 per year, total cost)

In this fourth round of funding, we are including several new focus areas related to applications of AI, and a new type of award, Grand Challenge, for large scale projects with far reaching impact in the science, engineering and/or applications of AI.

**Important**: projects funded under the MIT-IBM AI Lab are expected to represent substantial collaborative efforts between MIT and IBM Research personnel (rather than parallel workstreams at each institution). As such each proposed project must include at least one MIT and one IBM Research principal investigator. The IBM portion of the team is expected to allocate significant time to the projects. This year, IBM Researchers seeking to participate in Lab projects should seek the approval of their Pillar VP before submitting a proposal.

**Deadline and Timeline:**
Proposals are due **June 22, 2020, 5 pm EDT**.
Decisions will be announced by mid-August 2020.
Funding start dates: September 1, 2020 or January 1, 2021.
Proposals should be submitted as a single PDF file (< 10 MB in size) to: 
http://mitibmwatsonailab.mit.edu/submit
or

Please send questions to: mitibm@mit.edu

2. THEMES

Proposals should address one or more of the core research themes below. We have a strong preference for proposals that advance state-of-the-art AI rather than applying existing methods to new applications. If proposers have questions about the suitability of a topic, they are encouraged to contact Lab Directors David Cox (David.D.Cox@ibm.com) or Aude Oliva (oliva@mit.edu).

2.1 AI Algorithms

A major goal of the MIT-IBM Watson AI Lab is to create advanced algorithms that expand the capabilities of systems that learn from and reason about data. We seek to design AI algorithms that overcome the limitations of today’s machine learning algorithms, enabling AI to tackle a wide range of complex tasks.

We are particularly interested in new methods that combine learning and reasoning, including methods that mix neural networks and symbol manipulation. Also of special interest are methods for disentangled representation learning, self-supervised and unsupervised learning approaches, and methods that rely on relatively limited amounts of supervision. Other topics of interest include causal inference, explainable AI, and AI fairness.

Historically, the AI Algorithms theme has comprised the largest component of the MIT-IBM portfolio, and we anticipate that this will continue in future years.

2.2 Applications of AI

Artificial intelligence is broadly transforming science, technology, business, and public life. While the MIT-IBM Watson AI Lab is focused on fundamental advances in AI technology, looking at problems through the lens of AI applications often reveal new opportunities for fundamental algorithmic advances with significant real-world impact.

AI for IT. We are especially interested in new ideas in applying AI methods for efficiently managing and securing IT systems. Potential examples of topics in this area include AI methods for automatically analyzing, optimizing, troubleshooting and repairing cloud-deployed applications; methods for detecting
network vulnerabilities and intrusion, as well as malware; AI methods for analyzing, understanding and manipulating code.

_Ai for Healthcare._ Healthcare represents a fertile ground for the application of new ideas in AI. This year, we are particularly interested in applications of AI in the payer-provider space, optimizing healthcare delivery and outcomes.

_Ai for Accelerated Discovery._ AI has the potential to greatly accelerate scientific discovery. We are particularly interested in applications of AI to materials discovery and informatics, discovery of novel therapeutic compounds, and novel applications of AI to the life sciences.

_MIT-IBM Member Program._ We are particularly interested in project proposals that address specific needs of MIT-IBM Member companies. The MIT-IBM Membership program presently consists of relationships with leaders across multiple sectors: technology, healthcare, finance, construction, transportation, and energy. Topics of potential interest include: Fine-grained demand forecasting; Medical imaging for healthcare; Privacy-preserving synthetic data generation; Automated data fusion and graph construction; Ethical AI, Algorithmic fairness, and explainability; Sim-to-real inference with digital twins; Natural language processing (NLP) low-resource language learning; robotics and predictive maintenance; energy efficient computing (hardware or software) among other topics. PIs interested in a project mainly on _Applications of AI_ should contact Mark Weber for details (mark.weber@ibm.com).

### 2.3 Next Generation AI Hardware

We seek to investigate new AI hardware materials, devices, and architectures that will support future AI compute infrastructure by targeting two main areas 1) analog computing approaches to AI-model training and deployment and 2) the intersection of quantum computing and machine learning and 3) new ideas in efficient AI processors (low precision digital processors, etc.).

Areas of interest include: innovations in AI-related nanodevices, nanomaterials, and microarchitectures building on MIT.nano and IBM MRL fabrication resources to create unique platforms for hardware that overcome key AI challenges; acceleration of quantum computing systems and software that use AI; AI to improve the control and measurement of quantum devices; and the development of new AI algorithms on practical quantum hardware; new digital hardware approaches to accelerating or securing model inference and training.

### 2.4 AI for Good

Rapid advances in AI over the past decade have raised urgent questions about AI’s economic and societal benefits, and how those benefits will be shared among consumers, workers, enterprises and nations. AI promises to bring significant advances in healthcare, finance, education, transportation, and many other
domains. But as with earlier transformational technologies, AI has the potential to be misused, eliminate jobs, lower living standards, reinforce and amplify bias, erode personal privacy and create unfair outcomes.

We welcome proposals that address AI ethics and AI’s capacity for social good. In the area of AI Ethics, we seek proposals aimed at equipping AI with ethical principles, social norms, professional codes, and culture and context-specific moral values. In the area of AI for Social Good, we seek AI research projects looking to solve societal and humanitarian problems, such as economic inequality, hunger, poverty, social injustice, and disease. Finally, we are interested in research that looks at how automation can complement human skills through products, services, and innovative business models.

3. TYPES OF PROPOSALS

All proposals are collaborative between MIT and IBM PIs, and the award funds the MIT component of the collaboration. PIs should write a thorough budget justification.

3.1 Exploratory Projects (1 year; up to $150,000, total cost)

Exploratory projects are meant to seed projects that require substantial investigation before a multi-year proposal can be submitted. We anticipate that many longer-term Lab collaborations will begin this way. MIT PIs are encouraged to engage with IBM researchers during this period by giving seminars on their work at IBM or initiating brainstorming sessions to bring their work to the next stage.

3.2 Core Projects (up to 3 years; $150,000-$250,000 per year, total cost)

Core Projects are significant multi-year collaborations that strengthen ties between MIT and IBM researchers, with an expectation of significant in-person time working together at MIT or IBM Research in Cambridge. We anticipate that most Core Projects will grow out of successful Exploratory Projects.

3.3 Grand Challenge Projects (up to 3 years; $250,000-$500,000 per year, total cost)

Teams aiming to propose a Grand Challenge should contact MIT-IBM Lab directors David Cox (David.D.Cox@ibm.com) or Aude Oliva (oliva@mit.edu) to discuss the proposal topic.

Grand Challenge projects aim to fund longer-terms paths to scientific and technological discoveries. The team should include multiple faculty and tackle ambitious, innovative long-range research goals in the science, engineering, and/or applications of AI.

We expect that grand challenge projects will likely emerge from prior collaborative research between MIT and IBM researchers, with a strong record of research accomplishments and a demonstrated collaboration. In addition, proposals should include a thorough discussion of the ethical/societal impact
of the proposed work, plans for a workshop at MIT or IBM Research, and an educational plan for graduate students and postdocs in the social and ethical research responsibilities of AI.

**Additional Details regarding PIs and Budget**

The budget, which includes direct and indirect costs, is awarded to the MIT PIs. IBM researchers will be funded through IBM internal budgets and do not need to be included in the proposal budget. **All projects are to be jointly proposed and executed by MIT and IBM researchers.** The number of PIs necessary to complete a project is at the discretion of the applicants. However, funding is primarily for researchers (students or postdocs), rather than equipment or materials. PIs with current MIT-IBM project funding who wish to propose a continuation or a new proposal should include a one-page progress report on the previous/current award.

Additional funds may be requested upon submission if critical to the project’s success but must be clearly justified in the proposal budget. No-cost extensions of up to one year to finish a project or bridge to a new proposal will be considered.

The MIT-IBM Watson AI Lab proposal teams can include only MIT personnel or IBM personnel as participants, whether in the form of consulting or other potential intellectual contributions to the project.

**4. PROJECT REPORTING REQUIREMENTS**

MIT PIs should submit a slide summarizing their project at the start of funding; an informal progress-report meeting with Lab leadership once a year; a review workshop day once a year that includes a talk or poster presentation; and participation in a couple of research workshops/meetings per year. IBM PIs should expect more regular check-ins. Additional reporting for Grand Challenge proposal (2-3 page report) will be expected every six months from the start of funding. This report should highlight the collaborative accomplishments.

**5. REVIEW CRITERIA**

Proposals will be assessed by three criteria:

1) Advancement of AI
2) Strategic Alignment
3) Scientific, business, and/or broad societal impact

**Advancement of AI** will be evaluated by assessing how well the fundamental AI algorithmic advance is defined and targeted, how well those advances are measured, and how ambitious its overall objective is. We are especially interested in general AI progress and metrics for verifying advances in AI.
Strategic alignment will be evaluated by how well the proposal aligns with topics of interest outlined in this RFP.

Impact will be evaluated by your proposal’s potential contribution to science, industry, and/or society. Proposals should describe where the potential impact is highest.

6. PROPOSAL GUIDELINES

Full Proposal Deadline: June 22, 2020, 5 PM EDT.

Submission Format:

- Upload one PDF file (< 10MB in size, with Cover sheet, Proposal and MIT PI Acknowledgment of terms as a bundle pdf file) to http://mitibmwatsonailab.mit.edu/submit

  - Follow the below file name convention:

    **Exploratory**: E МITPIlastname_IBMPIlastname.pdf
    **Core**: C_MITPIlastname_IBMPIlastname.pdf
    **Grand Challenge**: G_MITPIlastname_IBMPIlastname.pdf

Project Duration and Funding:

- Exploratory: One year award, total amount of $150,000
- Core: up to 3 years award, total amount of $150,000 to $250,000 per year
- Grand Challenge: up to 3 years award, total amount of $250,000 to $500,000 per year

Principal Investigator Eligibility:

- MIT Faculty or MIT Research Scientists with principal investigator status
- IBM Researchers: For purposes of proximal collaboration with MIT, an IBM PI from Cambridge or Yorktown needs to be on the proposal, but participants/co-PI’s from other IBM labs are welcome.

7. PROPOSAL FORMAT

Proposals should follow the structure described below:

**Title**: PROPOSAL TEMPLATE
MIT-PI(s): name and email
IBM-PI(s): name and email
**Type of proposal:** select one (Exploratory, Core, Challenge).

**Theme:** Choose one or more themes that apply to your project (to help us select reviewers).

**Research Project Term:** Start Date: mm/dd/yy - Estimated Completion: mm/dd/yy

1. **Abstract:** Please submit a < 200-word abstract of the AI-related challenge your team wants to tackle, the transformative aspect of the proposed project, the longer-term scientific, technological or societal impact of this research, including new conceptual understandings or applications. The abstract should be clear and accessible to non-experts.

**Keywords:** (3 to 5): Describe your research topic, methods, and areas of interest.

2. **Introduction**
   Describe in one page or less the question or challenge as it relates to your work and place it in the context of related work, including how your proposal will expand on the limitations of prior results. This should be one page maximum.

2b. **Progress report (if applicable):** If you have previously received a grant from the MIT-IBM Watson AI Lab, please submit a one-page progress report, including a list of any publications, patents, conferences, and other scientific or broad impacts of the research.

3. **Research plan**
   Describe what you plan to do, and the real world problem(s) the research aims to address. The format is at the discretion of the PIs as different domains have different conventions for describing projects. You can include figures, schemas, etc.

   Exploratory Projects should cover two pages maximum; Core Projects, three to four pages maximum; and Grand Challenge, five to six pages maximum.

4. **Statement of Work**

   Please list technical tasks, milestones, and dates targeted for deliverables associated with your project (in six month intervals or less). Target dates may be offset from the project start. We recommend breaking tasks into smaller increments when possible to help reviewers understand the steps you intend to take. We realize that expected dates and targets will change as the research unfolds. Please explain how you will disseminate your results (i.e. conferences, workshops, github open source code release, publications, benchmarks, challenges, etc).

   Please include a table of MIT-IBM personnel working on the project, with an estimated percentage of time to be allocated to the project. Placeholders may be used for students or postdocs who are not yet identified.
Grand Challenge must include a plan for an annual workshop on the proposal topic at MIT or IBM, and an education plan for the graduate students and postdocs in the social and ethical responsibilities of AI research.

5. Ethical and Societal implications of the proposed work

Proposals must include discussion of the potential ethical and societal impact of advances to come out of the research. Please describe ethical and societal considerations in your proposal (e.g. How will AI complement human skills and activities and help to improve society? What are the risks?). Include concrete steps the research team will take to address concerns about accountability, transparency, bias, safety, privacy, and/or robustness. Define the capabilities and limitations of your AI system/algorithm, the scope of its use, and its potential for misuse. We expect these steps to be tied to the milestone goals outlined in the proposal.

6. Budget

Provide a budget (with personnel, materials, etc) with justification of how the funds will be spent. Budget totals should include direct and indirect costs, with F&A being standard MIT rate. An additional budget table may be added to the proposal. Questions regarding budget may be sent to Kate Anderson (kateand@mit.edu)

7. Confidential Information (if applicable)

1. Do you have any MIT or IBM information that should be kept confidential?
2. Do you have, or expect to have, intellectual property (patents or software) related to this proposal?
   Yes/No
   If Yes, please list IP and/or related MIT Cases

8. Data

Specify the data sets and types of data to be used by either IBM or/and MIT, and their source. It is important to be precise and list the plausible datasets which may be used for the project as exhaustively as possible. (“Publically available datasets” is too generic). Project plans may be updated to include additional data as the project progresses. All data sets must be reviewed and approved before the project can be funded, including publicly available data. Note that only “clean” data — not containing any personal data, such as PII or PHI — may be shared between IBM and MIT. Otherwise institutions may follow their own procedures for approving datasets for their own use.
9. Software

Specify all software to be used in the program, and whether the software to be used by MIT or IBM is proprietary or open source. Please also include whether software developed during the project will be made public, and if so, under what initiative and license.
List any software that will be provided to the other institution and under what conditions, for example previously developed software that is intended to remain under sole ownership of one institution. Otherwise software should be acquired by each institution separately according to their own procedures. Project plans may be updated to include additional software as the project progresses. Records must be kept noting the software assets that have been generated under the course of the program.

10. References

Include relevant work by the PIs, other collaborators and the field.

11. Biosketch

Include a one page CV or biosketch for each MIT and IBM PI with any additional information relevant to the project. The biosketch may include professional training, appointments, top publications, a link to your webpage or CV, related activities, and current projects. Additional key collaborators’ CV or biosketches may be added (one page maximum).