Opportunity Title: Enabling Agent-Based Model Development for Intelligence
Opportunity Reference Code: ICPD-2020-09

Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	ICPD-2020-09
How to Apply	**Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: https://orise.orau.gov/icpostdoc/index.html.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

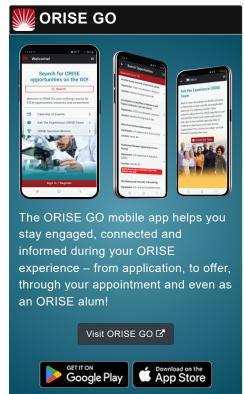|	
Application Deadline	2/28/2020 6:00:00 PM Eastern Time Zone
Description	**Research Topic Description, including Problem Statement:**

Agent-Based Models (ABM) are a proven tool to help understand complex situations from business dynamics to national economies to intelligence challenges. Enabling intelligence professionals to build models of their phenomenon of interest can provide a paradigm shift as analysts can simulate a specific behavior of interest to explore and analyze the complex interdependencies within a system. Such a capability will add rigor and precision and allow intelligence professionals to virtually test their assessments of a situation in a way beyond what a human can cognitively manage.

ABMs are currently being built from scratch for specific problems, requiring significant time and technical skill. This dynamic stands in stark contrast to Machine Learning and Deep Learning approaches that have robust libraries which provide users the required pieces to build models in a relatively short time period and with much less technical skill. The existence of ABM framework libraries (e.g. RePast, MASON, and Mesa) and repositories of individual models (e.g. Open ABM) show there is an active community of modelers, yet no similar ecosystem of component parts for rapid ABM development has emerged. The lack of such an existing support structure, combined with the fact that simulating the actions of diverse populations is a fundamentally more difficult challenge than executing Machine and Deep Learning models, makes building an ABM ecosystem to enable rapid model development a non-trivial problem.

With this situation, the research problem is: what does an ABM ecosystem that facilitates the rapid development of ABMs to support intelligence analysis and assessments look like? An intelligence professional with moderate technical skill needs access to robust libraries to build a working models in hours or days.

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Example Approaches:

There are different ways to approach this research; versatile approaches are encouraged. The researchers could focus on assessing the current ecosystems of other fields such as Django for journalists or Sci-Kit Learn and Pytorch for AI to well-done APIs/ Web services. From this assessment, they can identify the different features, which are most suited to the ABM dynamic.

Currently, the ABM libraries (e.g. Repast, MASON, Mesa) allow for extensions like GIS or distributed runs, but only the Python based library Mesa is attempting to create a central node that links to the building blocks of the ABM with its Mesa Packages initiative. This approach, however, is nothing more than a Github wiki page linked to different repositories.

Proposals could consider one or more of the following:

- How should the structural dynamic of the ABM infrastructure be different from that of other AI technologies that exist (e.g. machine learning)? Can this knowledge be extended to Multi-Agent Systems and Swarm AI to help catalyze their development?
- What standardization should be required to ensure the easy plug and play of different algorithms into agent processes? How should synthetic populations created and incorporated?
- What meta-analysis should be done on the ecosystem so insights can be gleaned from the most used and updated repositories to provide insights into the qualities of successful algorithms?
- How can someone link real time data feeds to update agent attributes or agent actions?
- How should libraries in related field like reinforcement learning be linked into the ABM ecosystem?

Relevance to the Intelligence Community:

Analysts' ability to rapidly develop virtual laboratories of ABMs will cause a paradigm shift in analysis. It will add rigor to an analysts understanding because it will allow them to explore complex interdependencies in ways they previously unimaginable. It will also provide the foundation to allow analysts to link in real time data to better assess dynamic situations. Furthermore, it will provide a new way to communicate these complex situations to decision makers and policy developers by providing dynamic simulations.

Key Words: Coding Libraries, Distributed Artificial Intelligence, Agent Based Models, Virtual Laboratories, Policy Development, Simulation

Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

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Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (2 👁)
  - **Computer, Information, and Data Sciences** (16 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (45 👁)
  - **Mathematics and Statistics** (10 👁)
  - **Other Non-Science & Engineering** (2 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (27 👁)