Opportunity Title: Using Machine Learning to Model Crustal Magnetic Field
Opportunity Reference Code: ICPD-2021-25

Organization Office of the Director of National Intelligence (ODNI)

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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 2/26/2021 6:00:00 PM Eastern Time Zone

Description

Research Topic Description, including Problem Statement:

In the age of Global Positioning System (GPS) denial, defining position and navigation (PN) by employing the Crustal Magnetic Field is an excellent solution for accurate PN where GPS denial or spoofing is a concern. One step in achieving this goal is to address the low resolution and areas with large voids, which current global magnetic anomaly maps provide. Artificial Intelligence (AI) approaches to address the shortfalls in crustal magnetic maps are promising.U.S. Military inertial navigation systems (INS) depend on the accuracy of the National Geospatial-Intelligence Agency's (NGA) gravity maps. The threat of GPS denial in recent years highlights the importance of alternative navigation sources, like INS. The Crustal Magnetic Field could also be used for INS because it does not change with time. For INS to reach GPS's centimeter-level accuracy, NGA must continue to improve current force models and create new accurate models, such as crustal magnetic field. This proposal demonstrates that AI via a neural network, in combination with existing measurements and satellite remote sensing, can greatly improve the resolution of crustal magnetic maps at every location on the globe, while substantially reducing production costs.

Example Approaches:

Map Automation: Leveraging bathometry, elevation, and crustal density as estimators, we aim for high-resolution crustal magnetism maps on a global scale by seeking AI and high-performance computing driven workflows capable of granular model estimation and big data processing. Fundamental leaps have been made in AI in recent years with deep architectures that learn the complicated relationships between endpoints of interest and key inputs, which are often complex, uncertain, and highly correlated. NGA has already demonstrated the potential of applying AI to automate the production of fine-scale gravity maps, including some data-poor areas. We envision a convolutional neural net trained to learn the relationship between marine and airborne track lines and bathometry, elevation (Tandem-X), and crustal density (CRUST) to produce fine-scale crustal magnetic field maps.

Relevance to the Intelligence Community:

Combining fine-scale crustal magnetic field maps with gravitational field maps will improve INS Position and Navigation (PN).This PN improvement will increase in relevance with the continued expansion of GPS denied areas, spoofing of GPS, and possibility of the loss of GPS globally.

Key Words: Artificial Intelligence, AI, Global Positioning System, GPS, Inertial Navigation Systems, INS, Modeling, Crustal Magnetic Field, Machine Learning, ML, Neural Network Position, Navigation PN, Satellite, Remote Sensing, Tandem-X

Qualifications

Postdoc Eligibility

- U.S. citizens only

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- 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

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** (17 👁)
  - **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 👁)