

Opportunity Title: Integration of sensor performance metadata into automated image analysis algorithms

Opportunity Reference Code: ICPD-2019-15

Organization Office of the Director of National Intelligence (ODNI)

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

Application Deadline 3/1/2019 6:00:00 PM Eastern Time Zone

Description **Research Topic Description, including Problem Statement:**

- Approaches to automated analysis of remote sensing data could be dramatically improved if they included detailed sensor performance metadata. Recent publications have illustrated dramatic improvements in the confidence and fidelity of remote sensing products when algorithms include key sensor performance metadata. An example includes the Maximum-Likelihood coherent change detection algorithm for synthetic aperture radar published by Sandia National Laboratories that includes spatially varying noise in the correlation calculation to improve estimates of change that reside above the system noise floor. Broadly speaking, this topic seeks research investigating the utility from propagating sensor performance metadata (particularly given available geospatial standards including SICD – the Sensor Independent Complex Data standard for SAR) into automated algorithms for the analysis of remote sensing data. Applications could include change detection, automated feature extraction to produce terrain use classification maps, interferometric processing approaches for subsidence and others. Because SAR systems use active illumination with carefully controlled imaging geometries and provide a rich phenomenology (including polarimetric scattering measurements, interferometric processing, and calibrated Radar Cross Section (RCS)), they represent a unique opportunity to explore automated processing that takes advantage of the rich sensor performance information often available from commercial, civil and airborne SAR payloads.

Example Approaches:

- Eliminate permanently shadowed regions from civil, commercial and airborne



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SAR coherent change detection through the inclusion of spatially varying noise parameters within the correlation equation to produce a maximum likelihood estimator of change free from strong sources of bias. This improves confidence in coherent change detection estimates and facilitates automated analysis approaches with lower rates of false change.

Relevance to the Intelligence Community:

- Automating remote sensing data is a critical challenge for organizations within the intelligence community that focus on geospatial intelligence. Frequently, remarkable detail on sensor and payload performance is available for synthetic aperture radar systems (including carefully calibrated commercial remote sensing systems like RadarSAT2, TerraSAR-X/TANDEM-X and CosmoSkymed as well as civil systems like the ESA Sentinel-1 mission). Textbook examples of remote sensing products derived from single look complex SAR imagery fully utilize sensor and payload performance – to include factors like collection geometry, noise, spatially varying parameters – within automated analysis algorithms. Investigating opportunities to improve automated algorithms by fully utilizing available metadata could improve the results for automated analysis. This could be relevant for HADR (humanitarian assistance / disaster relief) applications including flood water extraction, determining the extent of earthquake damage, volcano analysis, wide area subsidence, as well as critical infrastructure monitoring through interferometric techniques, etc.

Key Words:

Remote sensing, synthetic aperture radar, noise, automation, feature extraction, ATR

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.

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** (6 )
 - Computer, Information, and Data Sciences** (16 )

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- **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** (5 )
- **Physics** (16 )
- **Science & Engineering-related** (1 )
- **Social and Behavioral Sciences** (28 )