Opportunity Title: Synthetic Aperture Radar: Edge Detection with Neural Networks
Opportunity Reference Code: IC-16-20

Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	IC-16-20
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.
Application Deadline	4/15/2016 6:00:00 PM Eastern Time Zone
Description	Artificial neural networks (NN) are adaptive systems that mimic functions of the human brain in two ways: first, they have a learning mechanism, and second, they infer from learning to perform automated tasks of interest such as pattern recognition. Deep learning (DL) neural networks have multiple layers between the input and the output, thus exploiting modern computational power and extensive data storage. This research is concerned with edge detection in Synthetic Aperture Radar (SAR) data, using cellular neural networks (CNN) that are specialized for accurate feature definition. CNN are identified as most promising in SAR edge detection, due to a mathematical foundation that is suited for the phenomenology of SAR active data acquisition. There have been very few attempts at comprehensive research of CNN for change detection in SAR data, yet there is a consensus among researchers that the NN approach may perform better than humans for processing large amounts of data. This topic aims to research hybrid systems to combine the power of complementary techniques for SAR edge detection. Research could explore closely the power of neural networks for an important type of remote sensing data: SAR. A few key objectives are: • Assess the reliability of CNN for SAR edge detection. • Analyze and create a priori error bounds for various learning strategies in CNN. • Introduce and analyze hybrid approaches. **Example Approaches** The NN-based edge detection has a higher reliability over classical techniques, notably in images lacking strong brightness contrast. The NN approach can be combined with other big data

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strategies (e.g., fuzzy logic, ant colony system algorithm) and signal processing such as wavelet decomposition; there are published claims that edge detection is efficient with CNN and improved when using mixed techniques.

One example approach may be to conduct a 4 phase project:

1. In-depth study and documentation of the findings on the state-of-the-art in SAR edge detection with CNN.
2. Demonstrate new techniques such as:
   - Devise a CNN-based algorithm
   - Create hybrid approaches: devise and implement algorithms
3. Assess the needs for new tools, approaches, and thought processes. Evaluate the CNN learning rules and assess suitability of other functions and hybrid approaches.
4. Understand weaknesses that challenge SAR edge detection and explore the benefits of using CNN.

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Business** (11 👁)
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (6 👁)
  - **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** (13 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (28 👁)