

**Opportunity Title:** Deep Learning and Inference Using Models with Low Precision Synapses and Binary Unit Activations  
**Opportunity Reference Code:** ICPD-2021-14

**Organization** Office of the Director of National Intelligence (ODNI)

**Reference Code** ICPD-2021-14

**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.ora.gov/icpostdoc/index.html>.

If you have questions, send an email to [ICPostdoc@ora.gov](mailto:ICPostdoc@ora.gov). 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:**

Deep learning has revolutionized the field of machine learning. However, current approaches to deep neural network training require backpropagation of errors with high precision. This poses a challenge for training deep neural networks on future generation, low-power edge computing platforms under the constraint of low-precision (possibly binary) weights and binary unit activations. Recent research on binary neural networks (BNNs) and spiking neural networks (SNNs) offers hope that a solution to this problem can be found. However, this remains an open problem. Approaches may involve simulators, field-programmable gate arrays (FPGAs), and/or neuromorphic hardware.

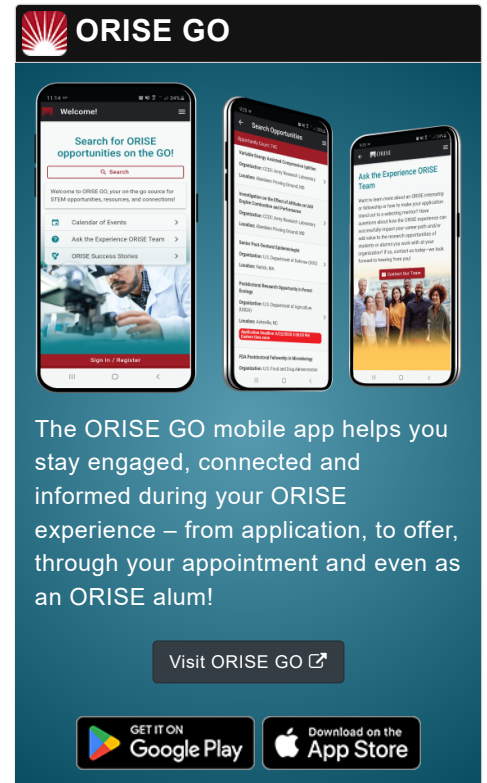
**Example Approaches:**

- “EventProp: Backpropagation for Exact Gradients in Spiking Neural Networks”  
arXiv:2009.08378
- “Training Binary Neural Networks with Real-to-Binary Convolutions”  
arXiv:2003.11535

**Relevance to the Intelligence Community:**

The Intelligence Community (IC) will increasingly rely on edge computing platforms to detect patterns of interest in sensor data. Developing algorithms for training and inference on future generation, low-power edge computing platforms will ensure that the IC is able to take full advantage of these platforms.

**Key Words:** Deep Learning, Machine Learning, Artificial Intelligence, Neuromorphic, Low Precision, Event Based Computing, Neural Networks, SNN, BNN

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## 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** (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 )