Opportunity Title: Neuromorphic Transducers: Analog-to-Information Converters
Opportunity Reference Code: IC-16-25

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.

Application Deadline 4/15/2016 6:00:00 PM Eastern Time Zone

Description As the world progresses to an ever more connected environment and events proceed at an ever increasing tempo enabled by modern ubiquitous communications (whether due to 5G or internet of things), the nonlinear challenges are more complicated than simple signal-to-noise phenomena. Existing collection and processing approaches are insufficient to deal with this problem. An alternative, non-Von Neumann architecture which enables the biologically inspired melding of collection and processing is needed to avoid overwhelming the system by transforming collection systems into analog-to-information converters. These transformative future neuromorphic transducers will enable revolutionary capabilities by migrating from an architecture that consists of analog-to-digital conversion followed by separate conventional post processing – an archaic approach that is unsustainable in terms of power and speed. The architecture must be transformed and neuromorphic processing technologies are the enablers. While several approaches to neuromorphic processing exist, such as coupled nonlinear oscillators and resistive synaptic arrays, with varying degrees of plasticity, further research is desired to advance these techniques for use as low-power, high-speed, analog-to-information converters in the form of neuromorphic transducers for the intelligence community.

Example Approaches

Potential research could explore biologically-inspired approaches yielding the potential of revolutionary reduction in power with concomitant increase in speed of rendering an input signal into an abstracted representation. That signal may be either optical or RF, depending on the particular intended future application considered by the proposer. Trades between plasticity and validation of the transducer function can be considered. Novel applications in the area of hardware assurance within the networking infrastructure, and not just conventional data processing, are not excluded. Investigations associated with data processing should indicate clear potential for revolutionary advancements in capability. Improvements of components, architectural implementations or associated learning

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techniques are of interest. Applications of neuromorphic transducers within space-based environments, as part of the collection or information transport layers, can be considered. Whether the core technology employs oscillators or physical phase change techniques, the approaches which maximize compatibility with, and facilitate interfacing with, conventional silicon microelectronics are of interest for the purposes of easing the transition of the innovation into current enterprises.

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 👁)