Opportunity Title: Heterogeneous network analysis
Opportunity Reference Code: IC-17-33

Organization Office of the Director of National Intelligence (ODNI)

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Application Deadline 3/31/2017 11:59:00 PM Eastern Time Zone

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

The rise of networks as a technology and as emergent phenomena in a connected world have outpaced our abilities to model and make sense of the data derived from them. Data about connections, relationships, and time-evolving behaviour is available and very rich.

We see networks in a varieties of modes. There are relatively static networks such as the physical infrastructure of transport, energy and telecommunications. In network flow, there are questions of optimal routing, assignment and pricing. Network users (both people and devices) display emergent modes of behaviour interacting with the network performance. Social network applications are instantiated on communication networks, and in turn both reflect and generate networks in the true society.

The requirements of modelling and design for networks are various. Network owners might prefer efficiency and predictability whereas a security engineer might view redundancy and flexibility as positive. The data derived from a network may be as profitable for its owner as the service it provides to the users.

Example Approaches:

- The overarching need is for models of heterogeneous networks which are sufficiently complex to capture the varieties of behaviour at the various levels of the network abstraction and the interactions between the levels. Models should be rich enough to generate useful observations about behaviour in the large, which simple enough to be computable. These models should be capable of largely unsupervised (untruthed) learning. A model capable of making inferences about the significance of anomalous behaviour would be particularly useful.
- Heterogeneous network modelling, informed by subject-matter experts but capable of supporting unsupervised parameter setting and machine learning.

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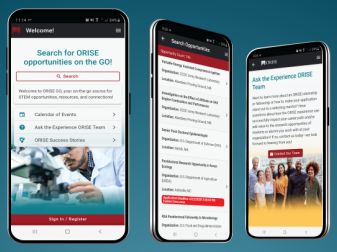
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- Models for community detection (k-tuples) in network activity. Inference for identification of anomalous activity.
- Tools for visualisation and down-sampling of network activity and enrichment of other analytic tools.

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)