Opportunity Title: Development of an Artificial Neural Network (ANN) Behavior Model to Predict Real time Events
Opportunity Reference Code: IC-16-10

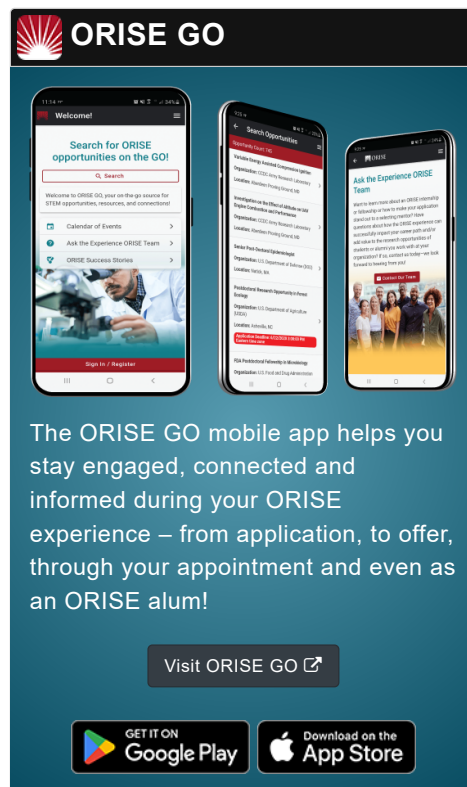|	
Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	IC-16-10
How to Apply	**Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not 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 (ANNs) are a family of methods created to simulate the workings of the human brain. A neural network is a powerful computational data model that is able to capture and represent complex input/output relationships. The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks or decision making similar to those performed by the human brain. Neural networks resemble the human brain in the following two ways:

1. A neural network acquires knowledge through learning.
2. A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights.

The true power and advantage of neural networks lies in their ability to represent both linear and non-linear relationships and in their ability to learn these relationships directly from the data being modeled. Traditional linear models are simply inadequate when it comes to modeling data that contains non-linear characteristics. The most common neural network model is the Multilayer Perceptron (MLP). This type of neural network is known as a supervised network because it requires a desired output in order to learn. The goal of this type of network is to create a model that correctly maps the input to the output using historical data so that the model can then be used to produce the output when the desired output is unknown.

One existing model is the Hitachi Predictive Model. The Hitachi Visualization Predictive Crime Analytics (PCA) Model uses neural network modeling to predict crime incidents which are then used by law enforcement to allocate manpower in an effort to reduce crime. PCA should serve as a framework starting point to build a behavioral model that meets the requirements of the

problem set.

Example Approaches

Research proposals should use similar ANN modeling techniques as developed for the PCA Model, but to predict behavior driven outcomes to address problems such as "The Escaped Prisoner" Problem, or the "Workplace Active Shooter" Problem. Many similar problems may follow the same behavioral decision marking model, e.g. Terror Event Planning, Cyber Attacks.

Proposals could address one or more of the following sample approaches, but are not limited to what is listed:

- Determine the pros and cons for each modeling approach and determine the best model type for the specific class of problem. There are three types of ANN Models, Supervised ANN, Dynamic Association Memories and Autopoietic ANNs which should be considered.
- Address whether the temporal domain can be predicted with required accuracy, what the impact of mixing relevant and irrelevant data as decision descriptors, or how to treat/filter irrelevant data based on the fact that ANN has a wealth of input information to simulate behavioral decision making.
- Test the validity of ANN modeling to predict with required accuracy decision behavior of IC and law enforcement targets.
- Authenticate outcomes related to the ability to identify changes to tradecraft, and to adjust the predictive outcomes based on how ANN deploys Machine Learning techniques. This may be useful in determining changes or shifts in target tradecraft based on input data that modifies the neural network predictive outcomes.
- Develop a novel application of ANN modeling to help determine if ANN behavioral modeling can assist in the described missions.

| 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 👁) |

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- **Mathematics and Statistics** (10 👁)
- **Other Non-Science & Engineering** (13 👁)
- **Physics** (16 👁)
- **Science & Engineering-related** (1 👁)
- **Social and Behavioral Sciences** (28 👁)