

## At a Glance

### What is it?

Information Processing, Discovery and Integration is a basic and applied research program that explores techniques to automatically detect relevant information from multiple sources and assemble them in support of information dominance.

### How does it work?

Mathematical techniques that organize structured and unstructured data (both categorical and numerical from sensors) are being developed, implemented and tested. The goal is to produce algorithms that automatically detect and uncover deeper data structures that reflect hidden information content. Multiple data sources can also be processed to discover potential shared information that might otherwise go undetected if each data source were processed and interpreted independently.

### What will it accomplish?

This capability will provide reliable, integrated and actionable information to the warfighter in a timely manner through the discovery of data content from heterogeneous sources.

### Point of Contact

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Today's battlespace environment is much more complex than in the past. The battlespace footprints are wider with the introduction of multiple types of sensors and new sources of information.

While these potential resources can enhance target acquisition or discrimination, and further improve the understanding of the common tactical or operational pictures, they can yield undesirable effects when communications resources and data storage are limited. The Office of Naval Research is exploring automated methods to detect information that may inconspicuously reside in different data sets. Unless data is processed and relevant information is accurately and timely extracted or integrated, the data deluge will become increasingly magnified.

Even with today's technology, a great deal of human resources is presently required to organize, process, extract, maintain and update information. A human presence is not an option in many operational scenarios. In response to these challenges, this program explores new scientific frontiers to address the pressing need of providing actionable information into the hands of warfighters.

To minimize human supervision, the program places emphasis on automation. Since there is a huge scientific gap between machine and human intelligence, this requirement compels the need for rigorous formulation of various concepts that are naturally understood by humans, but become dubious for software and hardware to handle. Scientific rigor with proven performance bounds are also unique aspects of this program. Typical considerations are: How innovative is a proposed idea? How well—quantitatively or qualitatively—does an approach work? Is it provable or just a common-sense approach? How fast and accurate is a technique expected to deliver? What are the required hypotheses?

### Research Challenges and Opportunities:

Providing scientifically rigorous principles and provably guaranteed implementation for the problems below:

- Representation and organization of unstructured digital data in meaningful ways
- Finding relevant information hidden at various granularities in vast pools of unprocessed data
- Exploiting multiple data sources of potentially different modalities
- Extending these techniques to cope with dynamic and evolving situations as new data is ingested

