Today's battlespace environment is much more complex than in the past. In particular, the battlespace footprints are wider with the introduction of multiple types of sensors and commingled sources of information. The rate at which data is arriving into the decision-making system is growing, while the number of humans available to convert the data to actionable intelligence is decreasing.

While these potential resources can enhance the target acquisition or discrimination process and further improve our understanding of the common tactical or operational picture, they can also yield undesirable effects when communication resources and data storage are limited. What we collect is data but what we want or need is information content that may inconspicuously reside in different datasets. 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 are presently required to organize, process data and extract, maintain, and update information. In many operational scenarios, the human presence is not an option. Facing these challenges, this ONR program explores new scientific frontiers to address the pressing need for having actionable information in the hands of warfighters with minimal latency.

To minimize human supervision, the program places emphasis on automation. Since there is a huge scientific gap between machine and human intelligence, this requirement, in turn, compels the need for rigorous formulation of various concepts that are naturally understood by humans but become dubious for software/hardware to handle. Moreover, scientific rigor with provably guaranteed performance bounds are also unique aspects of this program. Typical questions to be asked 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, accurately and robustly is a technique expected to deliver? What are the required hypotheses? In order to achieve this automation, the program focuses on automated image understanding; the organization, management, and extraction of information from unstructured data; and the management of sensor resources to obtain and maintain the picture to support decision making.

Research Challenges and Opportunities:
- Multiscale representation and organization of nonlinear datasets
- Dynamic topic modeling via a hierarchical Dirichlet process
- Algorithms for automated image understanding
- Fusion of disparate, high-dimensional data and distributed optimization with uncertain, incomplete, imprecise and latent data