

At a Glance

What is it?

- Basic and applied research to develop principles and computational methods that enable machine vision systems to fully understand images and videos of all imaging modalities in all environments

How does it work?

- Basic and applied research is focused on key problems including detecting and recognizing objects under varying appearance, tracking and recognizing activities of people and vehicles, understanding the scene type, discriminating between foreground and background, inferring intentions and threats, and concise description of the scene and activities taking place there. This requires developing robust representations for objects and activities, building sophisticated visual knowledge bases and developing methods for reasoning with images.

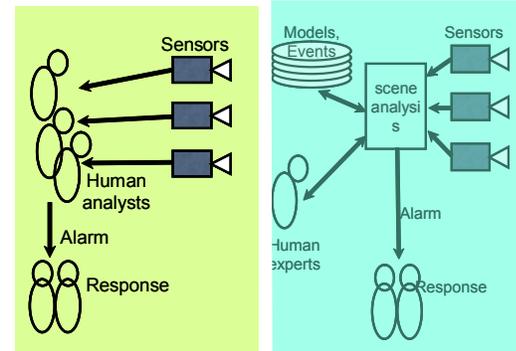
What will it accomplish?

- Automated image understanding will have significant impact for our warfighters including reducing the workload on image analysts; automated surveillance, reconnaissance and monitoring of wide areas over long periods with a network of mobile and stationary imaging sensors; robotics operations such as navigation and object manipulation. This capability is critical for situational awareness and timely alerts, as well as forensic investigations.

Point of Contact

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Huge amounts of raw imagery collected by sensors such as stationary pan-tilt-zoom cameras and mobile platforms (UAV, UGV, satellite, etc.) require more human resources for analysis than are available. As a result, most of the collected imagery is either archived or thrown away without ever being analyzed.



Now

Future

The objective of this research program is to develop theory, efficient computational methods and tools to enable automated analysis of imagery. Applications of such a capability are numerous and include reducing the workload of image analysts, automated surveillance of wide areas over long periods of time with a network of stationary and mobile cameras, rapid detection of potential threats, indexing and archiving images based on their content and concise description of the image/scene. Image understanding is also a critical component of perception in robotics operations for navigation and obstacle avoidance, manipulation of objects and interactions with humans.

Image understanding involves detecting, localizing and recognizing objects, tracking and recognizing activities of moving objects, recognizing the scene type (street scene, commercial area, residential area, hallway, sitting room, etc.), discriminating between background and foreground, determining what is important (which depends on the task) and coupling this information to the automated understanding system with the ultimate goal of inferring intentions, potential threats and opportunities.

Factors that make image understanding a challenging research area include the fact that there are thousands of object classes in the world and there are a very large, but unknown, number of activities. Also, a typical image contains 10s-100s of stationary objects and several to tens of moving objects and the appearance of objects can change with changes in illumination, view point and occlusion. Additionally, activities may appear different because of their inherent temporal variations.

Current emphasis of this program is on understanding EO/IR image/video. The longer term goal is to extend these methods to other modalities of imaging.

Research challenges and Opportunities:

- Representation of objects that are robust to appearance variations
- Representation of movements, actions and activities
- Building visual knowledge bases that include object shape, reflectance properties, behaviors, relationship to other objects and contexts in which it normally appears.
- Joint segmentation and recognition by developing methods that integrate low-level image data and high-level knowledge and reasoning