Department of the Navy SBIR/STTR Transition Program
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NAVAIR 2018-752

Topic # N161-013
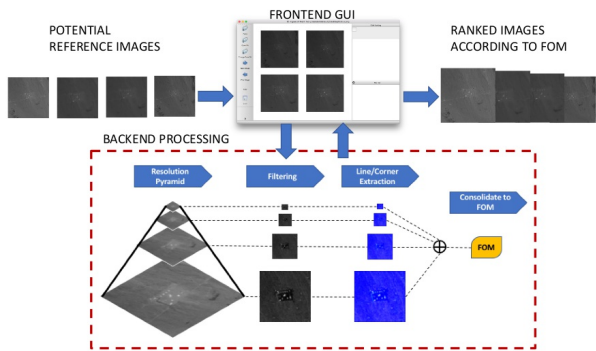Image Correspondence Figure of Merit (FOM)
Mayachitra, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 201 Precision Strike Weapons

Transition Target: Image-Guided Weapons

TPOC:
(760)939-0044

Other transition opportunities: This technology is applicable to all US Air Force, Navy, Army, and Marine Corps Image-Guided Weapons

POTENTIAL REFERENCE IMAGES

FRONTEND GUI

RANKED IMAGES ACCORDING TO FOM

BACKEND PROCESSING

Resolution Pyramid → Filtering → Line/Corner Extraction → Consolidate to FOM → FOM

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WHAT

Operational Need and Improvement: Current mission planning capability for image-guided weapons are limited. When planning to employ these weapons, images are used to aid in the target acquisition process and to guide the weapon to the target. Images used during the mission planning phase may be from any of a number of sources and may be screened for potential best or optimal success in aiding the weapon, based upon content, clarity, and/or mode. What is needed is a simulation or method that can compare images and provide a measure or figure of merit (FOM) for the level of correspondence that should be expected, so that the best image can be selected and used.

Specifications Required: When multiple images are available, the mission planning system can use the FOM, statistical measure, and the simulation to find the image that would give them the highest success rate for the mission. For example, the simulation would only look at the images with a FOM greater than a predetermined critical value - images with the most unique features. Simulation is leveraged to determine a weapon's performance using the planned profile in a design of the experiment. This will determine how many times the weapon will be correlated to within tolerance using each image. Using these results, the simulation would provide the best image needed to achieve mission success.

Technology Developed: Mayachitra's Phase II effort is aimed at taking the guesswork out of the analyst's job to improve accuracy and reliability by developing a Figure of Merit (FOM). The approach scans an image using a condition-based theoretic approach to isolate strong line and corner information, present in the image. It also examines the distribution of that information about the image. Mayachitra then quantifies the quality of the image with respect to registration potential. A Graphical User Interface (GUI) is provided to streamline the analyst's interaction with the FOM. The GUI provides extended functionality to intuitively access and process data on demand.

Warfighter Value: The proposed technology simplifies the job of an analyst when choosing a reference image for image registration. Analysts are typically provided with a group of images that overlap a target area. They are tasked with choosing the best among those images to serve as a reference image. However, the qualities that separate good images from mediocre images are subtle and difficult to gauge by eye alone. There are high stakes involved with target acquisition. Any improvements we can make to accuracy and reliability will have immediate and long-term benefits.

WHEN

Contract Number: N68936-17-C-0061   **Ending on:** March 25, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Establish FOM against limited set of images	Low	Software interfaces with end user hardware and performs to specifications	TRL-4	February 2018
Establish Function GUI	Low	Software environment functions to support arrays of any size and curvature	TRL-4	December 2018
Test and Evaluation of FOM simulation against real data sets	Med	Correlation with supplied imagery and NAVAIR metrics	TRL-5	February 2019

HOW

Projected Business Model: Mayachitra initially focused on the Department of Defense (DoD) Navy, Airforce, and Marine Corps to support technology transfer through sales, support contracts, and licensing agreements.

Company Objectives: Mayachitra's technology automatically detects and recognizes multitudes of objects of potential interest providing a high confidence, near real-time, object recognition decision capability for processed electro-optical/infrared (EO/IR) sensor imagery. In today's environment warfighters are faced with an exponential increase in available overhead video sensor data. Based upon changes in the battlefield many different types of pre-mission objects of interest are anticipated – the proposed technologies' active learning component provides operators the capability to find objects of interest in real-time given various operating environmental parameters, backgrounds, clutter, weather, etc. Mayachitra's primary objective is to connect its technology with interested Program Management Activities and NAVAIR Labs, to mature capabilities under technology insertion initiatives, adapt the capability to meet the needs of the greater unmanned aerial surveillance (UAS) community, and deploy the capability through Navy program of records to support theater operations.

Potential Commercial Applications: This technology would be useful for the United States Coast Guard (USCG), Department of Homeland Security (DHS), Department of Energy (DOE), and other federal agencies for which protection from vehicle-based threats is important. Commercial security entities could likewise benefit from automated processing of imagery data. Federal, state and commercial rescue organizations could also benefit from the ability to track objects. All organizations, for which remote imagery is valuable, could potentially benefit from this technology.

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