Department of the Navy SBIR/STTR Transition Program
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NAVAIR 2018-684

Topic # N14A-T008
Foveated Video Object Recognition
Mayachitra, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-281 Strike Planning and Executions Systems

Transition Target: PMA-281's Common Control System (CCS) for Unmanned Systems implements a software and user interface architecture that provides common vehicle management, mission planning and mission management capabilities for all future Navy unmanned air vehicles (UAVs), including unmanned air systems (UAS). Mayachitra's advanced visual information processing capabilities are targeted for early adoption and integration into the CCS architecture.

TPOC:
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Other transition opportunities: All programs that fly UAS and collect electro-optical (EO) sensor video data. Potential transition candidates include NAVAIR's Persistent Maritime Unmanned Aircraft Systems (UAS) (PMA-262), NAVAIR's (PMA- 265) Tactical Aircraft Programs, and the Naval Air Weapons Station (NAWS) China Lake.
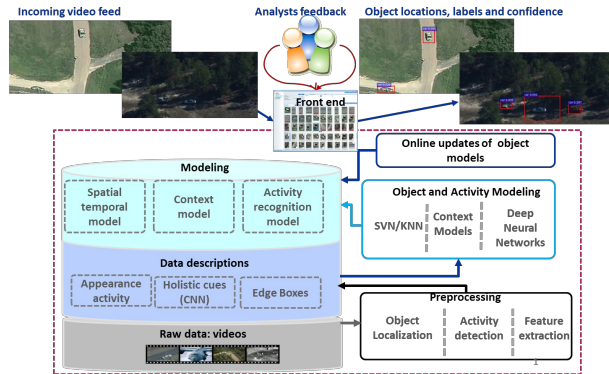
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WHAT

Operational Need and Improvement: Employment of advanced automated and semi-automated techniques enables enhanced identification opportunities from useful unseen data, and provides support to task saturated intelligence officers and staff. Future operations will require faster, more accurate methods to assess visual data that combine traditional human evaluation and automated techniques. Low-resolution quality of operational data, size of objects of interest, view occlusions, and crowded scenes degrade the performance of state-of-art region saliency and object recognition approaches applied to overhead sensor data.

Specifications Required: Automatically detect and recognize the multitude of objects of potential interest providing an object recognition decision with a high level of confidence - it is critical to understand the performance and performance evaluation; to perform object recognition/cueing in real to near-real-time on medium to high-end desktop computers;

Technology Developed: Mayachitra has developed technology to automatically detect and recognize objects of potential interest from overhead video and sensor imagery, which provides object recognition decision with a high level of confidence. Efficient and effective object recognition is performed in real to near-real-time and can be executed on low size, weight, and power (SWaP) Unmanned Aerial Surveillance (UAS) processors. Mayachitra's technology employs state-of-art deep learning and foveated video object recognition techniques to efficiently and effectively detect small objects from overhead noisy (crowded occluded) videos, where state-of-art models fail. The technology integrates a suite of the support modules to enhance user interaction.

Warfighter Value: Reduction in un-evaluated data from sensors used due to lack of resources required to evaluate the data collected. Reduction in workload for intelligence officers and their staff. Higher hit rate on targets of interest and less false alarms on innocuous or friendly objects. Tasks processed on the platform to reduce data smog.

WHEN

Contract Number: N68335-18-C-0199 **Ending on:** March 22, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Optimize the architecture design of the deep learning network to support small object recognition	Low	Prototype demonstration with relevant data sets	6	September 2018
Object recognition at multiple levels of description.	Low	Average precision	6	July 2019
Tune the modeling pipeline to meet precision recall demands	Med	Average precision	6	September 2019

HOW

Projected Business Model: Mayachitra's is initially focused on the Department of Defense (DoD) U.S Navy, U.S Air Force, and U.S. 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 battlefields 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 PMAs and NAVAIR Labs, to mature capabilities under technology insertion initiatives, adapt the capability to meet the needs of the greater UAS community, and deploy the capability through Navy program of record 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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