

VEHICLE TRACKING WITH COMMERCIAL ASSETS AT THE TACTICAL EDGE

PREDICTIVE VEHICLE ACTIVITY FOR IDENTIFICATION AND LOCATION (PreVAIL)

WHAT IS IT?

PreVAIL is an AI/ML toolbox that enables the stateof-the-art for satellite-based tracking capabilities by investigating a novel approach to automated target detection and recognition (ATD/ATR) using a novel neural network and predictive traffic analysis.

PreVAIL leverages commercial and military assets using sensor-agnostic algorithms to maintain custody of targets, even in periods of intermittent coverage, increasing Global Integrated Intelligence, Surveillance and Reconnaissance (GI-ISR) mission effectiveness.







WHY IS IT IMPORTANT?

- PreVAIL accurately predicts the vehicle location, orientation, and appearance before the target is acquired by the sensor
- PreVAIL algorithms can reveal subtle, anomalous vehicle behavior across multiple sensors, times, and locations
- Imagery analysts can locate the target within a scene sooner and with fewer false alarms, leading to faster target engagement
- PreVAIL allows for more flexibility by leveraging commercial and opportunistic surveillance assets
- PreVAIL's sensor-agnostic capabilities save time and allows for optimized use of ISR assets

HOW DOES IT WORK?

PREDICTION:

PreVAIL algorithms use machine learning and road networks to predict the appearance and orientation of target vehicles in future imagery.

DETECTION:

PreVAIL integrates traffic data and driving characteristics to determine the most probable search area for a given timepoint.

IDENTIFICATION & TRACK:

PreVAIL requires minimal information about previous detections and vehicle type to make accurate predictions of the future vehicle position.

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THE AIR FORCE RESEARCH LABORATORY

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BACKGROUND

Along with the creation of the AFRL Transformational Capabilities Office, the Explore group was formed to conduct broad market scans aligned with strategic demand signals to identify emerging transformational technologies and inform future investments. The pilot Explore campaign awarded seven feasibility efforts under three identified challenge areas: Aerial Re-arming and Logistics, Rapid Delivery of Personnel Recovery Kit, and Vehicle Tracking using Commercial Satellite Imagery. All awards concluded in FY22, and the Explore team evaluated feasibility and associated analytic studies to determine potential further investment.

After the feasibility efforts concluded, it was determined that the Predictive Vehicle Activity for Identification and Location (PreVAIL) effort was the top candidate to move forward to a phase-II award with strong strategic ties to current demand signals and efforts. The project lead, Dr. Andrew Stokes, carried this effort forward, coupled with two related SBIR awards that would augment the software work being conducted under PreVAIL. Together, these two pieces create a collective portfolio titled Space Based Tracking at the Tactical Edge. The goal of this portfolio is to create a cloud-based software application that incorporates the full range of satellite tasking and access with artificial intelligence enabled automated target recognition for processing, exploitation, and dissemination to track multiple targets by merging space-based sensor data with other sources.

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The Combined Air Operations Center (CAOC) at AI Udeid Air Base, Qatar, provides command and control of air power throughout Iraq, Syria, Afghanistan, and 17 other nations. The CAOC is comprised of a joint and coalition team that executes day-to-day combined air and space operations and provides rapid reaction, positive control, coordination, and de-confliction of weapon systems. (U.S. Air Force photo by Tech. Sgt. Joshua Strang)

agnostic algorithms to maintain custody of targets, even in periods of intermittent coverage, increasing Global Integrated Intelligence, Surveillance and Reconnaissance (GI-ISR) mission effectiveness.

ROADMAP

Phase I – AFRL Explore proof of concept completed (2nd Quarter 2022)

Phase II – Advanced algorithm development and basic UI/ UX (3rd Quarter 2022 – 3rd Quarter 2024)

Phase III – PreVAIL prototype and enhanced UI/UX, IOC architecture integration (TBD)

Phase IV – Prototype demonstration in exercise and IOC as Program of Record (TBD)



PreVAIL can enhance (orange) the dynamic targeting process of Air Force operations through its sensor-agnostic algorithms. An analyst can pull from a variety of data sources, including commercial satellite imagery, to predict the target pose and traffic patterns. This will enhance target custody capability and shorten re-acquisition timelines with limited ISR assets. (U.S. Air Force graphic)