

UAV Survey LLC

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A.I., Neural Networks, Computer Vision, Machine Learning, and Unsupervised Classification Enhancements for DoD Weapon Systems and ISR Platforms

Introduction

The concepts and associated technologies of Artificial Intelligence, Neural Networks, Computer Vision, Machine Learning, and Unsupervised Classification are not novel. These are capabilities that have been developed and integrated in various industries in various capacities within the last decade. However for the most part these technologies haven't necessarily been integrated into the weapon systems and Intelligence, Surveillance, and Reconnaissance platforms and other National Technical Means. This white paper will provide a high level look into how these capabilities could be integrated into DoD platforms and systems and illustrate how a Joint Venture partnership between Inc. and UAV Survey LLC could be the entities to bring this to fruition.

Issue

Artificial Intelligence (AI) technologies has not been effectively integrated into weapon systems and ISR platforms utilized by Department of Defense entities and the Intelligence Community. There are many ways in which AI can enhance and augment various systems, programs, and TTPs in the Department of Defense and the IC. This white paper will focus on two areas where AI can make a difference, one of which is a

Family of Systems (FoS) platform called Air Launched Effects (ALE), and the other is Small Unit Operations such as SOF.

Before we go on, for clarity I will go into a high level explanation of some of the AI technologies.

Artificial Intelligence: The simulation of human intelligence in forms such as learning, identification and problem solving.

Neural Network: A computational learning system that consist of an internetwork of neurons and algorithms which allow the network to autonomously identify patterns and objects from inputs.

Computer Vision: The discipline of AI that deals with the analysis and classification of images.

Unsupervised Classification: When a computer autonomously identifies objects or phenomena and properly groups the objects into homogeneous classes without intervention from a human user. If a user pre-defines the classes then it is called a supervised classification.

In October 2017 a memorandum was released by Army Chief of Staff General Milley named “Modernization Priorities for the United States Army.” It stated that their current capabilities weren’t sufficient to ensure the future overmatch of capabilities. The memo then recommended six areas of modernization that the Army should focus on to rectify the situation. They are as follows:

1. Long-Range Precision Fires capability
2. A Next Generation Combat Vehicle

3. Future of Vertical Lift
4. The Army Network
5. Air and Missile Defense capabilities
6. Soldier Lethality

While AI and its related technologies could benefit all six areas of modernization, this paper will focus on Future of Vertical Lift, more specifically the Air Launched Effects portion of the program.

The technical description of Air Launched Effects is a Family of Systems consisting of an air vehicle, payload, mission system applications, and associated support equipment designed to autonomously or semi-autonomously deliver effects as a single agent or a member of a team. One example of an ALE is the Altius-600 from the aerospace company AREA-I. The Altius-600 is an autonomous tube-launched UAS that can be deployed from air, sea, and ground launch platforms such as the UH-60, MQ-1C Gray Eagle, ground vehicles, and surface vessels. The modular payloads carry out SIGINT, Counter-UAS, ISR, and Kinetic missions. It has a range of 276 miles. I argue that the capabilities of the Altius-600 does not reflect the spirit of the “Modernization Priorities for the United States Army” memo because they don’t necessarily ensure the future overmatch of capabilities. The Altius-600 amounts to a novel way of launch/deployment with legacy functionality, which again does not necessarily amount satisfying the customer’s (The US Army) requirements of deploying new systems needed to regain the competitive advantage before the next first battle.

Solution

The convergence of Artificial Intelligence will represent the largest evolution of the Air Launched Effects program. It will significantly increase the capabilities of the complete platform (air vehicle, payload, mission systems application, and associated support equipment). AI Enhanced ALE (ALE-AIE) would also be closer aligned to the objectives laid out in the “Modernization Priorities for the United States Army.” Ensuring the future overmatch of capabilities in future battles.

The specific AI technology that would be the most effective with an ALE platform is called Computer Vision. Computer Vision utilizes a Convolutional Neural Network to properly identify, locate, and classify objects in images and video. Computer vision excels at pattern recognition and edge detection and can process large amounts of visual data rapidly. Due to its Deep Learning capability it has the ability to classify and segment the visual data autonomously via a process called Unsupervised Classification. An AI Enhanced ALE could identify camouflaged and dug in positions on the battlefield, anti-aircraft batteries, opposition order of battle, and troop movement all without the intervention of a human user. With battlefield network support, the data collected by the ALE-AIE platform could be sent via a downlink to Soldiers on the ground using the Army’s Integrated Visual Augmentation System (IVAS) platform. IVAS uses Augmented Reality (AR) Goggles which overlay critical information projected out to the environment via a holographic display that doesn’t sacrifice situational awareness like Virtual Reality Goggles does. This capability satisfies the 3rd, 4th and 6th priorities of the “Modernization Priorities for the United States Army.” which are Future of Vertical Lift, The Army Network, and Soldier Lethality respectively.

Figure 1.

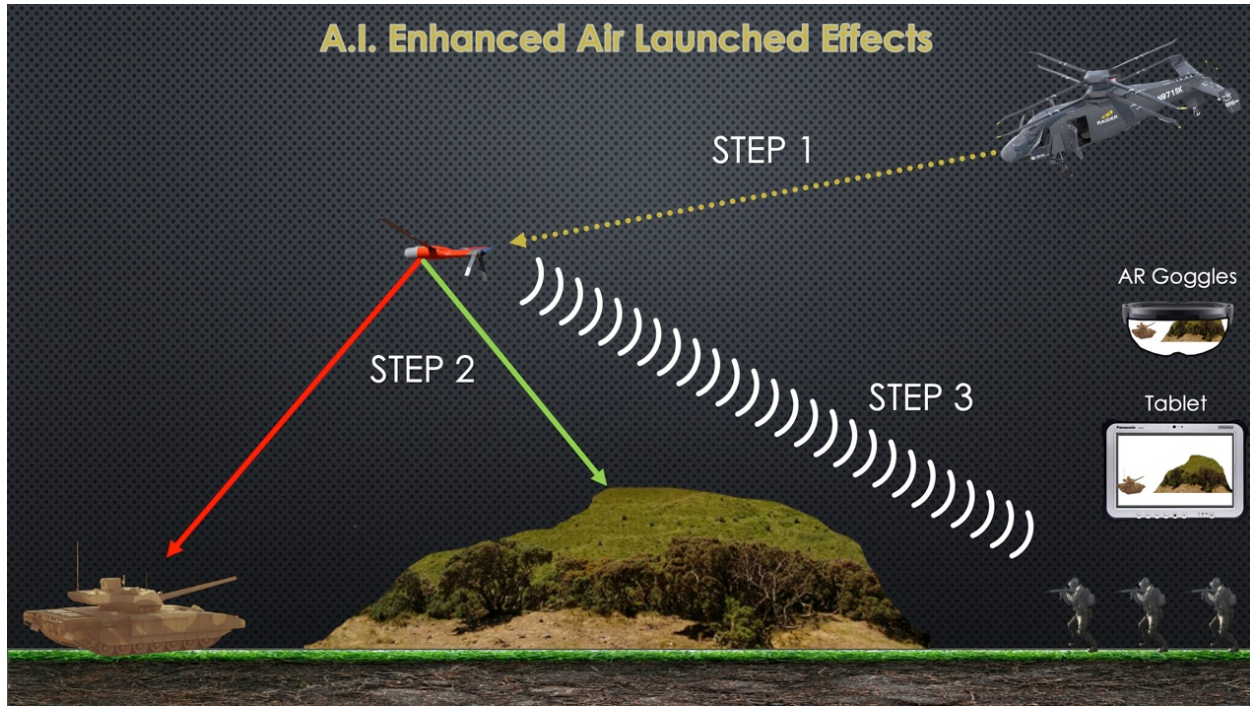


Figure 1. illustrates how AI Enhanced Air Launch Effects would work.

STEP 1. The Future Vertical Lift Aerial vehicle launches the ALE Aerial Vehicle and it flies a prescribed flight pattern while autonomously scanning and identifying objects.

STEP 2. The ALE vehicle autonomously scans the terrain using Computer Vision and correctly identifies and classifies a large hill as well as an enemy tank.

STEP 3. The ALE sends the processed data via a downlink to the AR goggles and tablet of the IVAS system of the soldiers on the ground providing them with near real-time situational awareness.

Benefit

Inter-networked, autonomous data collection and processing capability utilizing the Artificial Intelligence technologies of Computer Vision, Neural Networks, and Unsupervised Classification would truly modernize the Army's weapon systems and platforms. It would lighten the load of human analysts as well as make the data collection and dissemination process more efficient. Soldiers on the ground would benefit from increased lethality due to a marked increase of situational awareness and near real-time battlefield data.

This technology is feasible and is already applied in other applications such as autonomously driven cars, facial recognition detectors, and geospatial applications such as mapping and surveying. Research and development of this program could be facilitated via the OTA program, or via the Small Business Technology Transfer program where Vali Inc and UAV Survey LLC jointly partner with a non-profit research institution to develop and integrate this technology.

Proof

Kwasi Perry of UAV Survey LLC has a B.S. in Geography/Geospatial Science from North Carolina Central University Summa Cum Laude. While there he worked as a student research assistant at the Environmental Protection Agency. He then worked as a GIS Technician for Defense Acquisition Inc in Huntsville Alabama before deploying as a contractor for SOCOM in Iraq. The position that provided Kwasi the most experience

relevant to this project was working as a Federal Civilian Intelligence Officer for the National Geospatial Intelligence Agency in which he worked in Washington DC and Afghanistan. His roles in UAS and Satellite intelligence analysis, target vetting, Multi-Intelligence Fusion, Asymmetrical Warfare Support, and the creation of Geospatial Strike Packages gives him the knowledge and experience to understand how this technology convergence of AI and ALE would be extremely effective.

UAV Survey LLC has the opportunity to partner with Vali Inc and their vast experience in Army Aviation, military leadership, defense contracting with large DoD agencies such as the Missile Defense Agency. They form a vastly capable partnership capable of executing this project along with experienced and capable engineers and computer scientists located within the network of Vali Inc.