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Enabling AI/ML at the Tactical Edge

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Abstract:

SAIC's Tenjin enables warfighters to sense, make sense, and act in near real time in Denied Degraded Intermittent and Limited (DDIL) bandwidth environments. It provides Artificial Intelligence, Machine Learning (AI/ML), and data analytic capabilities in DDIL environments using SAIC's Edge Services Architecture (ESA), a lightweight, open architecture that is flexible and adaptable to support distributed operations for the Army of 2030 and beyond. Developed using ESA, Tenjin is small form factor deployable software that performs sub-second aggregation and fusion of real-time data at the edge. It hosts multiple AI models, including object detection, entity recognition, and speech to text, enabling rapid threat to targeting decision making through automated tagging, classification, and aggregation at the source. It also provides a visualization of AI model effectiveness to ensure confidence in dynamic operational environments.

Tenjin automates data tagging using streaming Attribute Based Access Control (ABAC) to secure data for US and Coalition partners, avoiding the need for manual intervention and cross domain solutions (CDS). Tenjin includes two approaches to improving AI models and performance at the edge. First, it provides easy-to-use no-code tools to rapidly create AI models in the field without special hardware, cloud, or network access. These models are immediately deployable in multiple formats, including ARM64, x86/64, and Web Assembly. Second, it performs inference on real-time edge data, evaluating and analyzing new sensor information to automatically improve performance of its edge-deployed AI/ML algorithms. For example, inference could adapt AI models to the current terrain or weather conditions.

Tenjin provides real-time monitoring and instant alerts on environmental changes or emerging threats, enabling real-time data-informed decision making. To do this, Tenjin uses SAIC's AI Feature Importance model to identify actionable data or other priority information, such as algorithm outputs or fused sensor data. It then prioritizes

transmission of critical data, optimizes the type and amount of total data transmitted, and sends data on the best network path using an Auto Primary Alternate Contingency and Emergency (PACE) algorithm. Before transmission, all data is compressed and encrypted to minimize bandwidth consumption.

Using Tenjin, SAIC:

• Reduced transmission of required sensor data from the edge by 74% using AI Feature Importance

• Performed vehicle classification in 10 ms using fused sensor data on microcontrollers with digital signal processing (DSP)

• Displayed classification in remote vehicle in DDIL environment in less than 1 second

• Synchronized 2.5K data records per second over Bluetooth