TTM Technologies
Time-To-Market Interconnect Solutions

Enhanced AoA Determination & Spoof Detection

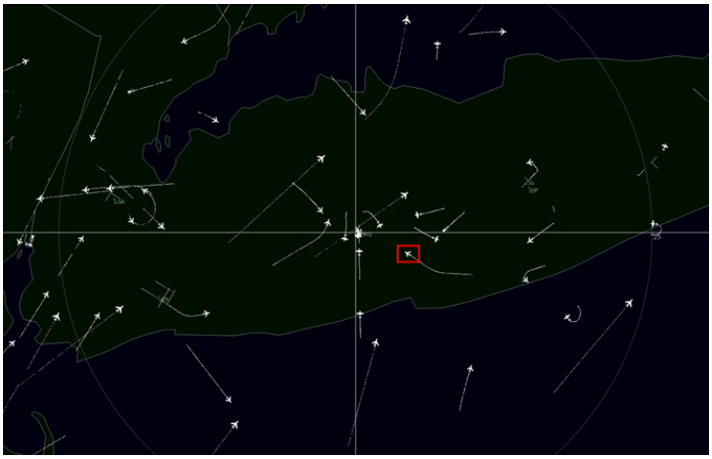
Machine Learning Enabled AN/UPR-4(V) PDRS

TTM continues to inspire innovation with the latest capability of Enhanced Angle of Arrival (AoA) and Spoof Detection using Machine Learning in the AN/UPR-4(V) PDRS. This capability provides increased situational awareness and flexibility in installation in an increasingly complex operational environment.

Solving Problems Through Innovation

The AN/UPR-4(V) PDRS (Passive Detection and Reporting System) is TTM's passive surveillance system that detects ADS-B messages from aircraft to create airspace situational awareness. It uses a six-channel antenna that allows the system to measure Angle of Arrival (AoA) of incoming messages based on amplitude comparison between channels. The AoA estimation accuracy is impacted by variations in antenna patterns, orientation of the antenna, and other real-world environmental effects.

ADS-B is not a secure protocol and the aircraft's GPS location transmitted in the ADS-B messages can be manipulated or "spoofed". Spoof Detection is possible by comparing the location reported in the ADS-B messages with the estimated AoA calculated by the PDRS. TTM's Innovation Cell used Machine Learning to increase the accuracy of the calculated AoA, thereby providing a more robust Spoof Detection function. The team implemented a Neural Network that achieved a significant improvement in accuracy. Additionally, Machine Learning allowed for proficient operation in areas of environmental RF degradation or antenna pattern issues.



Spoof Identification based on Angle of Arrival

This approach eliminates the need for pre-defined antenna pattern tables, providing a more adaptive and efficient solution. It determines the AoA without requiring knowledge of antenna orientation, antenna patterns, or other installation variations, thus enhancing accuracy and versatility.

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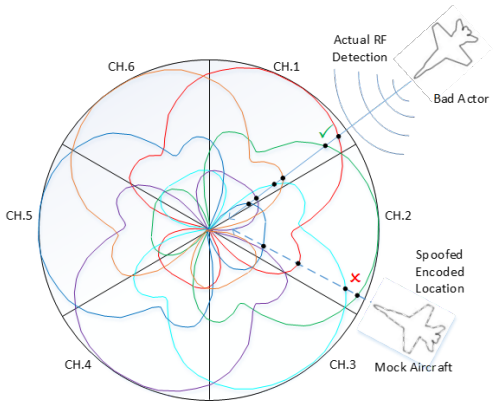
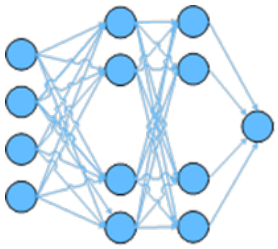


Spoof Detection Context Diagram



Multi-layered Neural Network (Generic Picture)

Enabling Features

Enhanced AoA Feature	Problem	TTM Advantage
AoA Determination using Passive RF Only	Traditional methods use a transmit pulse giving away their location.	No reliance on a transmit signal for AoA determination.
Agnostic to Antenna Orientation	Flexibility in installation is hampered by the need for a specific antenna orientation.	Enhanced AoA Determination is agnostic to the installed orientation (rotation) of the antenna, enhancing flexibility during installation.
Agnostic to Antenna Pattern Distortions	Antenna pattern distortions due to manufacturing variations and environmental effects require pre-defined tables for correction.	Enhanced AoA Determination is agnostic to distortions in the antenna pattern, eliminating the need for new pre-defined tables based on serial number or installation.
No Prior Knowledge of Antenna Pattern	Existing systems require prior knowledge of the antenna pattern.	Enhanced AoA Determination operates without prior knowledge of the antenna pattern.
Improved AoA Accuracy for Spoof Detection	Existing technologies may lack precision in AoA determination, degrading spoof detection.	Enhanced AoA Determination provides better accuracy in AoA correlating with increased accuracy in spoof detection.

Inquire with TTM Technologies on how to unlock the power of machine learning for enhanced AoA Determination!

Visit ttm.com for more information.

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Inspiring Innovation