Occlusion Handling in Radar for Detection of Wires and Pylons

Key-words: Polarization signature, Staring array, Interferometry, Pulse Doppler, Track before Detect, Occlusion predict and coast.

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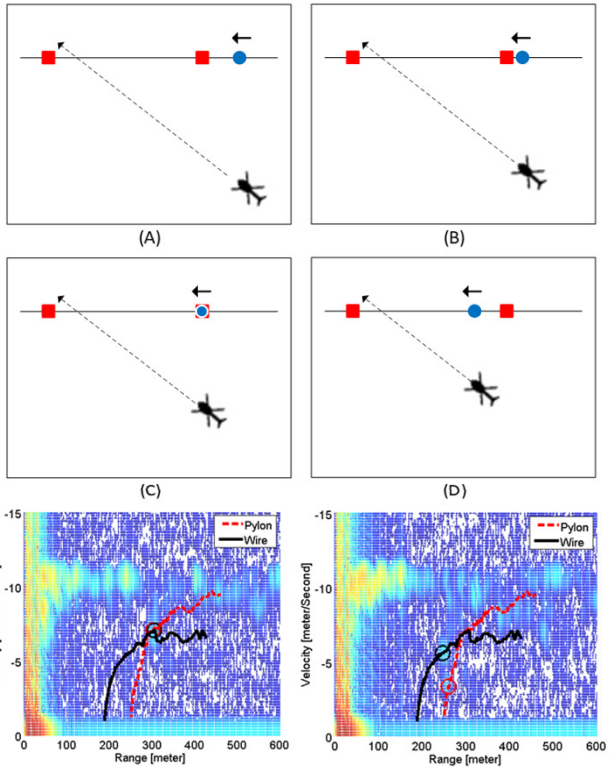
ABSTRACT

This paper deals with target occlusion in a staring array radar which detects Pylons and towers by their characteristic Polarization signature. A flood-light beam illuminates terrain with circular polarization and points of normal incidence (PNI) on such targets return specular echoes with linear polarization, received by parallel H and V channels. Azimuth angle is obtained by interferometry and pulse-doppler processing with advanced Track before Detect is used.

OCCLUSION

A situation in which the data from a target to the sensor is corrupted or masked by another target echo:

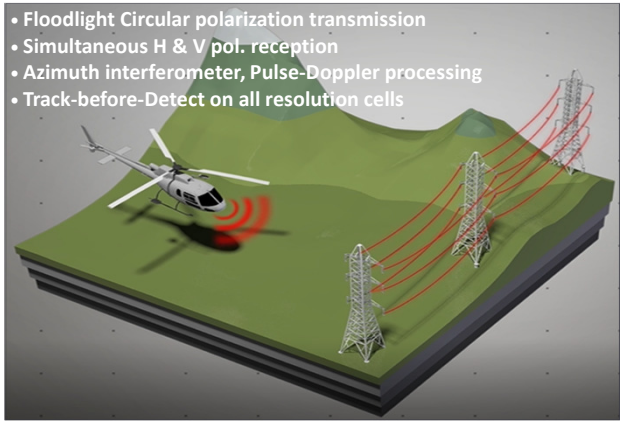
- **Line of sight**: when the targets and the sensor are situated on the same line when one of the targets is closer to the sensor than the other one
- **Proximity**: when two targets are closely-spaced and within the radar resolution interval so that the objects interfere with each other



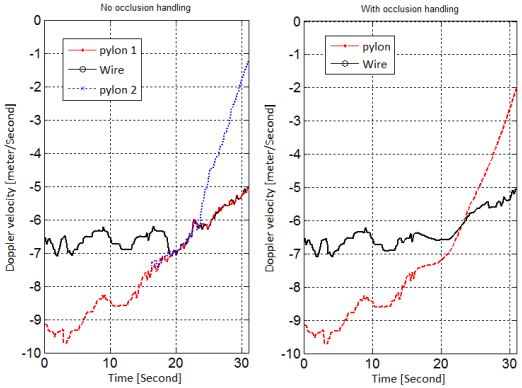
METHOD

When the distance between two tracks goes below 10m and 2m/Sec, the tracker ignores the measurements and uses the **kinematic model** only.

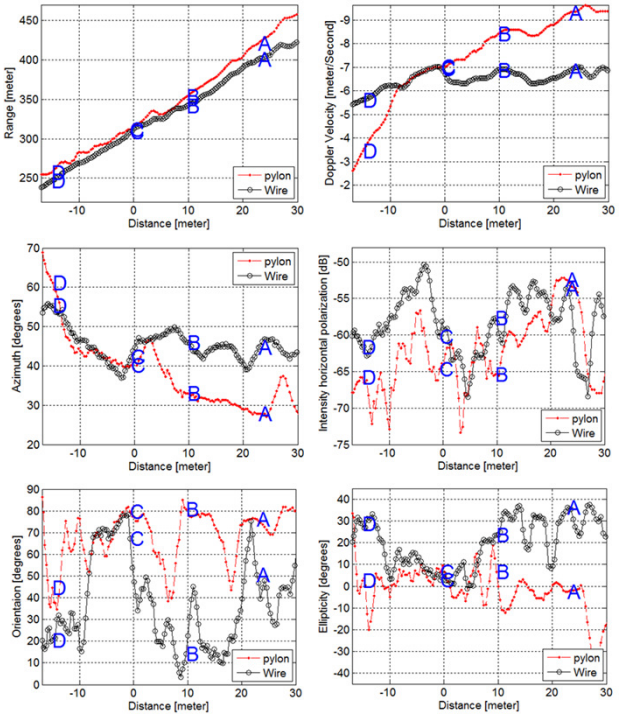
When the distance between the tracks goes above 10m or 2m/Sec, the tracker resumes its normal **measurements-based association process**



RESULTS



The tracks in the Doppler velocity vs. time space without occlusion handling (left), and with occlusion handling (right). Applying the proposed occlusion handling method, the Pylon is tracked continuously across the field of view.



The estimated range between the radar and the PNIs, Doppler velocity, azimuth, intensity measured in the horizontal polarization port, polarization orientation and polarization ellipticity of the Pylon (red dots) and the Wire (black circles).

CONCLUSIONS

Full or partial, occlusion is a challenge for trackers. When a tracker loses its track because of temporary occlusion, the continuity of the tracking is spoiled, and the Track-before-Detect strategy for detection is impaired.

Occlusion handling based on predicting the occlusion event and coasting the track using kinematic estimation has been implemented with good effectiveness in **RodRadar**'s **Rodeo**™ lightweight radar demonstrator for Helicopter protection.

The work reported demonstrates a method for confident Wire and Pylon tracking under occlusion situations, using real-world flight data. The algorithm strengthens "Track before Detect".