Detection of Moving Vehicles by Using Along Track Interferometry with TerraSAR-X Data

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ABSTRACT

The method to combine along track interferometry (ATI) and constant false alarm rate (CFAR) detection, referred to ATI-CFAR, is considered to be a promising method for ground moving target indication (GMTI). In order to evaluate its ability for GMTI with TerraSAR-X data, a set of experimental schemes and an improved ATI-CFAR method are presented. The results suggest that TerraSAR-X data can be well employed in GMTI, and the improved method based on the priori knowledge of coarse vehicle velocity is able to effectively improve GMTI.

RESULTS

The theoretical joint distribution model and false alarm probability (Pfa) are chosen as same as those in [1]. The detection thresholds are shown in fig. 3, where the phase threshold is estimated to be $T_p=\pm 0.43$ radians based on the minimum vehicle speed of 50 km/h, while the amplitude threshold is determined to be $T_m=T_g=7.78$, finally 16 moving targets are detected (Fig. 4).

Fig.3 Detection thresholds and results of moving targets in the M-P plane.

By comparing the two kinds of speeds derived from ATI phase and offsetting in azimuth direction respectively, 14 among 16 moving vehicles detected are considered to be reasonable, and their average speed is accordingly comparable with vehicle velocities measured by other means, the detection correctness is about 88%. The vehicle number on the target road section is estimated to be 20 calculated at average speed, and the detection rate is up to 70%.

Fig.4 Detection results of moving targets in SAR images, (left) the original position, (right) the position on the North Fifth Ring Road projected back along azimuth direction.

Fig.5 Comparisons between velocities of detected moving targets estimated from ATI phase and azimuth offset.

CONCLUSIONS

The experimental results show that TerraSAR-X data can be well used in GMTI. However, the phase threshold after CFAR detection might easily overestimated if directly utilizing the statistical properties of interferometric phase, and result in missing detection of moving targets. The proposed method based on the priori knowledge of vehicle velocity is able to effectively improve the GMTI performance in TerraSAR-X images.

MAJOR REFERENCES