# SAR-MTI Improvement Using *A-Priori* Knowledge of the Road Network

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***Abstract*— This paper focuses on the SAR-MTI processor improvement by using *a priori* knowledge of the road networks. The proposed technique is fit for civil applications where the traffic obeys to certain rules, such as being bound to a road with a predefined direction and complying, in average, with a velocity range. This possibility is demonstrated using a mixture of simulated and real data.**

## I. INTRODUCTION

Traffic monitoring using Synthetic Aperture Radar (SAR) is becoming an increasingly important research topic [1]-[12]. The main reason for this is the all-weather capability and large coverage area when compared with the conventional systems.

Automatic moving target indication (MTI) and velocity estimation using SAR is presently a challenge, being the subject of several recently published papers. Traffic monitoring using civilian SAR systems is really a difficult task when compared with the military ones. The main reason is that the systems available in this context typically acquire data with a single channel, or at best, have the possibility of using two channels, such as TerraSAR X [9] and RADARSAT-2 [12], although only in experimental mode.

It is well known that the moving targets, if processed as static ground, appear displaced and defocused in the SAR image. The displacement occurs mainly in azimuth and is proportional to the object across-track velocity. Therefore, the detection of this kind of targets may require searching vast regions of the SAR image.

To reduce the computational requirements of the SAR traffic processors, some authors already incorporated information about the road networks [9]-[12]. This information may prove useful to derive, among other features, the so-called displacement maps [9]-[10] which, put simply, provide information about the expected displacement from the corresponding roads of interest.

This paper, which elaborates on [8] proposes an additional improvement for SAR traffic processors by developing a strategy which incorporates directly in the SAR ambiguity function the *a-priori* knowledge of the angle for the road of interest. This enables the SAR ambiguity function to filter out automatically targets moving in unwanted directions. This improvement is very important in dense networks since the road under study will have many others nearby with different directions. These nearby roads may carry traffic which, otherwise, will be detected and may degrade the estimation accuracy of the traffic parameters of interest.

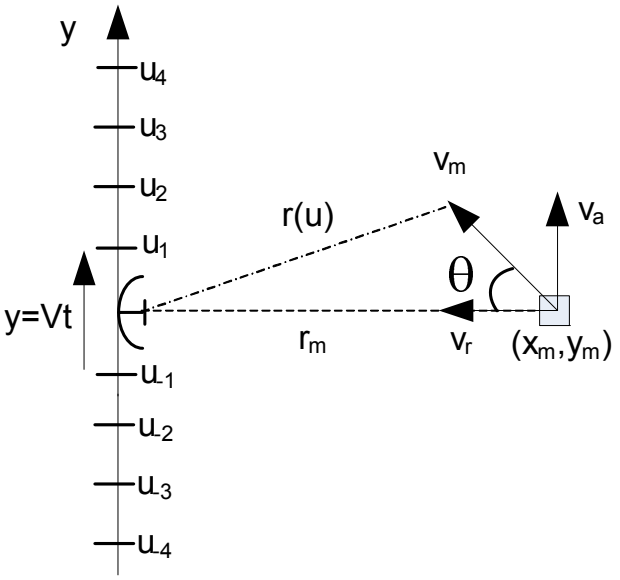


Figure 1. Considered SAR geometry.

The paper is organized as follows. Section 2 presents the modified SAR ambiguity function which is selective with respect to a predefined direction of interest. Section 3 focuses on the SAR traffic processor improvement using the modified SAR ambiguity function. Section 4 demonstrates the effectiveness of the proposed strategy using a mixture of simulated and real data. Section 5 draws the conclusions.