Contribution of multipath Direction of Arrival information to the reduction of localization ambiguities in around the corner radar

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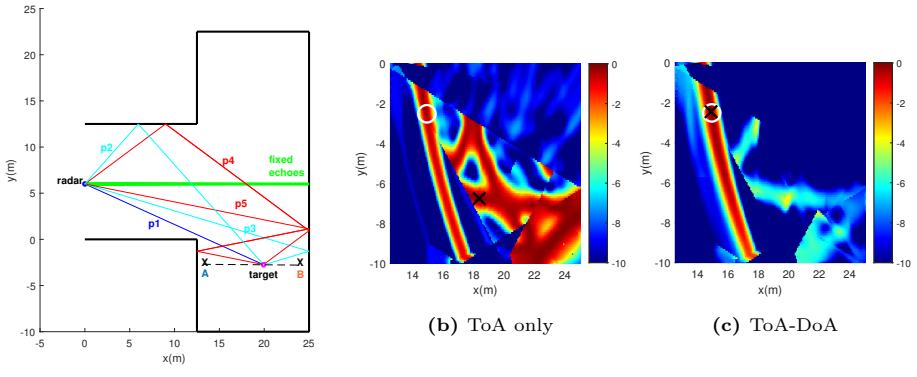
Abstract

Around-the-corner radar is aimed to detect and locate targets in the absence of direct line of sight (NLOS for Non-Line of Sight) exploiting multipath information. This emerging technique has a strong application potential, especially in the fields of surveillance and autonomous vehicles. Several works have been carried out on this topic during the last decade. Some pioneering works [1], [2] showed the feasibility of exploiting multipath to detect NLOS target. More recently, [3] proposed localization methods based on time-of-arrival (ToA) association. [4] introduced a multi-target localization method in NLOS. Deep learning is used in [5] for NLOS target detection and tracking in the automotive context.
Contrary to most of the studies where the target position in NLOS is deduced from the estimated intermediate parameters, [6] directly performs the detection test in the (x, y) target space with the Subspace Matched Filter (SMF)[8]. This approach enables to formalize the detection/estimation problem with multipaths in a similar way to that of conventional radar and is known to be more efficient [9]. However, its localization criterion, based only on ToA information, leads to high local maxima which correspond to ghost positions. The latter, similar to classical sidelobes, become the main source of estimation error in the presence of strong noise and create *localization ambiguities*.
In this work, we highlight the **contribution of multipath direction-of-arrival (DoA) information** to reducing NLOS target localization ambiguities. By considering an urban scenario (Fig 1a), the localization results on experimental data exhibit better performance of ToA-DoA model (Fig 1c) compared to the ToA-only model used in [6] (Fig 1b), with a lower estimation error. These results, that already improved over a single radar measurement, could be further refined by particle filter tracking [7] method over several measurements.



(a) Scenario

(b) ToA only

(c) ToA-DoA

Fig. 1: The scenario and the localization results for a NLOS position in the search area. The true human target position is circled; his estimated position is marked by a cross.

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