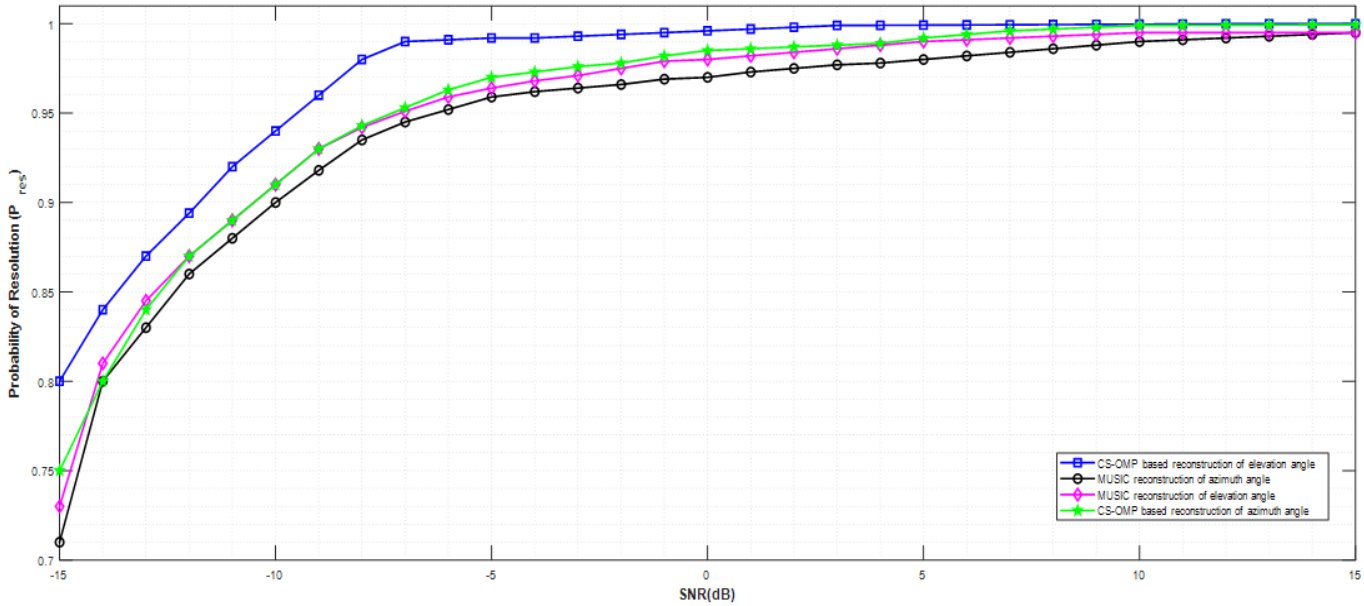

Figure 4. Plot of variation of probability of resolution (P_{res}) of DOA estimation with SNR

Table 3 shows the simulation of execution times of 2-D MUSIC and CS-OMP algorithms for DOA estimation. It is clear that the proposed method requires lesser reconstruction time as compared to standard MUSIC.

Table 3. Comparison of reconstruction time

Algorithm	Reconstruction Time (sec)
2D-MUSIC	0.053
Proposed CS-OMP	0.008124

At equivalent and high SNR values also CS-OMP based approach performs better as compared to MUSIC based estimate. The above interpretations turn out to be more apparent if we observe Figure 4. The error (RMSE) committed for elevation and azimuth angle estimation at lower SNR values are much lesser for CS-OMP based approach as compared to MUSIC. At higher SNR values, the error committed for MUSIC decreases, but CS-OMP based reconstruction commits considerable lower estimation errors.

Simulation results of Table 2, 3 and 4 are carried at $SNR = 0\ dB$, considering equivalent signal and noise power levels.

Decent estimation of the target locations by CS-OMP method at low SNR by single snapshot generate suitable application area in hostile environments, where the signal power is very less as compared to the noise power. This increases the prospect of development of an intelligent, cognitive radar system that can locate and track quasi-stationary objects, including human beings. The L-shaped array, with all its benefits in DOA estimation, together with compressive sensing based OMP reconstruction method can provide information of things or human lives trapped inside a building or behind a wall, to the military or police to take instant decisions. As modern day warfare practises are predominantly bound to urban combat, shrewd enemy or terrorists may deploy jammers and high power interferers to lower the SNR level, thus blocking possible tracking and locating their movements within a building. O'connor et al. [32] provides a good method to mitigate jamming and interferences up to a certain level, but the technique is based on GPS tracking, which may not be feasible always in urban battleground. Thus, CS-OMP based reconstruction method using a sparse L-shaped array structure can be implemented in a synthetic aperture radar (SAR) for through-the-wall-radar imaging (TWRI) applications in unfavourable circumstances.

In a severe multi-path consequence, as in a densely populated mobile communication environment, more accurate DOA estimation or localization of a source mobile station can be achieved in a single snapshot with low complexity by using the CS-OMP based sparse reconstruction approach with a L-shaped array at the base station. Consequently, the SNR is very low in a multi-path scenario with multi-path signals impinging on the receiver array from various directions from the same or different source. The proposed method can be used to identify or localize a source more accurately in a low SNR conditions with lesser complexity.

6. CONCLUSION

In this paper, we recommend a method of estimation of 2-D DOA of sources by single snapshot at the far field using an L-shaped array by compressive sensing. Orthogonal Matching Pursuit algorithm is used at the reconstruction. It is a greedy iterative algorithm which is single snapshot based. It requires less number of samples and much lower computationally complex compared to eigen-decomposition, like MUSIC. The failure rate and reconstruction time are also very low. The performance of the proposed method is compared with the standard MUSIC algorithm for 2-D DOA estimation, RMSE and probability of resolution measure. Simulation results show that the proposed method outperforms MUSIC, particularly at low SNR. This becomes more evident from the RMSE and P_{res} vs SNR (dB) plot. More accurate direction finding with lower complexity and single snapshot is achievable. The proposed method incorporated with the L-shaped array can lead to the development of synthetic aperture radar systems which can be a very effective in hostile situations, like urban warfare scenario. Also, base station antennas can be incorporated with CS-OMP based sparse L-shaped array for multi-path mitigation.

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