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# Infrared Small Target Tracking Based on Tensor Structure

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## INTRODUCTION & AIM

Infrared images are images generated by infrared imaging equipment based on the thermal radiation signals of objects on the surface. The detected target will not be affected by adverse weather conditions such as wind, snow, and fog, and has good environmental adaptability. Compared with visible light detection that can only be performed during the day, infrared imaging has the advantage of strong all-weather working ability. At the same time, the long observation distance makes it possible to detect targets earlier, which has significant advantages in the detection field. However, infrared images inherently have the characteristics of weak energy, few pixels, lack of shape, color, and texture information, and the existing infrared scene is increasingly complex, making the background and noise drown the moving target, and the general target tracking algorithm is difficult to accurately distinguish the target from the background, causing the target to be unable to be tracked normally. As the application range of infrared search and tracking system is gradually expanded, the scenarios and needs to be addressed become more complex and variable. Therefore, it is of great academic value and engineering practicality to analyze and study the infrared small target in complex dynamic environments and design a red-infrared small target tracking algorithm with higher precision, higher robustness, and better real-time performance.

## METHOD

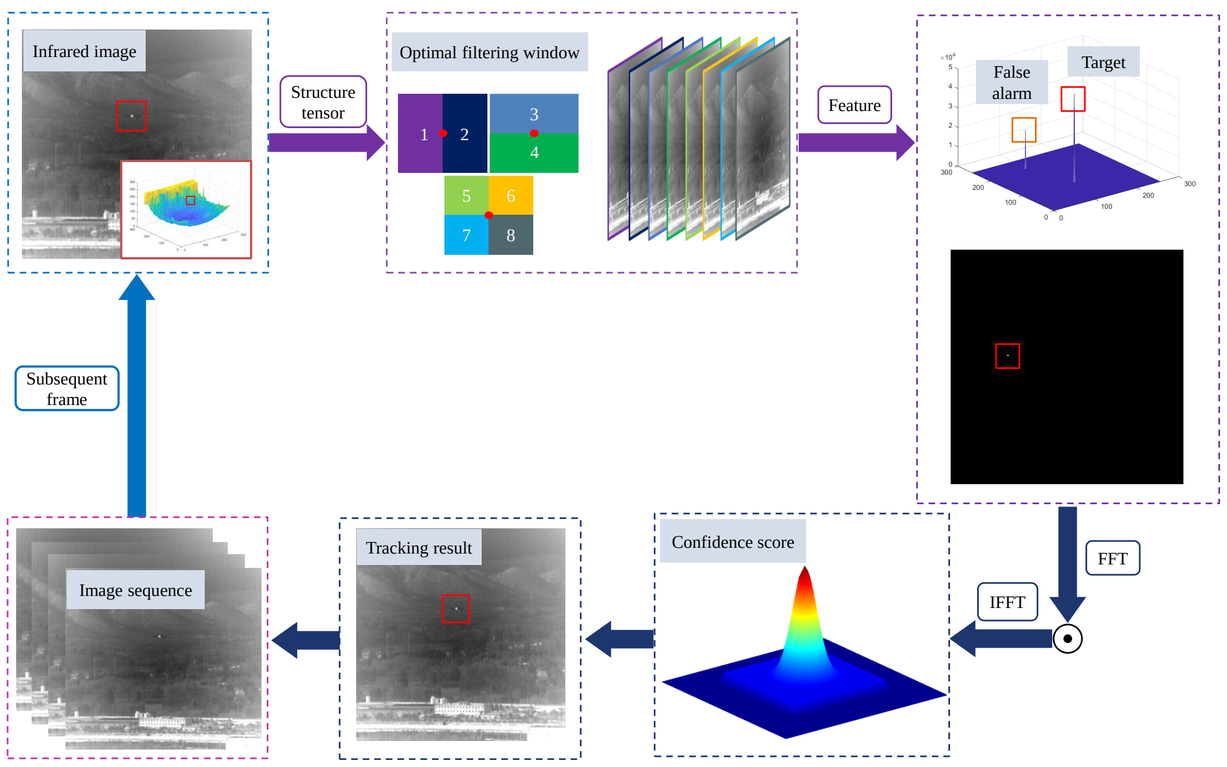


**Figure 1.** Illustration of the proposed method.

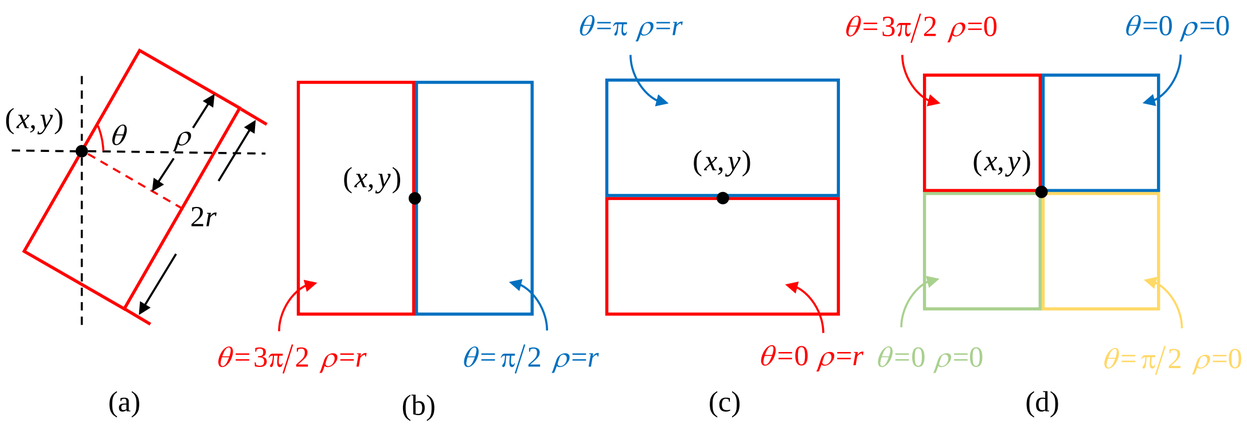


**Figure 2.** Filtering principle of the side window. (a) Pixels processed by the side window filtering window. (b)-(d) Eight possible directions of the side window.

## RESULTS & DISCUSSION

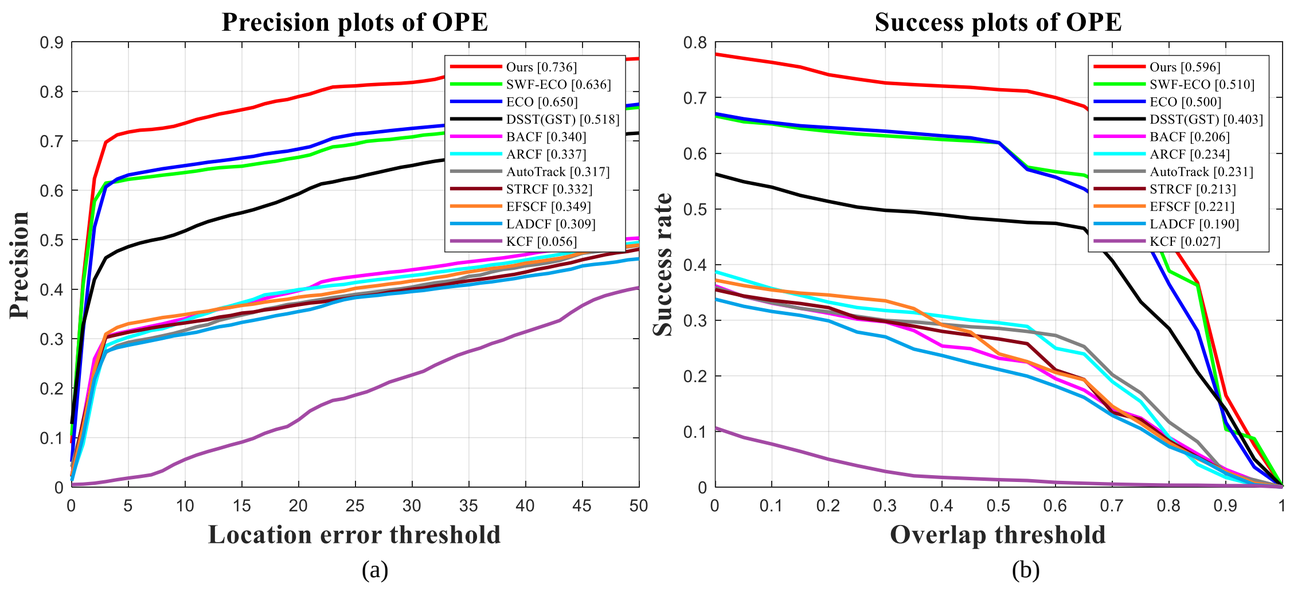


**Figure 3.** Comparison of tracking accuracy in different scenarios. (a) Precision plots. (b) Success plots

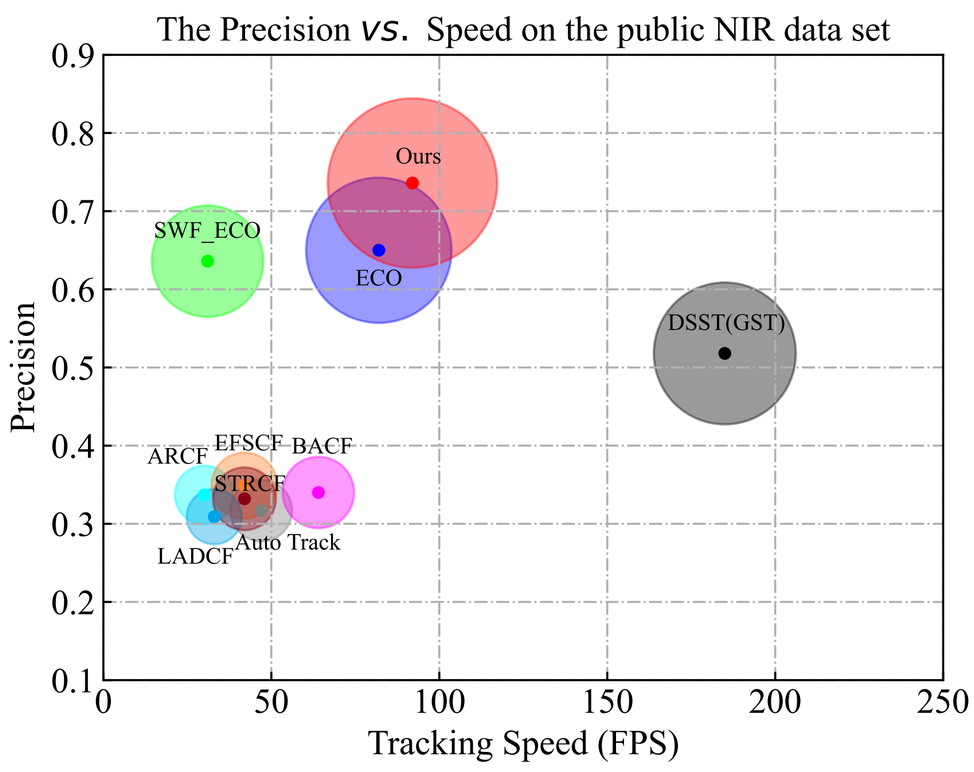


**Figure 4.** Comparison of comprehensive performance of different tracking algorithms (tracking performance depends on the area of the bubble).

## CONCLUSION

We propose a method based on structure tensor that can effectively realize infrared small target tracking in complex environment. Firstly, the features of the infrared small target are extracted by the structure tensor, and the edge preserving effect is achieved by using the side window filter, which filters out a large number of complex backgrounds and preserves the features of the small target well. Finally, the infrared small target is tracked by combining the advanced correlation filter tracking algorithm. The experimental structure shows that the tracking algorithm proposed in this paper improves the tracking effect of the correlation filter tracking algorithm on the infrared small target.