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ICIEA22-000320 UAV Recognition and Tracking Method Based on YOLOv5

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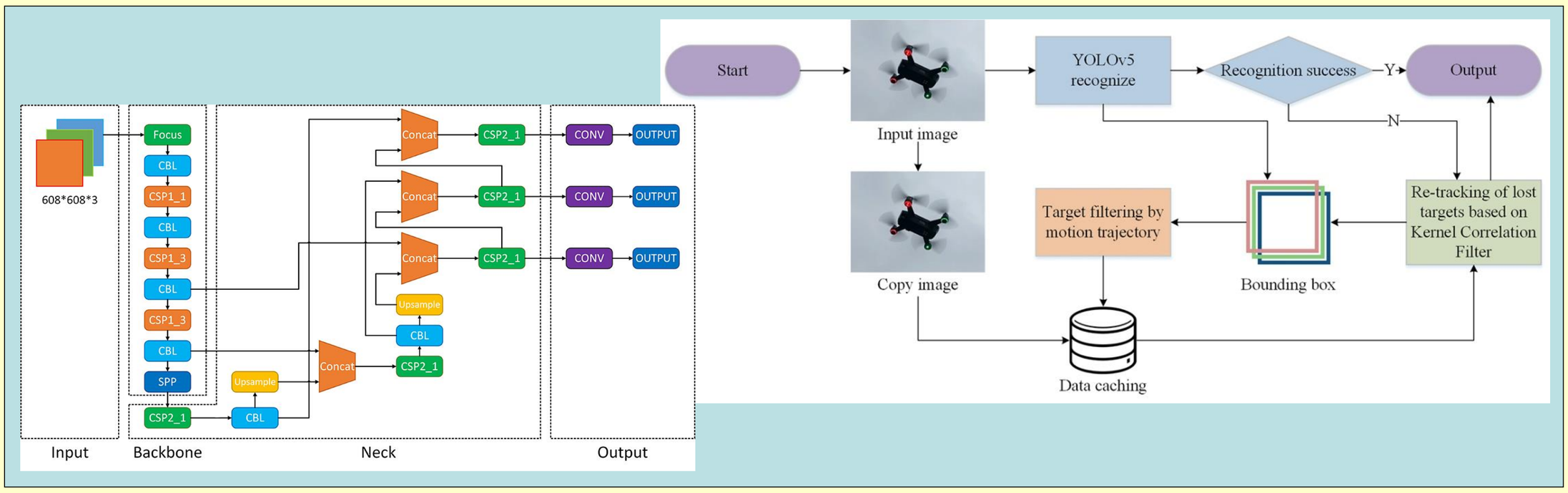
Image recognition method



The UAV interception device needs to maintain the same direction as the target to transmit jamming signals, therefore, it needs to obtain the target's position as continuously as possible. For this reason, firstly we use YOLOv5 to pre-identify UAVs, then cache the copy of the frame and the target's bounding box at the end of each recognition. After the UAV is recognized in the current frame, the coordinate of the target is obtained and the motion trajectory is constructed together with the cached coordinates from the previous frame. Similarly, in the next recognition, the motion trajectory of the post-frame target is constructed. Calculate the distance of the trajectory in the before and after frames, and when the distance deviates significantly from the previous n-frame range, the trajectory is judged to be abnormal and the bounding box is discarded. When the target isn't recognized by YOLOv5, the algorithm initializes and trains the Kernel Correlation Filter using the cached pre-frame images and bounding boxes to re-track the lost target in the current frame.

UAV Interception System

The main body of the UAV interception platform consists of an anti-UAV device, an image acquisition device, a steering base, and a portable computer. The video stream is transmitted to the computer via USB and handed over to the algorithm of this paper to identify the UAVs therein, and the output of the identification is transmitted to the steering base by wired means to drive the interception device to turn to the target UAV. After testing the platform, the result shows that the success rate of interception exceeds 90%

Summary

This work proposes a YOLOv5-based recognition and tracking method for UAVs to address the problem of poor UAV recognition in complex environments, combining trajectory filtering and Kernel Correlation Filter and using multi-frame as recognition objects to effectively improve the detection of UAVs. Experiments show that the algorithm in this paper achieves 77.64% precision and 75.3% recall, which are 9.13% and 11.54% higher than the original algorithm, and the detection speed reaches 27.64fps, which can achieve fast detection. The system tests show that deploying the algorithm in this paper to the UAV interception platform can efficiently track and intercept the invading UAV targets.