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ENHANCED MULTI-SENSOR DATA FUSION METHOD USING RECURRENT NEURAL NETWORK

Abstract

The failure of the mult-sensor navigation system can result in serious problems during the carrier operationand it highly costs to recover the system failure. To deal with this, the robust fault detection and isolation algorithm is required. The federated filtering structure has excellent fault detection and isolation capabilitiesand the interactive multiple model IMM is widely used in the detection and diagnosis of sensor and actuator faults, as well as the design of active fault tolerance control. The combination of federated filtering and IMM has received widespread attention.
At the same time, the navigation data of the integrated navigation system can be trained based on deep learning. Using recurrent neural networkRNNfor data prediction during signal loss can ensure the continuity and accuracy of the navigation system.
This paper proposes an improved INS / GNSS / Odometer carrier information fusion positioning method based on IMM and RNN. Firstly, this method combines adaptive interactive multiple model filtering (AIMM) and Federal Kalman algorithm to divide the integrated navigation system into two integrated navigation subsystems: INS / GNSS and INS / Odometer. Using the proposed algorithm, global information fusion is performed on the local estimates of the two subsystems, and the improved Kalman filter is used as a parallel model filter of the AIMM method to adaptively detect and process outliers in the measurement signal. Furthermore, this method is aimed at the case where the GNSS signal and the Odometer signal are lost, and the RNN is used to correct the error of the navigation system. First initialize the weights and thresholds of the model. When the GNSS signal and the Odometer signal are valid, train the network to correct the weights and thresholds. When the GNSS signal and the Odometer signal are missing, use the trained network data information to predict and complete the error correction. Simulation results show that the method can achieve multi-mode dynamic interaction and dynamic change. At the same time, in the case of GNSS and Odometer signal failure, the accuracy of the navigation service is improved. In comparison, this method significantly improves the robustness and reliability of navigation estimation.