

An Efficient Foreign Object Intrusion Detection Method For Ballast Tracks Based On Deep Segmentation Convolutional Neural Network

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High-speed trains mainly run on two kinds of track infrastructure: the ballast track and the ballastless track. Due to the influence of various factors, e.g., the vibration generated by the fast running of the train, the shock of wind and rain, and the irregular construction operation on site, a large amount of ballast often falls on the sleepers of the track. Once the high-speed train passes by, the ballast on the sleeper could bounce and land on the rail surface due to vibration and shock, causing significant vibration of the train and damage to the rail surface, which brings a considerable safety hazard to the driving safety. To avoid the occurrence of faults as much as possible and realize early warning of potential abnormal conditions, this paper proposes an efficient foreign object intrusion detection method for ballast tracks based on deep segmentation convolutional neural network. First, a lightweight instance segmentation network is proposed for the effective detection and segmentation of sleepers, fasteners, and foreign objects in the rail sleeper area. And then, according to the geometric shape and spatial distribution characteristics of foreign objects, a risk level criterion of foreign object intrusion is proposed to evaluate the degree of harm caused by foreign objects and guide on-site maintenance personnel to overhaul operations. The experimental results show that the method can quickly and accurately detect the intrusion of foreign objects on the track, improve the maintenance efficiency of on-site operation, and ensure the running safety of high-speed trains.