Preventing Trespasser Fatalities in NJ Transit Rail Lines Using a YOLO Single-Stage Convolutional Neural Network

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Pedestrian and vehicle trespassing is a significant problem in the railroad industry. According to the Federal Railroad Administration, 94% of rail-related deaths occur at railway crossings due to trespassing. These circumstances often happen due to individuals illegally taking shortcuts in off-limits rail zones or ignoring traffic signals at grade crossings. This is especially a problem present in NJ Transit rail lines, with there being reports every year of pedestrians or vehicles being struck by a train due to trespassing. NJ Transit collects a large amount of surveillance data across many of their rail crossings, but it is very expensive and inefficient to manually review this footage. My study proposes a preliminary implementation of a YOLO convolutional neural network to detect railway trespassers in video footage, creating anchor boxes around the train, pedestrians, vehicles, and railroads in the input data. My model improves upon previous models through the use of a single-stage for detection that improves speed and computational resources. This neural network, constructed using libraries from Darknet and YOLOv7, was found to be 100% accurate in its detections and has been tested in a wide variety of situations. The data collected from this can be used to provide NJ Transit necessary data regarding the types of crossings that are most dangerous for pedestrians, the times of day that trespassing occurs, and the typical causes of trespass. Future studies within this topic may involve a live alert-based system for trespass and the implementation of specific regions of interest the model may focus on.

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