A Deep Learning Approach for Street Pothole Detection

In this paper, for street pothole detection author proposed a method based on deep learning. There are four models trained and checked with a pre-trained dataset like YOLO V3, SSD, HOG, SVM, and Faster R-CNN. The appropriate data is collected and then transformed the labeled image file to a train used by the models as an input. Images were trained and labeled by creating a rectangular bounding box around the item on all of the training photos using the Lebelme tool. Hyperparameters are calibrated, and the size estimation of potholes is considered for more precise detection outcomes.

Index name	Description
Image size	72dpi*72dpi
Total categories	2
Total dataset size	2036
Training dataset size	1384
Test dataset size	652

Figure 1. Detailed statistics of the entire dataset

Size	YOLO V3	SSD	HOG	Faster R-CNN
200 Images	3 hours	4 hours	2 hours	2 hours
650 Images	4 hours	5 hours	3.5 hours	2.5 hours
850 Images	4 hours	5.5 hours	4 hours	3 hours
1000 Images	4 hours	6 hours	-	3.5 hours
1100 Images	4.5 hours	-	-	4 hours
1500 Images	5 hours	8.5 hours	-	6 hours

Figure 2. Time taken to train different models

Size	YOLO V3	SSD	HOG	Faster R-CNN
200 Images	53%	47%	24%	72%
650 Images	67%	59%	25%	71%
850 Images	65%	55%	27%	67%
1000 Images	69%	59%	-	69%
1100 Images	73%	-	-	60%
1500 Images	82%	80%	-	74%

Figure 3. Comparison of accuracy of different models

There was a significant decrease in localization errors. The paper presented that YOLO V3 architecture has more speed than other models. YOLO V3 has super speed, and accuracy rates are very high. Nevertheless, there were some errors in the detection of small objects. This work needs more improvement for the aimed project.

References:

[1] Ping, Ping & Yang, Xiaohui & Gao, Jerry. (2020). A Deep Learning Approach for Street Pothole Detection. 10.1109/BigDataService49289.2020.00039.