KF5012 – Software Engineering Practice

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Data Preparation and Integration Report

Data Motivation

The Glie-44 (model) is an object detection software, which identifies people from drone-mounted visuals to help security forces and other surveillance officers to monitor people in crowded places. The model has been trained on the Visdrone dataset, which consists of various aerial images of people in public places. The Visdrone dataset consists of images taken in various locations, in various conditions, and aerial views. But still, there is always a need to train the model with additional data. The reasons for introducing additional data to further train the model are mentioned below.

- To improve the accuracy of the model.
- To strengthen the model to identify people amidst challenging situations.
- To reduce errors in prediction.
- To improve the performance of the model.
- To reduce bias in the data.
- To prevent the model from memorizing the data.
- To avoid overfitting of the data.
- To increase the variance in the data.

Data Preparation

To further train the model, no additional dataset was used. Rather the same Visdrone dataset was transformed using the data augmentation to further train the model. The reason for selecting data augmentation instead of introducing a new dataset is, to train the model, the Visdrone dataset is used and it is stored in Google Drive. The Visdrone dataset took about 13 Gigabytes out of 15 Gigabytes of storage, which is a lot. By introducing any additional dataset may further consume the storage in the drive. So instead of introducing an additional dataset, the Visdrone dataset is transformed by using the data augmentation to train the model. This approach might save the storage in the drive as well as the effort to write additional lines of code to integrate an additional dataset.

The ColorJitter data augmentation technique was used to further train the model. Other data augmentation techniques like Resize, RandomHorizontalFlip, RandomVerticalFlip, RandomRotation, RandomErase, RandomPerspective, and Greyscale were also used during the training but while evaluating the performance of the model, these techniques did not show any tangible performance improvements but rather decreased the performance of the model. But when ColorJitter was used,

the model showed better performance. So only ColorJitter was selected to train the model and other data augmentation techniques were ignored.

A train function is used to train the model using the Visdrone dataset. An argument called preprocessing is given to the train function to pre-process the data, from the Visdrone dataset, before it is utilized for training and evaluation. The preprocessing argument takes the images from the dataset, and firstly, it applies ColorJitter to the images with a hue and saturation of 0.5, then it converts the images into tensors to inject them into the model for train and evaluation. In this way, the data is prepared before it is injected into the model for training and evaluation.

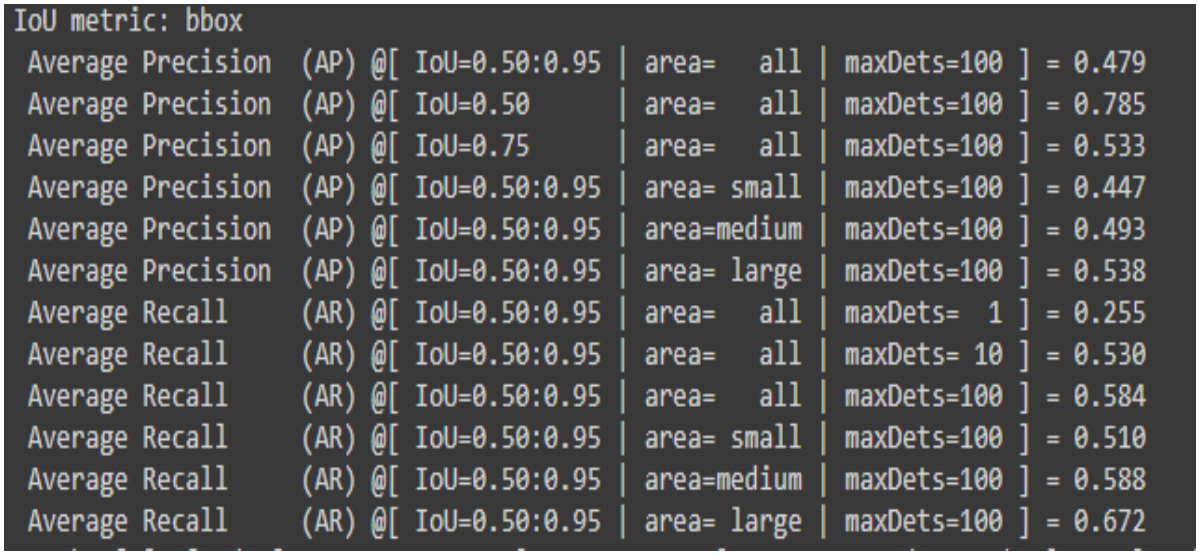

Figure 1: Performance of Glie-44 before adding additional data.

The transformed Visdrone dataset was integrated into the train function to train and evaluate the performance of the model. The performance of the model before and after integrating with the additional dataset was captured and is showed in Figure 1 and Figure 2. Figure 1 shows the results of the model before adding the additional data and Figure 2 shows the results of the model after adding the additional data.

The performance of the model is measured based on maximum average precision (mAP). Since the Visdrone dataset consists of about 16,000 images, so Figure 1 and Figure 2 show the results of the performance of the model, when the model was trained on only one out of a hundred epochs with only 10% of training and testing images for analysis.

```
IoU metric: bbox
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.502
 Average Precision  (AP) @[ IoU=0.50      | area=   all | maxDets=100 ] = 0.836
 Average Precision  (AP) @[ IoU=0.75      | area=   all | maxDets=100 ] = 0.538
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.476
 Average Precision  (AP) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.483
 Average Precision  (AP) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.696
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=  1 ] = 0.234
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets= 10 ] = 0.503
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=   all | maxDets=100 ] = 0.574
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= small | maxDets=100 ] = 0.536
 Average Recall     (AR) @[ IoU=0.50:0.95 | area=medium | maxDets=100 ] = 0.550
 Average Recall     (AR) @[ IoU=0.50:0.95 | area= large | maxDets=100 ] = 0.743
```

Figure 2: Performance of Glie-44 after adding additional data.

In Figure 1, the mAP of the model is 47.9%, whereas in Figure 2 the mAP of the model is 50.2%. This shows that the model, after adding the additional dataset, has outperformed the previous model by 2.3%. This shows that the performance of the model has increased by the integration of an additional dataset. Therefore, from the analysis, it is concluded that by the integration of additional data, the performance of the model has been improved.

Conclusion

Training is an essential phase of building Machine Learning software. The Glie-44 model was initially trained on the Visdrone dataset. But to avoid introducing a new dataset, data augmentation was used to modify the existing Visdrone dataset to further train the model to improve its performance. The ColorJitter data augmentation technique was used to further train the model. The performance of the model has been measured based on the maximum average precision. By calculating the mAP of the model, it proved that the model had shown better results after training with additional data. Hence, the performance of the model got improved by training it on additional data.