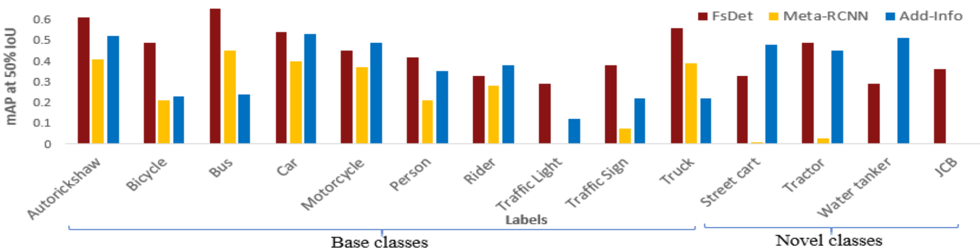

Figure 5: Classwise performance of metric-learning and meta-learning based techniques in detecting rare objects in IDD dataset. The last 4 classes represent the rare categories. FsDet, a metric learning based approach, performs better than meta-learning approaches in both base and novel classes.

4.3 Discussion

Our experiments uncovered several findings on the nature of road objects and the behaviour of few-shot object detection networks in the context of driving. Results from Tables 3 and 4 demonstrate that cosine similarity based TFA architectures (FsDet) outperforms meta-learning based architectures (Meta-RCNN, Meta-Reweight and Add-Info) on novel-class performance by 11.2 mAP points on IDD-10 (split 1) and 1.0 mAP point on IDD-OS split. We attribute lower inter-class distance between new object categories as the probable reason for the lower performance of meta-learning over similarity-based methods. This aspect of IDD makes it a unique dataset well suited for evaluation of few-shot object detection in a real-world, driving scenarios. Comparing the base class performance in Table 4 against the roofline performance metrics in Table 2, we demonstrate a lower degradation in base-class performance when adopting TFA architecture (FsDet) over its meta-learning counterparts, after the introduction of novel classes. Meta-learning techniques like Meta-RCNN and Add-Info suffer a significant reduction in base-class performance except when additional features were provided to the final prediction head of the object detector.

Figure 6 shows class-level confusion among all classes in IDD-OS split trained on 10-shot data samples using TFA architecture. In particular, the confusion between $truck$ vs. car, $bicycle$ vs. $motorcycle$ and $water\text{-}tanker$ vs. car classes are high, with the maximum being 40%. This observation can possibly be explained by the fact that road objects in context, share a large number of low-level features with other object classes, thus posing a challenge for few-shot algorithms to differentiate. This observation here is in line with that by the authors of MetaDet (**?**) that confusion between classes is the primary challenge in few-shot learning scenarios. This is further echoed by the authors of Meta-Reweight (**?**) that there exists a high confusion of 50% among classes in PASCAL VOC dataset.

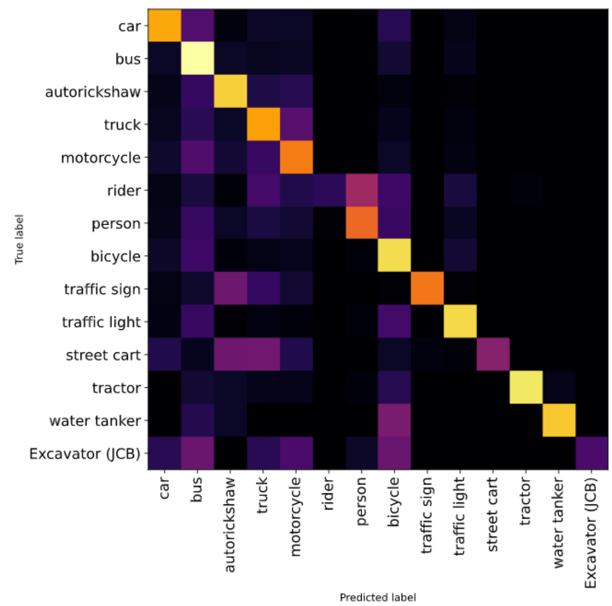

Figure 6: Confusion matrix plotted for class prediction results from IDD validation dataset showing confusion between classes when trained on IDD-OS 10-shot split on FsDet network.

5 Conclusion

We analyzed the performance of state-of-the-art methods for few-shot object detection, using a real-world dataset (IDD) which inherently contains class-imbalanced data from driving scenarios. Our evaluation of methods was for two tasks: same-domain and open-set representations. To evaluate these settings, we expanded a publicly available dataset with additional class labels in the open-set representation. By creating an extension of IDD, we hope to pave a way for many future works in few-shot learning with real-world datasets. Based on our experiments, we conclude that cosine similarity based TFA network (FsDet) outperforms meta-learning based networks in both the tasks by 11.2 and 1.0 mAP points in novel class performance respectively. We conclude that meta-learning networks while achieving great strides, tend to under perform even simpler baselines from metric-learning based methods. We also observe that class-confusions remains an open challenge in any few-shot learning paradigm and can be the focus of further improvements.

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