IDD: A Dataset for Exploring Problems of Autonomous Navigation in Unconstrained Environments

1st John Lorance William
Nile university
J.Lorance@nu.edu.eg

2nd Nadeen Mohammed
Nile university
n.farid@nu.edu.eg

3rd Nadine Walid Abdallah
Nile university
N.walid@nu.edu.eg

4thNouran Hady Shaaban
Nile university
N.hady@nu.edu.eg

5th Sama Ahmed Okasha
Nile university
S.Okasha@nu.edu.eg

I. Introduction

The rise of autonomous driving technology has promised to revolutionize transportation by reducing accidents, decreasing traffic congestion, and increasing energy efficiency. However, the development and deployment of self-driving cars have been fraught with challenges. Safety is a crucial issue as autonomous cars are still prone to accidents and mistakes. Additionally, there are ethical concerns around how autonomous cars ought to act in specific circumstances, such as choosing to save passengers or pedestrians in the case of an inevitable collision. Additionally, there are regulatory and legal difficulties, including the requirement for new guidelines and rules to guarantee security and handle liability concerns. Despite these limitations, the potential advantages of autonomous driving technology remain enormous, and continuing research and development in the subject might result in a safer, more efficient, and more sustainable future for transportation

II. Background

According to P. Bhargava [1] the India Driving Dataset (IDD) is used to address the issue of incremental learning in object detection rather than the present algorithms, which perform poorly when evaluated on different data distributions. The strategy makes use of numerous domain-specific classifiers as well as efficient transfer learning methods that are designed to prevent catastrophic forgetting. On linear layers, for instance, they used Faster RCNN, Baseline Models. They concluded that these transfer learning strategies work well together and prevent information loss as they adjust to various target distributions [1]. With only a small number of input samples, Few-Shot Object Detectors (FSOD) are tasked with locating and classifying objects in an image. An Attention Guided Cosine Margin (AGCM), which enables the development of tighter and wellseparated class-specific feature clusters in the classification Identify applicable funding agency here. If none, delete this. head of the object detector, was created to overcome these drawbacks in metric learning-based FSOD approaches. Catastrophic forgetting is reduced by the Attentive Proposal Fusion (APF) module, which was added to AGCM, by lowering intra-class variation among co-occurring classes. The tests were used on the India Driving Dataset (IDD), which offers the well-known FSOD benchmark PASCAL-VOC alongside a realistic,class-imbalanced environment [2]. The India driving dataset is a very special kind of dataset, as it contains unstructured data and cityscapes as well. The India driving dataset mainly solves domain adaptation, fewshot learning, and behavior prediction in road scenes [3]. As a result, many solutions were proposed to the India driving dataset. One of the significant models was a model with new architecture Eff-UNet model. In this model it was successfully used the EfficientNet as an encoder for feature extraction and in combination with UNet decoder for the segmentation of the fine-grained segmentation map. This solution achieved 0.7376 and 0.6276 mean Intersection over Union (mIoU). And won first prize in IDD lite segmentation challenge outperforming other approaches in the literature [4]. METEOR present a new and complex traffic dataset, which captures traffic patterns in unstructured scenarios in India. METEOR is a unique dataset in terms of capturing the heterogeneity of microscopic and macroscopic traffic characteristics. Furthermore, they provide annotations for rare and interesting driving behaviors such as cut ins, yielding, overtaking, over speeding, zigzagging, sudden lane changing, running traffic signals, diverse traffic scenarios corresponding to rainy weather, nighttime driving, driving in rural areas with unmarked roads, and high-density traffic scenarios. they use our novel dataset to evaluate the performance of object detection and behavior prediction algorithms. they show that stateof-the art object detectors fail in these challenging conditions. [5]. As autonomous driving and assistance systems understand

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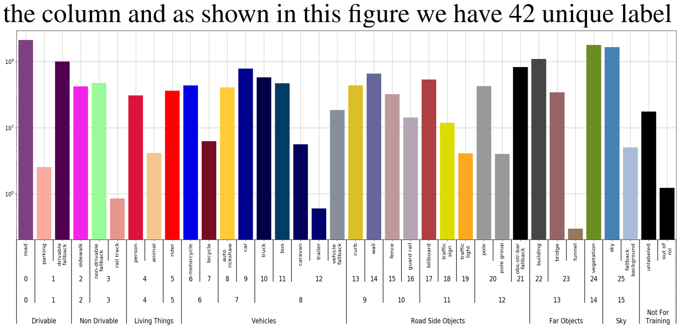
III. Methodology

A. Dataset

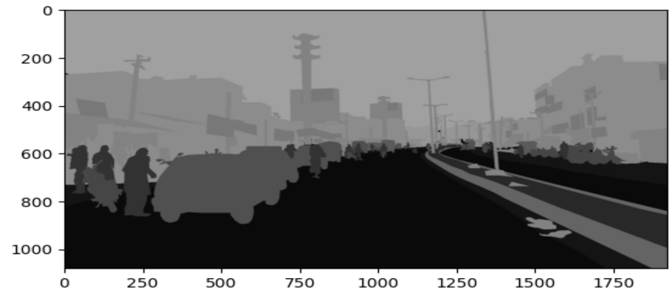
The Indian Driving Dataset (IDD) was generated by simply installing a camera on the front of the car and then tagging the items to make it helpful for supervised learning. It is a remarkable dataset that deals with the unstructured driving environment. The dataset includes roughly 10,000 images with fine semantic segmentation annotation; 20,000 images with fine semantic segmentation annotation (14K Train, 2K Val, 4K Test) from 350 drive sequences were released in 2018. It was applied in many different contexts and addressed a wide range of issues, including semantic segmentation and object detection. The data collection contains various variables that are helpful in each of these various contexts. There are numerous architectures that were created using these models, and each of them had a unique outcome that was enhanced by the special dataset and performed well. Therefore, it might assist in lowering the hazard posed by these autos and aid in their maintenance.

B. preprocessing

we start preprocessing the data by creating two columns: one for storing images and another for storing JSON objects. starting with the JSON file which has 3 attributes (imgHeight: which tells the height of the image,imgWidth: which tells the width of the image, objects: it is a list of objects, and each object will have multiple attributes).in the beginning we started to see how many unique objects are there in the JSON file by making a function that read and store all the objects present in JSON file by iterating through each file in the column and as shown in this figure we have 42 unique label



then we extracted the polygons from the JSON files by iterating through each of the objects in that file, appending labels to a list, and creating a list of vertices for each polygon. moreover, we created Image segmentations by drawing a set of polygons by creating a list of files that are in the JSON format and creating an empty list called mask that iterates through each file in the JSON list to create a polygon for each label and saves this image as a new file . Finally, it returns the mask list which is now all saved images and loops through each file, and creates an image and draws a polygon on it as shown in this figure



C. model

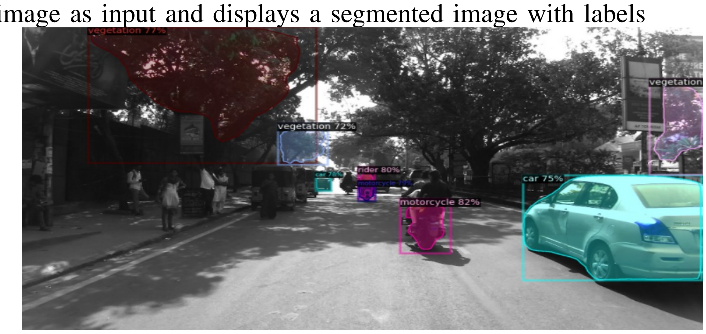
As for our model, we decided to use detectron for instance segmentation using coco format for the dataset. furthermore, we started the implementation for our model by defining a function that takes in two parameters: directory, which is where the data will be stored, and classes, which is iterable of strings that represent the different types of objects to be detected. then we decide what datasets will be used for training and testing, set up some weights for the model, specify how many iterations should be run on each batch of data and Finally, load the model with its own set of weights and settings so that we can test our results against them after that we create a predictor using your model weights to use it on loaded image with outputs being a list of predictions for each pixel in the input image. finally, we create a configuration file for detectron2 and that uses an image as input for the predictor object's prediction function and outputs predictions in a list called "instances". Then, draws these predictions on the top of an instance and finally displays it

D. deployment

we worked on our deployment by starting to define the weights of the model and downloading it and then we made our prediction function that takes the input image and predicts the image in a way that removes the colors of unsegmented pixels to display the segmented image with labels

IV. Results and Analysis

working on Indian driving dataset has been a challenging task as most of the researchers used Mask,rcnn , YOLO5,Unet and Canet .but we decided to try and train a new model on IDD which is detectron that no one tried it before . we tried to calculate the accuracy of our model by using COCOEvaluator but as it requests high computation power we could not calculate it but as soon as we have it, it will be calculated . as this figure shows the results of our model as it takes an image as input and displays a segmented image with labels



V. Conclusion

The India driving dataset is a very special kind of dataset, as it contains unstructured data and cityscapes as well. The India driving dataset mainly solve domain adaptation, few-shot learning and behavior prediction in road scenes. we analyze the label statistics and the class imbalance present in the dataset. Our dataset on instance semantic segmentation is different from those already available because it was collected in India, where there are more variances in the appearance of both traffic participants and background classifications. In the future, we plan to work more on developing detectron to work on instance semantic segmentation and calculating its accuracy as it will be new challenging task for us

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