Inventory Monitoring at Distribution Centres

1.Domain Background :

Inventory monitoring at distribution centers involves tracking the movement and quantities of goods within a warehouse. Real-time visibility into inventory facilitates demand forecasting, efficient replenishment, and timely order fulfillment, enhancing customer satisfaction and operational efficiency. This domain plays a critical role in supply chain management, enabling businesses to meet consumer demands while minimizing costs and maximizing profitability.

Before the digital age, there was a lot of manual effort involved including manuaaly counting the items. With the digital powers, these task can now be automated.

2.Problem Statement :

To effectively manage inventory , an automated system can be very useful to reduce manual errors and increase efficiency. The Computer vision process can help in automating and helping with cost efficiency as well.

3. Solution Statement : Computer vision can be used to solve this problem. To complete this project we will be using the Amazon Bin Image Dataset(opens in a new tab). The dataset contains 500,000 images of bins containing one or more objects. For each image there is a metadata file containing information about the image like the number of objects, it's dimension and the type of object. For this task, we will try to classify the number of objects in each bin.

The training will be done in AWS stack primarily on AWS Sagemaker. PyTorch will be primary framework.

Storage – S3
Platform – AWS SageMaker

4.Benchmark Model : CNN can be used as a benchmarking model. The amazon bin challenge can also be used as a reference https://registry.opendata.aws/amazon-bin-imagery/

5. Evaluation Metric : Various

Classification model metric's can be used as evaluation metric. The overall accuracy can be used for evaluating metric

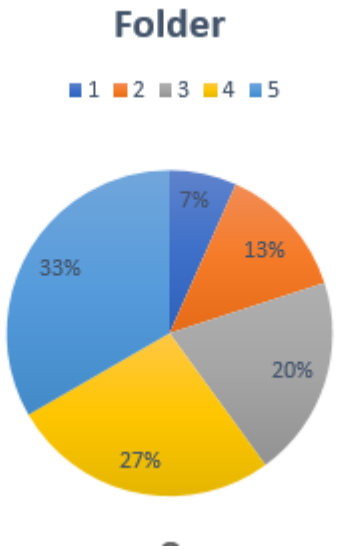
6. Dataset Explorations : The data taken from Amazon Bin Image Dataset. The data is downloaded in such a way that the folder name has the images containing number of items in the bin. The dataset is divided into training , validation and testing datasets. These datasets are loaded into S3 locations and used to train the model.

```
Downloading Images with 1 objects
100%|██████████| 1228/1228 [01:35<00:00, 12.91it/s]
Downloading Images with 2 objects
100%|██████████| 2299/2299 [03:03<00:00, 12.50it/s]
Downloading Images with 3 objects
100%|██████████| 2666/2666 [03:45<00:00, 11.82it/s]
Downloading Images with 4 objects
100%|██████████| 2373/2373 [03:20<00:00, 11.86it/s]
Downloading Images with 5 objects
100%|██████████| 1875/1875 [02:34<00:00, 12.13it/s]
```

7. Dataset visualization and distribution:

The dataset is retrieved from https://registry.opendata.aws/amazon-bin-imagery/. The data is downloaded in such a way that the folder name has the images containing number of items in the bin. The data is distributed as seen in below table.

Folder	Count
1	1228
2	2299
3	2666
4	2373
5	1875



The data is not evenly distributed.

8. Implementation details :

The implementation Algorithm is done using resnet50 Pretrained model. The dataset is divided into training , validation and testing datasets. These datasets are loaded into S3 locations and used to train the model. The framework used is PyTorch and the techstack used is AWS Sagemaker.

9.Algorithm Details :

The algorithm is built using the CNN method. In this, the dataset is fed into the network like neurons , connected to each other and output is produced. The Deep Learning framework used is PyTorch and pre-trained resnet50 model. S3 is used as storage for deeding into the model built on AWS Sagemaker techstack

10. Model Evaluation / RESULT :-

Below is the result from the run done. The accuracy achieved is 22.6 % as seen in below screenshot.