Capstone Project Proposal for

Inventory Monitoring at Distribution Centers

1. Domain Background

Inventory monitoring at distribution centers is a crucial task for businesses that deal with many products. It involves tracking the number of items in each bin and ensuring that the correct number of items are delivered to customers. This task is often performed using robots that move objects in bins. Machine learning can be used to automate this process and make it more efficient. In this project, we will apply what we learned and use AWS SageMaker and good machine learning engineering practices to build a model that can count the number of objects in each bin.

2. Problem Statement

Inventory monitoring at distribution centers is currently facing significant challenges due to outdated monitoring systems and lack of real-time data. These issues have led to an average increase of 15% in warehousing costs and a 20% decrease in order fulfillment.

Distribution centers often use robots to move objects as a part of their operations. Objects are carried in bins which can contain multiple objects. In this project, we will have to build a model that can count the number of objects in each bin. A system like this can be used to track inventory and make sure that delivery consignments have the correct number of items.

3. Datasets and Inputs

The dataset we will use is the Amazon Bin Image Dataset which contains over 500,000 images and metadata from bins of a pod in an operating Amazon Fulfillment Center [1]. The bin images in this dataset are captured as robot units carrying pods as part of normal Amazon Fulfillment Center operations.

Since the dataset is large, we were provided a subset of it to use in this project. Our data are 5 folders named 1 to 5, each representing the number of objects in each image in that folder.

4. Solution Statement

To come up with a solution for our problem, we will utilize the State-of-the-Art techniques of Computer Vision tasks to do our multi-class image classification. We will use transfer learning and a pre-trained convolutional neural network to solve our problem.

5. Benchmark Model

Training a classification model or a CNN from scratch to create a benchmark model to compare and validate our pre-trained transfer learning model with.

6. Evaluation Metrics

I am going to use classification report to best describe the performance of our classification model. As the report includes f1-score, precision and recall and the mean overall accuracy of the model, we can evaluate our model accordingly.

7. Project Design Pipeline [2]

i. Data preparation:

- Download a subset of the data.
- Preprocess and clean the data.
- Upload train, test, and validation files to an S3 bucket so SageMaker use them for training.

ii. Write Model Training script:

- Read, load, and preprocess our training, testing and validation data.
- Choosing the pre-trained model, optimizer and loss function we will be using.

iii. Train our CNN Model with SageMaker:

- Define our instances type and count for training.
- Hyperparameters tuning.

8. References

[1] https://github.com/awslabs/open-data-docs/tree/main/docs/aft-vbi-pds
[2] https://github.com/udacity/nd009t-capstone-starter