Capstone Proposal

- **Domain Background:**

The Amazon Bin Image Dataset is a collection of images of products stored in Amazon fulfillment centers, captured by mobile robots as they travel around the facilities. The dataset presents an opportunity to develop an object recognition system for identifying products based on images of their packaging.

- **Problem Statement:**

The problem I am investigating is how to accurately classify images of products sold by Amazon using machine learning techniques. The goal is to develop a model that can accurately identify the number of products in bins, which can be used to improve the inventory and the delivery systems on Amazon's Warehouses.

- **Datasets and Inputs:**

I will be using the Amazon Bin Image Dataset, which is available on the AWS Open Data Registry. This dataset contains images of products that have been sold by Amazon, along with metadata about each product. The dataset is large, containing over 500,000 images, which will provide a robust set of data for training and testing the machine learning model. To prepare the dataset for use with ResNet50, I will resize the images to match the expected input size of 224x224 pixels, which is required by the algorithm. Then, the dataset will be split into training, validation, and test sets in a ratio of 60:20:20.

A sample image from dataset

- **Solution Statement:**

The solution proposed for the problem is to use a pre-trained ResNet50 model and fine-tune it on the Amazon Bin Image Dataset. Fine-tuning involves training the model on a new dataset, but starting with pre-trained weights, allowing the model to learn from a large dataset without requiring a lot of labeled images. Additionally, we will perform hyperparameter optimization to fine-tune the model by tuning the learning rate and batch size to achieve the best performance. Then the model will be trained and deployed to AWS Sagemaker.

- **Benchmark Model:**

A simple Convolutional Neural Network model will be created for benchmarking, and the accuracy will be calculated. Then, a pretrained model will be fine-tuned and the results will be compared. The PyTorch library will be used for creating the CNN model.

- **Evaluation Metrics:**

The evaluation metrics used to measure the performance of the model will be accuracy and Cross Entropy Loss function. Accuracy measures the percentage of correct predictions.

- **Project Design:**

The project will be implemented in Python, using TensorFlow and Keras frameworks for deep learning. The steps involved are as follows:

1- Data preprocessing: resize images to 224x224 and normalize pixel values to the range [0,1]

2- Split Data into train, test and evaluation subsets.

2- Load the pre-trained ResNet50 model

3- Fine-tune the model on the Amazon Bin Image Dataset by tuning hyperparameters (learning rate and batch size)

4- Evaluate the model on the test set using evaluation metrics (accuracy and Cross Entropy Loss)

Sources:

Amazon Bin Image Dataset
ResNet50