Capstone Project Proposal

Inventory Monitoring at Distribution Centers

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Domain Background

A long time before the industrial age, keeping track of things was mainly done by counting and tallying items. The earliest form of inventory management dates back over 50,000 years in which people used tally sticks to count. The empowering of the distribution centers to automate their process through a digital workplace is the need of the hour to manage the demand and supply chain. During the time of pandemic, there is a huge demand fro the logistics service. Nowadays, objects are carried in bins and robots are used to move them in the distribution centers. To make sure that the delivery consignments have the correct number of items, a model that can count the number of objects in each bin and track inventory is essential. Therefore, I propose in this project to train an image processing model to be able to count the number of objects in an imagery.

Problem Statement

The problem I aim to tackle is to count the number of items present in the bin.

- The number of items present in a bin can possibly be limited (for example less than 10).
- The background of the items in a bin should be the color of the bin (instead of any random, complex backgrounds).

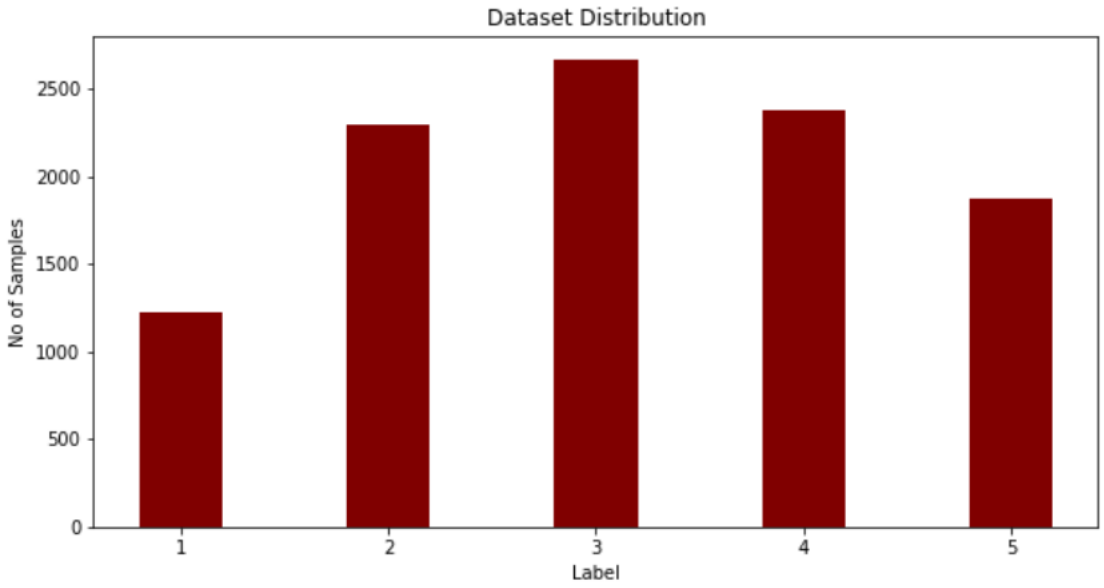
These two assumptions/conditions can simplify the problem to some degree and reduce the time of training model by providing appropriate training dataset.

Solution Statement

To solve the problem stated above, I propose to use a pre-trained convolutional neural network (such as ResNet-50) to perform the classification and train the model on SageMaker. I will add log parameters (such as epoch number, train/test phase, accuracy of each batch in training and testing) to monitor the model training progress and testing performance on the training jobs in SageMaker.

Datasets and Inputs

To train the model I will use the Amazon Bin Image Dataset. It contains 500,000 images of bins that contain one or more items. There is a metadata file associated with each image, which contains information such as the number of items in the bin, the dimensions, and the types of items. (Please see the example picture of the dataset in this archive.) For this task, I will only classify the number of items in each bin, and only a random subset (~10, 000) of the images which only contains no more than five items in each will be used for the training. Below is a histogram of an example of randomly selected dataset.



Benchmark Model

The following research can be used as a benchmark model for this research.

Verma, N.K., Sharma, T., Rajurkar, S.D. and Salour, A., 2016, October. Object identification for inventory management using convolutional neural network. In 2016 IEEE Applied Imagery Pattern Recognition Workshop (AIPR) (pp. 1-6). IEEE.

In this research, the authors performed real time inventory monitoring using an algorithm developed from Convolutional Neural Network. They developed a reliable and efficient method for object counting using vision interface. Their model performed well irrespective of resolution and color variations in the input images. Therefore, it is a good benchmark model for this project.

Evaluation Metrics

Because this model is a multi-class classification model, I will use the *F1 score* and the *overall accuracy* of the classification to evaluate the model.