

Capstone Proposal

Inventory Monitoring at Distribution Centers

Ahmed Al Qady

December 24, 2022

Domain Background

Huge warehouses like Amazon requires reliable automated systems that sort and distribute packages. These packages can hold multiple items, therefore an automated system that counts the items in each package is required. Such system needs to be reliable and be able to identify and count items correctly even if the input photo is not very clear. This capstone project is about developing such system.

Amazon Bin Image Dataset contains photos of packages with a metadata file that shows the number of items in the package. This dataset will be used to train a model that can count the number of items in each package. A system like this can be used to track inventory and make sure that delivery consignments have the correct number of items.

Problem Statement

Create a system that counts number of items in a package based on a picture of the package's content. The trained model need to have a known accuracy to be able to predict false positives.

Datasets & Inputs

This project will use only 10,000 images from Amazon Bin Image Dataset to keep the project size reasonable. Post-processing the dataset divides it into train, test and validation sets using ratios of 60%, 20%, 20% and the number of images per class will be similar.

Solution Statement

A machine learning model that counts number of items in a package based on an input image of the package's content.

Benchmark Model

ResNet-50 is a 50 layers deep convolution neural network, it has an image input size of 224x224, a pre-trained version of this network is available in AWS which was trained on more than a million images from the ImageNet dataset, therefore it learned rich feature representation for a wide range of images, so it will be used as a baseline model in this project.

Evaluation Metrics

Standard metrics like Cross Entropy Loss and precision (accuracy) will be used to assess the quality of the training process, these metrics measure and quantify the solution and ensure its repeatability. Hyper parameter optimization will be used to ensure the training converges into expected results and that the dataset won't be over-fitted.

Project Design

The proposed project is developed in AWS using Sagemaker while minimizing the costs of the training process. The key steps of the project are as following:

1. Data Preparation
 - Downloading data from a dataset
 - Preprocessing the data and dividing it into train, test and validation datasets
 - Uploading data to S3
2. Model Training
 - Hyper parameter tuning
 - Training the model and ensuring no training anomalies
 - Measuring KPI metrics
3. Model Deployment
 - Verifying model results
 - Assessment of the project quality, if not acceptable the training should be repeated