

Domain Background

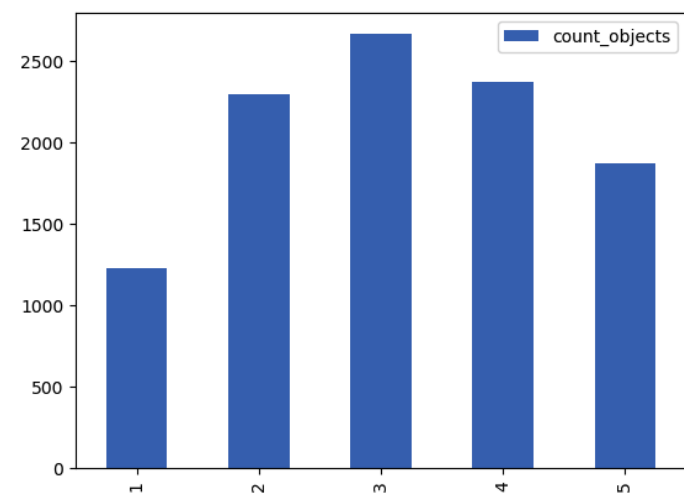
For my Udacity capstone project I propose using the Amazon Bin Image Dataset to classify the number of objects in each bin. Amazon is an internet based enterprise that focuses on providing e-commerce, cloud and digital services. In order to fulfill the orders placed on their e-commerce site they often store goods in warehouse facilities. In these facilities the goods are stored in bins. Currently Amazon's warehouses are overseen by fulfillment workers. Initially, pickers were used to update a bin's capacity, but since 2012 robots have been added to improve the workload.

Problem Statement

One issue with the bin storage layout is that employees currently have to estimate or manually keep track of the number of items in a bin if they want to be aware of its capacity. Given how Amazon tries to automate most of its processes this leaves an area of improvement. The time it takes employees to manually track the bin's capacity can be used better elsewhere.

Datasets and Inputs

In order to work on this project data will be collected from the ^[1][Amazon Bin Image Dataset](#). The Bin Image dataset contains over 500,000 images of bins from an Amazon Fulfillment Center. Although the entire dataset will not be used, part of it will be sampled to test, train and validate the model. The dataset consists of images with 1-5 objects per image. The images are distributed between categories as seen below:



Solution Statement

This project will serve to remedy that problem by predicting the number of items in a bin. Given an image of the Amazon storage bin, this project will use a convolutional neural network to

classify the number of objects in each bin. A pre-trained RESNET model will be used as the additional layers will likely be needed for this complex model. This algorithm will be built using Amazon Sagemaker. The platform will allow me to scale to meet the demands of the model.

Benchmark Model

The benchmark model that will be used for this analysis is a convolutional neural network. Various types of Convolutional Neural Networks are often used for object counting. As authors Wang, Xiao, Guo and Zhang note,^[2] “the accuracy of object detection has been dramatically improved thanks to the advance of deep convolutional neural networks”. Given others tend to have the most success when counting objects with a convolutional neural network, that will be used for this analysis as well.

Evaluation Metrics

The primary metric that will be used to evaluate this model will be accuracy. Other metrics that may be considered include MAE and RMSE. The accuracy will be used to ensure the neural network is giving correct predictions on the number of objects in a bin. A higher accuracy will suggest that the model is working well.

Project Design

The process to complete this project will include understanding the problem/business objective, then working to process and analyze the data. Once the data is processed and in a state fit to build a model on, the model building process will commence. Upon model build completion it will be tested on a portion of the dataset mentioned prior. Depending on the accuracy the model may be tuned to fit the best hyperparameters. Once the performance is satisfactory the model will be evaluated using the evaluation metrics above.

Citations

^[1] <https://registry.opendata.aws/amazon-bin-imagery/>

^[2] Wang, Jianfeng, et al. *Learning to Count Objects with Few Exemplar Annotations*. arXiv, 20 May 2019. *arXiv.org*, <http://arxiv.org/abs/1905.07898>.