Inventory Monitoring at Distribution Centers

CAPSTONE PROPOSAL

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1. Domain Background:

Inventory Monitoring is a critical process in a Distribution Center. It is the process of ensuring the right number of products or items present in a particular bin. It is an integral part of the supply chain management, that ensures the flow of goods from manufacturing venue to the warehouse or a distribution center and to the sale location.

The empowerment of the distribution centers to automate its process through a digital workplace is the need of the hour to manage the demand and supply chain. During the time of the pandemic, there is a huge demand for the logistics services.

2. Problem Statement:

Manual Inventory Management requires a huge workforce, and it is also error prone. So, there is a need for an effective inventory management.

Effective Inventory Management enables the business to save time and increase productivity. The automation of this process would eliminate the manual errors, thus saving cost and time. For larger organization, the process is much complicated.

3. Solution Statement:

The identified problem can be solved using Computer Vision Techniques. By feeding appropriate data to train the machine learning model, a robust model can be produced.

Components:

1. Dataset / Image Source
2. Algorithm
3. Environment or the platform

Dataset or the Image Source:

The **Amazon Bin Image Dataset** is to be used to train the model.

It contains over 500,000 images and metadata from bins of a pod in an operating Amazon Fulfillment Center. The bin images in this dataset are captured as robot units carry pods as part of normal Amazon Fulfillment Center operations.

Documentation about the open source dataset can be found here.

Algorithm :

1. The Algorithm will be built using the Convolution Neural Network (CNN) architecture.
2. Deep Learning Framework – PyTorch
3. A corresponding Sage Maker instance will be created and data will be fed from the S3 bucket.
4. The model will also be tuned to find out the best hyper-parameters.

Environment or the platform :

1. Amazon Web Services
2. Sage Maker Studio – to train, tune and deploy the model.
3. S3 – Storage Bucket

4. Benchmark Model:

The following research paper is used as a benchmark to achieve the results.

N. K. Verma, T. Sharma, S. D. Rajurkar and A. Salour, "Object identification for inventory management using convolutional neural network," 2016 IEEE Applied Imagery Pattern Recognition Workshop (AIPR), 2016, pp. 1-6, doi: 10.1109/AIPR.2016.8010578.

5. Evaluation Metrics:

Since it is a classification problem, **the overall accuracy of the classification and F1 score** can be used to evaluate the performance of the trained model.