Project Proposal: AWS Machine Learning Engineer Nanodegree

Capstone Proposal

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Proposal

Domain Background

According to citycleanandsimple website: *the earliest form of inventory management* ***dates back over 50,000 years*** *in which people used "tally sticks" to count. ... Over time, inventory management developed into slightly more accurate systems of accounting and record keeping, particularly in ancient Greek and Egyptian societies.*

Humans have also evolved through many stages in terms of inventory management. Below are some of the stages according to https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.barcodedirect.com/2015/09/05/the-evolution-of-inventory-management/&ved=2ahUKEwip6cK4maL1AhVCEWMBHYwdAskQFnoECCYQAQ&usg=AOvVaw2bwwGsYWiRvToXLbGZRMTW.

- Industrial Revolution Era Tracking.
- 1880s – Enter the Machine Readable Punch Card.
- 1940s – The Barcode is Born!
- 1980s – Software Improves Tracking.
- 2000s – The Introduction of RFID in Barcode Technology.

Amazon is a giant ecommerce business. Its activities majorly involve selling and shipping items online with clients. The items sold often are put into cartons or parcels before they are shipped to designated clients' locations. The items shipped are in thousands if not millions, hence counting and keeping inventory records for these huge chunks of products is greatly

cumbersome and highly time consuming if only done by humans. This creates a huge problem that needs to be resolved.

Problem Statement

The huge inventory record management creates a huge challenge that is not easily solvable by ordinary humans. There is a need to create an automated tool that is able to accomplish this essentially required task with no error, no fatigue and with accelerated efficiency.
Such solutions required domain knowledge expertise in the field of Artificial Intelligence to help innovate streamlined tools for such.

This particular problem will need the application of deep learning, a subset of AI.This process will be used in **AWS Sagemaker** to train the model and also **AWS S3** for data storage.

According to the Stanford researchers' paper, ResNet consists of a series of convolutional filters followed by a fully connected layer. Deeper networks usually suffer with vanishing gradient issues and ResNet attempts to solve this problem by stacking identity mappings.

Pretrained ResNet18, ResNet34 and ResNet50 Convolutional Neural Network architectures have been used in the experiments in the research paper.However in this project we will use ResNet34 which generally shows better model performance in the data.

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Datasets and Inputs

The dataset to be used in this project is Amazon Bin Image Dataset. The Amazon Bin Image Dataset 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.The dataset is not updated frequently.For each image there is a metadata file containing information about the image like the number of objects, it's dimension and the type of object. For this task, we will try to classify the number of objects in each bin.

Solution Statement

I will use a convolutional neural network to train on the bin images and count the number of objects on it. My prefered solution is a pretrained ResNet model.

Benchmark Model

My benchmark model is
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjrhMKKz6H1AhUKXsAKHY0sDVgQFnoECAIQAQ&url=http%3A%2F%2Fcs229.stanford.edu%2Fproj2018%2Freport%2F65.pdf&usg=AOvVaw1k1vScd2o3vmpd8-Qd0_fp.
The above is a research paper by researchers from Stanford University titled ***Amazon Inventory Reconciliation Using AI .***

The paper focuses on similar data us ours. It explores various aspects of AI and uses it to count objects in Amazon bin inventory images. I particularly focus on using ***ResNet ,*** a convolutional neural network to achieve this.
This will lay the basis for our model and guide us to writing code to achieve this similar objective.

Evaluation Metrics

Evaluation metric for this project is to calculate the training loss of our preferred model.To measure this we will have to calculate the ***CrossEntropy*** *loss of our model.*

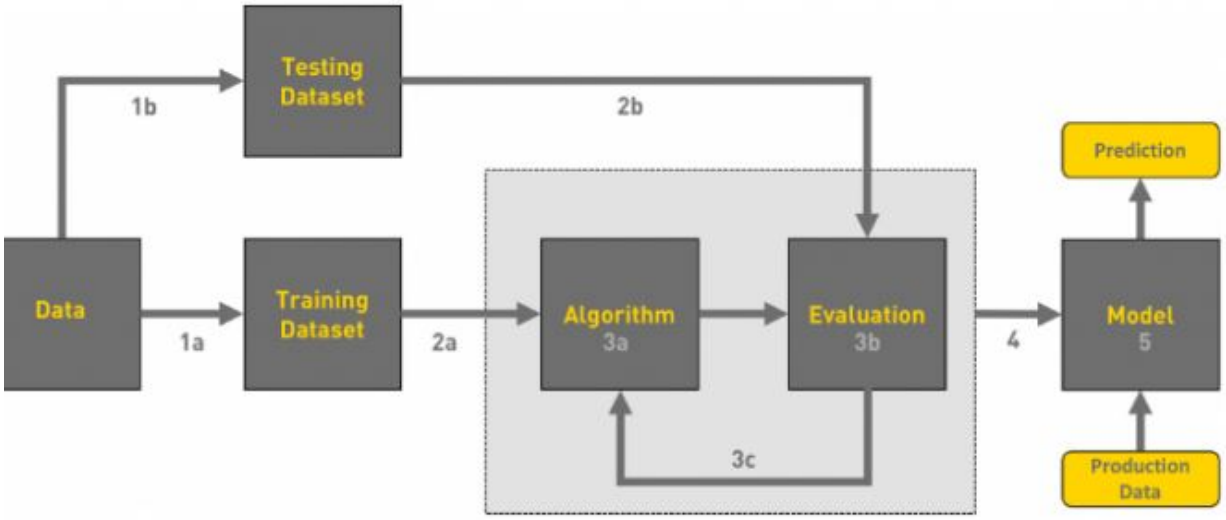
Project Design

1. Download the required dataset from amazon data repository.

2.Upload Training Data: we will have to upload the training data to an S3 bucket.
3. Model Training Script: Once we have done that, we will have to write a script to train a model on that dataset.

4.Train in SageMaker: Finally, you will have to use SageMaker to run that training script and train your model. Create an estimator to train and fit our model.

Below figure illustrates the above process.



Overview of the Workflow of ML