

Capstone Project

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## **Fashion Products Classification Using CNN**

### **Domain Background**

The Fashion products classification is a well-known problem in Machine Learning domain. It is highly demanded for modern day fashion industry, e-commerce applications as well as customer retention problems of businesses. It is a key for customer demand analysis too. The problem is to identify a fashion product if product image is given as input and to give the category of that fashion product as output. The idea is to build a pipeline that can process real world user supplied images and identify an estimate of the fashion product class like T-shirt, court, sandal, bags etc. This is a multi-class classification problem where we can use supervised machine learning approach to solve this problem. After completing this model, we are planning to build a web app where user can input an image and obtain prediction from this model. This project gives me an opportunity to build and deploy ML models for industry specific applications, so we have chosen this as our capstone project.

### **Problem Statement**

The goal of the project is to build a machine learning model that can be used within web app to process real-world, user-supplied images. The algorithm has to perform two tasks:

***Classification of Fashion Product (Blurry Image):*** If supplied a blurry image of the fashion product, the model will identify an estimate product category.

***Classification of Fashion Product (Non-Blurry Image):*** If supplied a non-blurry image of the fashion product, the model will identify the resembling product category.

### **Datasets and Inputs**

For this project, the input format must be of image type, because we want to input an image and identify the category of the fashion-product. The dataset for this project is provided by Zalando research - The Fashion MNIST dataset. The dataset has pictures of popular fashion products. The dataset has 70,000 total images which are sorted into train (60,000 Images), test (10,000 Images) directories. Each of this directory (train, test, valid). Each image is a 28x28 grayscale image, associated with a label from 10 classes. The data is balanced because the number of images provided for each category is same. The training and test data sets have 785 columns. The first column consists of the class labels and represents the article of clothing. The rest of the columns contain the pixel-values of the associated image between 0 and 255. The total 10 classes of the dataset are - T-shirt/top, Trouser, Pullover, Dress, Coat, Sandal, Shirt, Sneaker, Bag, Ankle boot. We shall make the dataset unbalanced for generation of a robust model which can work at any situation specifically for identification of rare category.

### **Solution Statement**

For performing this multiclass classification, we can use Convolutional Neural Network to solve the problem. A **Convolutional Neural Network (CNN)** is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The solution involves three steps. First, to make the dataset unbalanced for robust model creation and to be able to detect rare category image. Secondly, to develop an Opencv based edge detection algorithm like Canny edge detector. Finally to develop a CNN based classification model for the development and implementation of web app.

### **Benchmark Model**

For the above solution we shall design our own custom architecture CNN model from scratch. The model has 3 convolution layer and each layer followed by maxpooling, batch normalization and dropout layer. Finally dense layer is added for final class prediction. The custom model is designed from scratch to ensure a better accuracy than other. The model will be trained with Adam optimizer with cross entropy as loss function.

### **Evaluation Metrics**

The goal is here to achieve performance of the designed model as good as possible, for both blurry and non-blurry cases. Hence we shall evaluate the performance of

the model by using accuracy as evaluation metrics for both blurry and non-blurry image input cases.

## **Project Design**

The project will be designed in following number of steps –

Step 1: Import the necessary dataset and libraries, Pre-process the data and create train, test dataset.

Step 2: Algorithm to detect face blurry or non-blurry.

Step 3: Convert the dataset into unbalanced one.

Step 4: Create a separate edge detection algorithm in case of blurry images.

Step 5: Create a CNN to classify fashion product images from scratch, train and test the model.

For the implementation of the project we shall use tensorflow deep learning framework and Google colab.

## **References**

[1] The original fashion MNIST dataset can be obtained from

<https://github.com/zalando-research/fashion-mnist>

[2] Tensorflow documentation

<https://www.tensorflow.org/guide>

[3] Tensorflow saving and loading model

[https://www.tensorflow.org/tutorials/keras/save\\_and\\_load](https://www.tensorflow.org/tutorials/keras/save_and_load)

[4] Google Colab

<https://colab.research.google.com/notebooks/intro.ipynb>

[5] Kaggle page of fashion MNIST data

<https://www.kaggle.com/zalando-research/fashionmnist>

[6] Donahue, J, et al. "Long-term recurrent convolutional networks for visual recognition and description." Proceedings of the IEEE conference on computer vision and pattern recognition. 2015.