CLASSIFICATION OF GARMENTS USING FASHION MNIST DATASET

Koushik Kambham
Student
Department of Computer Science & Engineering
Mahatma Gandhi Institute of Technology
koushikkambham123@gmail.com

K. Sreekala
Assistant professor
Department of Computer Science & Engineering
Mahatma Gandhi Institute of Technology
ksrikala_cse@gmail.com

ABSTRACT –

Online fashion market is constantly growing and fashion websites are also getting more data from different brands. Due to this, classification of different garments has became very tough for many websites. To solve this problem, An algorithm with high accuracy is required in which it can identify garments that can help companies in the clothing sales sector to understand the profile of potential buyers and focus on sales targeting specific niches, as well as developing campaigns based on the taste of customers and improve user experience. This project is aimed to find the best model with highest accuracy and precision results. Models like Logistic Regression, Decision Tree Classifier, Random Forest Classifier and some other models are used in this project to classify the garments. To train and test these models, the Fashion MNIST dataset is used. Among all the models which are used here, the model which shows best performance is suggested to the fashion website.

I. INTRODUCTION

The fashion market has changed dramatically over the last 30 years, resulting in an evolution in that industry. Understanding customer tastes and better-directing sales are the way to increase profit. The rise of internet business lets people buy their clothes through websites, faster and easier. The introduction of methods to improve user's experience when searching for items in these platforms in decisive. Classifying clothes is part of the broad task of classifying scenes. The automatic generation of image labels that describe those products can alleviate human annotators' workload. This kind of information may also help labeling scenes and better understanding users' tastes, culture, and financial status.

Classification of garments has become a very tough task for many websites due to large data and many different images. Even though there are many methods in classifying the clothes there is some misclassification and output is not as expected i.e., when you search for shirt in any website then the website will suggest some extra outfits like pant, shoes which are not required for us and irritate us sometimes. To solve this problem different models are used and fashion MNIST dataset. In the Fashion – MNIST data set based on images from Zalando, which is the Europe's largest online fashion platform. Fashion MNIST has 60,000 products with 28x28 pixel grey scale images divided into 10 categories: t-shirt, trouser, pullover, dress, coat, sandals, shirt, sneaker, bags and ankle boots.

The evaluated implementations (from scikit-learn) in this project were: Decision Tree, Logistic Regression, Random Forest, Stochastic Gradient Descent, XGBoost and sequential model. These models are trained using the Fashion MNIST dataset and performance measures are calculated for each of the models . The model which gives best performance measures is tested with the testing dataset. Among all the models sequential model has the best performance measures when compared to the remaining models.

II. LITERATURE SURVEY

The following literature reviews discusses about various methods for prediction of the disease.

(1)**"Cloth Classifying from Fashion-MNIST Dataset"** by Anita Maria Rocha, V.Q. Leithardt, L. Rodrigo, S. Correia. They proposed SVM, Random Forest Classifier and drop-out technique for Cloth Classification. The main goal is to compare those results with the original one, providing future research to be able to easily choose the most suitable classification method. This model demonstrated a good performance measures and accuracy from 89.7% to 99.1%. The major drawback of this paper is, Classification problem, due to the richness of clothes properties and high depth of cloth categorization.

(2)"Classification of Garments Using CNN LeNet-5 Model" by Mohammed Kayed, A. Anter, H. Mohamed. LeNet-5 outperforms both classical CNN and state of the art model. The demerit of this model is it cannot deal with challenges in training a Convolutional Neural Network and overfitting is also cannot be handled.

(3)"Fashion-MNIST Classification Based on HOG Feature Descriptor Using SVM" by Greeshma KV, Sreekumar K. In this paper they classified the dataset based on HOG feature descriptor. They used Support Vector Machine (SVM) classifier algorithm. Min reason for using SVM is it is the best method to train the images. But Accuracy is not clear for each class of classification.

(4)"Image Classification of Fashion-MNIST Dataset Using Long Short-Term Memory Networks" by Shuning Shen in 2018. It discusses the LSTMs model, Network pruning and Training Pattern Reduction. Computational cost of this model is low. Disadvantage of this paper is Performance of training pattern sets is worse when number of training patterns is reducing.

(5)"ImageNet Classification with Deep Convolutional Neural Networks" by Alex Krizhevsky, Ilya Sutskever, Geoffrey E. Hinton. Described about Local response normalization and also about training pattern reduction. In this paper is Non-saturating neurons of conventional operation are used, so that training is done faster. Disadvantage is the models used in this paper achieve error rate more than 35%.

III. DESIGN METHODOLOGY

The Objective is to design a system which classifies the data into required items and different classes, this consists of using Fashion MNIST dataset and various algorithms. The approach comprises a sequence of steps for loading the dataset and classifying the dataset into 10 different classes and also standardizing the dataset, so that all the values of each feature (pixel) is in a small range (based on the standard deviation value). To get good prediction for some models we should consider a large dataset. The general work-flow of the program can be seen in Figure 1.

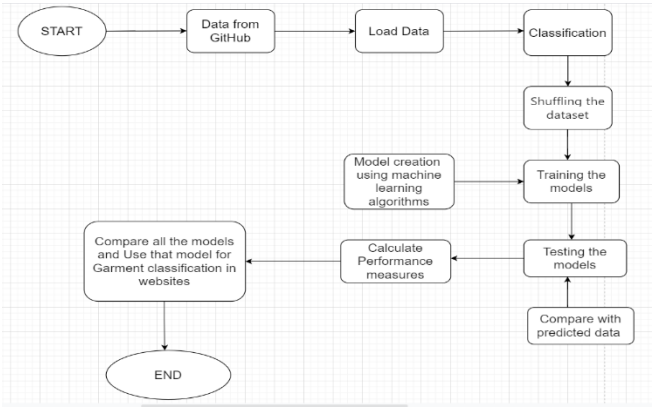

Fig. 1. Architecture diagram

As shown in the Figure above the data is retrieved from Github and then it is loaded to into the program. Then the data is classified into different classes. Dataset is the shuffled to make sure there is no bias in the dataset. Models like Random Forest, XGBoost, sequential models are used. By using the dataset we train these models and performance measures are calculated for these models then the best testing is performed on the model which has the best accuracy.

The most important criteria for good classification is to have the accurate dataset. Fashion MNIST dataset is considered for classification of garments.

The dataset we have taken from Github - consisting of a training set of 60,000 examples and a test set of 10,000 examples. Each example is a 28x28 grayscale image, associated with a label.

The dataset obtained doesn't have any noisy and missing values. Also, all the attributes needed to get best results are acquired in this dataset. So, the classification is directly done by training the models

with the data. Some pixel values out of 785 are showed in the below figure 2 and 3.

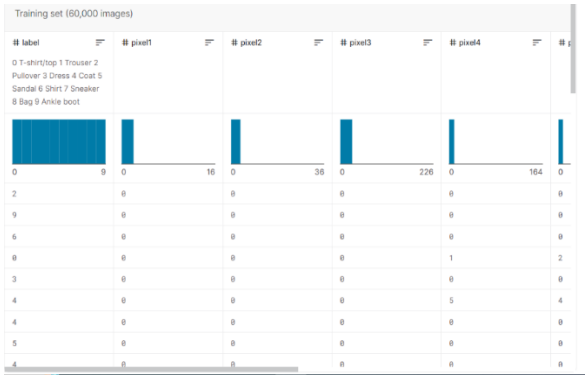

Fig. 2. Training dataset of 60,000 images

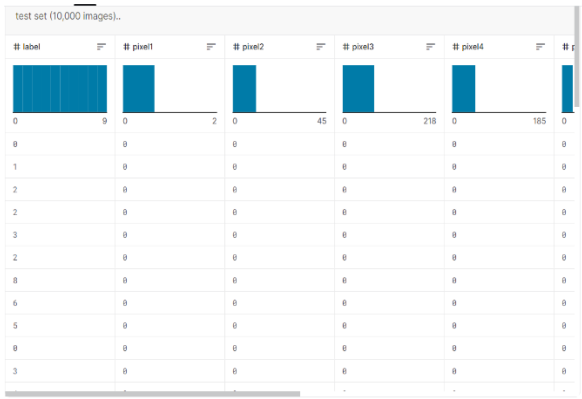

Fig. 3. Testing dataset of 10,000 images

Fig. 4. Use case diagram

In Figure 4, the user loads data and classifies the data into different classes. Then different algorithms are used to train the model by using the data and to calculate performance measures. Fashion websites uses the model which has best performace measure i.e., accuracy and precision.

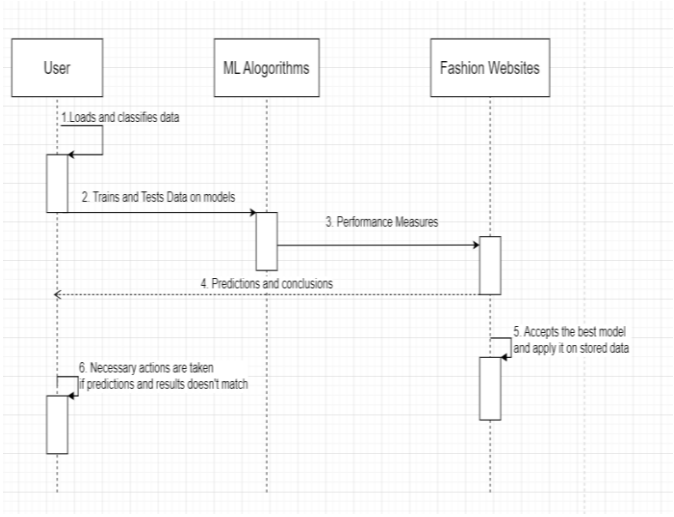

Fig. 5. Sequence diagram

The Figure 5, shows the sequence followed in the project, where the user loads data and classifies the data into different classes. Then different algorithms are used to train the model by using the data and to calculate performance measures. Fashion websites uses the model which has best performance measure i.e., accuracy and precision.

IV. TESTING AND RESULTS

As we can see from the Figure 6, below the view of images based on the pixel values ranging from 0 to 255. Labels are classified into 10 different classes as T-shirt, Trouser, PullOver, Dress, Coat, Sandal, Shirt, Sneaker, Bag, Ankle boot.

Fig. 6. Image View

Performance measures are calculated for various models used in here. Cross validation is used here to find the proper score of each model, also to ensure that the model is not overfitting or underfitting. If the cross validation

score values for a performance measure (say accuracy) are not varying significantly for various folds (k-folds) then we can say that the model is not overfitting. If the cross validation score values for a performance measure (say accuracy) are not very low for various folds (k-folds) then we can say that the model is not underfitting. We will perform k-fold cross-validation. This will randomly split the training set into 3 distinct subsets called folds (cv=3). Since cross validation is a computing intensive and time consuming process, we are limiting 'cv' (no. of folds) to 3 instead of normally 10 folds. Then will train and evaluate each model 3 times by picking a different fold for evaluation every time and training on the other 2 folds. The result will be an array containing the 3 evaluation scores for each of the measures - accuracy, precision, F1 score. We will use cross_val_score() function to calculate accuracy.

From the Figure 7, the accuracy of all the models is above 80 except Decision tree, where it has around 80. XGBoost has accuracy of nearly 90 and sequential model has over 90. Because epoch operation is performed on this model. So eventually the accuracy increases as the number of epochs increases. Hence, we can consider sequential model as best model because it has high accuracy.

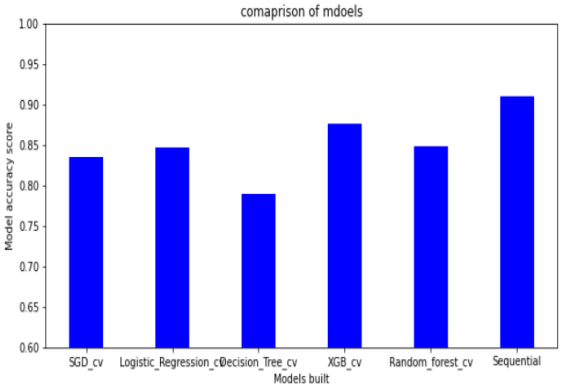

Fig. 7. Comparison of Models

The Figure 8, describes the output for the first 15 labels and the predicted output. If the color of the bar in graph represents blue then we can say the predicted output is right and classification is done well. If the bar color is red then the classification of the model is wrong. Grey color represents some deviation from the output. If both pictures have similar structure then there is chance of wrong prediction. As from the figure we can conclude that most of the class labels have the right outcome and classification of the model works accurately.

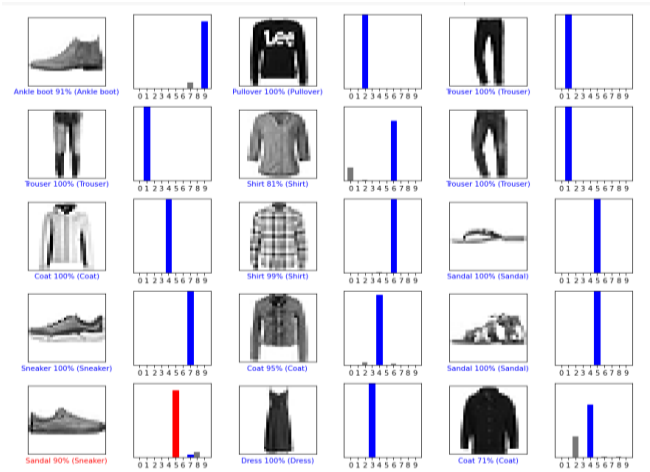

Fig. 8. Results of sequential model after testing the model

V. CONCLUSION AND FUTUREWORK

Classification has become a severe problem for many companies and websites because of the huge data and different kinds of data. In this Proposed system, garment classification is done using various models. The best model is sequential model. The final accuracy of the sequential model is 91% and is the best model when compared to all other models. This algorithm is easy to implement and fast when compared to all other models used to classify the dataset. This machine learning model can be used by fashion website to solve the classification problem. Thus, the proposed system provides accurate results and is can easily classify the data.

The similar classification system can be built to solve this problem with the help many upcoming technologies and it is suggested to further improve this model using different kind of machine learning models. Also, new algorithms can be proposed to achieve more accuracy and reliability. Some warnings had occurred while training some models. These can be eliminated by increasing the number of iterations or scale the data. The time taken for the implementation of some models and cross validation is very high. Even tough k-fold value is reduced, time consumption is high. There are some ways in which the performance of the system can be further improved and time consumption can be reduced.

VI. REFERENCES

[1]V.Q. Leithardt, L. Rodrigo, S. Correia, "Cloth Classifying from Fashion MNIST dataset," 2021 Advances in Science Technology and Engineering Systems Journal, February 2021, DOI: 10.25046/aj0601109

[2]M. Kayed, A. Anter and H. Mohamed, "Classification of Garments from Using CNN LeNet-5 Architecture," 2020 International Conference on Innovative Trends in Communication and Computer Engineering (ITCE), Aswan, Egypt, 2020, pp. 238-243, DOI: 10.1109/ITCE48509.2020.9047776

[3]K V, Greeshma & Sreekumar, K, "Fashion-MNIST classification based on HOG feature descriptor," 2019 International Journal of Innovative Technology and Exploring Engineering. 8. 960-962.

[4]Shen. S, "Image Classification of Fashion-MNIST Dataset Using Long Short-Term Memory Networks" 2018, Research School of Computer Science, Australian National University, Canberra

[5]A. Krizhevsky, I. Sutskever, G.E. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks" 2018, Information Technology and Management Science

[6]Fashion MNIST Dataset[available online]: https://github.com/zalandoresearch/fashion-mnist

[7]Python(3.5)[Available online]: https://www.python.org/downloads/release/python-350