IMAGE-CLASSIFICATION-MODEL OF APPARELS USING LOGESTIC REGRESSION AND CNN

Archit Gupta (20351203117) and Eshika Agarwal (20351203117)

***Abstract*—Clothing serves for much more than just covering and protection. It is a means of communication to reflect social status, lifestyles, or even fashion sense. Therefore, a huge amount and various styles of clothes have been produced to satisfy people's different tastes. The objective of the project is to arrange or designate apparels by scanning and testing the clothes with the model. Furthermore, have compared our accuracy level among Convolutional Neural Network and Logistic Regression. Dataset is a 28x28 grayscale image, which has 10 classes. Zalando - Research has created Fashion-MNIST because it is a better baseline dataset rather than the original MNIST data set for comparing Machine Learning models. It is based on the same properties as the orginial MNIST. Different supervised machine learning and deep learning techniques for classification have been studied and procedural comparison have been performed. Logistic Regression and Convolution neural networks (CNNs) have been used and it has been observed that CNNs outperformed other classification algorithms, after optimization of the data, giving the best accuracy rate by correctly classifying the highest number of instances. The main objective of this research paper is to predict the correct apparel using machine learning algorithms. In classified data, best accuracy of above 88.16% was achieved.**

Index Terms

- Convolutional Neural Networks(CNN), Fashion(MNIST), Deep learning.

I. Introduction

Computer vision is one area that is advancing rapidly and enabling new applications. Computer vision methods are image classification, object detection and neural style transfer. It is a technique of extracting, analyzing and understanding of useful information from a single image or multiple image in a sequence. The computer vision task that is being used in this project is image classification. Apparel classification is identifying the type of item in an image. This field has applications in social media, e-commerce and in law sector used to identify suspects with their clothes. Focus is on apparel classification, to classify the images Convolutional neural network is used. CNN model demonstrates a method to detect fashion apparels a person in an image is wearing or holding. The types of fashion apparel include hat, bag, skirt, pant, shirt etc. In both models Fashion –MNIST image data set is used. It is a data set created in Zalando's research lab having 70,000 fashion article images. It has labeled from 10 classes. With the continuous development of these systems, expect image classification to be better, faster, and more accurate. To further understand and explore the concept of image recognition, basic approach has been done to classify a set of images. Much simpler to visual image recognition, our team has selected the Fashion MNIST dataset that has pictures consisting of only one class, that is, each image will only belong to one category. There are a total of 10 categories. Further description of the dataset will be in the "Data Preprocessing" section below.

Found other approaches to image classification of this particular dataset, but explored what was needed. Specifically, logistic regression and convolutional neural network models were used.

Having only been briefly introduced to convolutional neural networks, observed that this was a great chance to delve into this model further through application. For analysis of the models, observed various outputs. From selection of the dataset, understood the implications that came with it, primarily, the large size of the dataset

This paper is organized as follows: Brief review of the related work of image retrieval with deep learning in Section 2. Elaborate on the details of our method in Section 3. Finally, experimental results are provided in Section 4, followed by conclusions in Section 5.

II. Problem Definition

Classification of image is one of the most foundational problems in computer vision, which has a variety of practical applications such as image and video, Although the problem of identifying an object from an image is a very trivial problem for a human-being to perform, it is very challenging for a computer algorithm to do the same with human level accuracy. The algorithm must be invariant to a number of variations in order to identify and classify the images. This can be achieved by implementing the algorithms in the CNN environment. [1]

III. Related Work

CNN is first choice to do the image classification. [2] To improve the apparel image classification meta-data enrichment is used with five different CNN architecture to analyze the pre-trained models. [3] Implementation of the metadata free database with retraining of the final layer of GoogLeNet for the apparel classification of the image, and they had used two apparel classification (a)Multiclass classification of apparel type and (b)Similar Apparel retrieval based on query image. [4] It introduces fashion-MNIST, with 70,000 fashion products with 10 different classes and the images in fashion MNIST were converted and compared with that of original MNIST dataset making it instantly compatible with all the machine learning packages. For the same fashion MNIST data

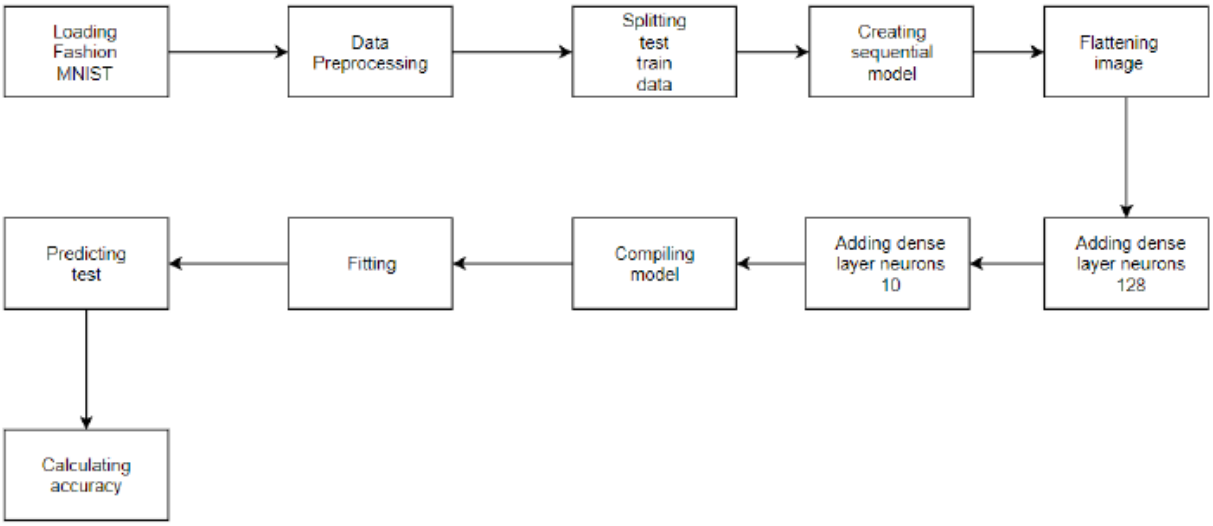

Fig. 1. Proposed Methodology : This method is used in the model described with the CNN method and gives us an accuracy of approx 88.61%

set, batch normalization and skip connections are added to improve the accuracy of 92.54% and reduces the training time of the model. It incorporates state-of-the-art object detectors with various geometric priors of the object classes. [5] As identifying clothes is also based on the posture the model has, this is also considered in the baseline model. [6]

IV. Machine Learning

Machine learning and artificial intelligence are one of the growing industries in the world today. Let's start with making out the difference between artificial intelligence and machine learning.ML is the part of the big industry known as AI here we predict future on the basis of our current experiences .ML is divided into following categories -:

1) Supervised Learning
2) Unsupervised Learning
3) Deep Learning
4) Reinforcement Learning

- Supervised learning -: Given a set of data points {x(1),...,x(m)} associated to a set of outcomes {y(1),...,y(m)}, we want to build a classifier that learns how to predict y from x.
  Data can be in the formats of regression (meaning the data will be in some sort of continuous arrangement) or classes fit regression use model named linear regression for prediction and accuracy of our data.
- Regression provides us models like logistic regression, SVM , Naive Bayes etc text classification is also a regression problem
- Logistic Regression [7]

Logistic regression is a binary classification technique. It is used in predictive analysis . It uses sigmoid function as its loss function . Values below 0.5 are considered as 0 and above are considered as 1 . Logistic regression is used in the classification problem of iris dataset, Titanic dataset it provides good means for classification, and we can use gradient descent for increasing accuracy too.

- Convolutional Neural Network [8]

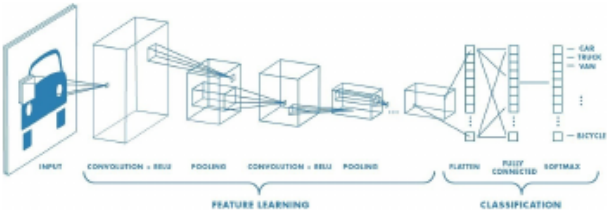

Fig. 2. CNN Classification (https://medium.com/@RaghavPrabhu/understanding-of-convolutional-neural-network-cnn-deep-learning-99760835f148)

A convolutional neural network consists of an input and an output layer, as well as multiple hidden layers. [9] A convolutional neural network (CNN) is a specific type of artificial neural network where are used perceptrons, a ML algorithm, for supervised learning, to analyze data. CNNs apply to image processing, natural language processing and other kinds of cognitive tasks. ConvNet is another way of referring a C. Neural Network. [10]

A convolutional neural network has a input layer, hidden layers and output layer which is pretty much common in neural networks. Some of these layers are convolutional, using a mathematical model to pass on results to successive layers. This simulates some of the actions in the human visual cortex.

When an object is passed through CNN it is passed through cnn layer then it is generally sent through maxpool layer where max values according to the filter n*m are chosen and then similar process is used in other layer after this the picture is passed through flattening because for passing a picture through dense layer it should be in 1D format in the dense layer

activation functions like Relu and Softmax etc are used then the obtained output is used for compiling and steps like fitting and evaluation are used. [11]

CNNs are a fundamental example of deep learning, where a more sophisticated model pushes the evolution of artificial intelligence by offering systems that simulate different types of biological human brain activity. [12]
[13]

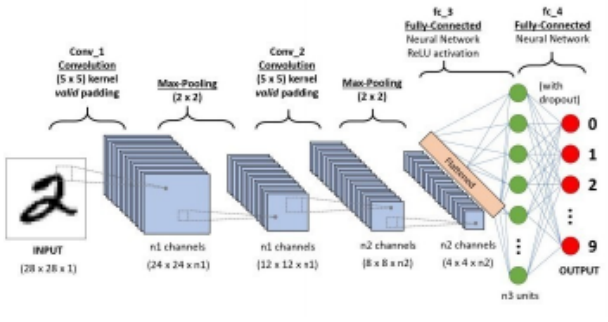

Fig. 3. Working of CNN (https://towardsdatascience.com/a-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53)

V. Implementation

- Fashion MNIST with Keras

1) a) Used 60,000 images to train the network and 10,000 images to evaluate how accurately the network learned to classify images. [14]
   b) Accessed the Fashion MNIST directly from TensorFlow, imported and loaded the data.
   c) The data must be pre-processed before training the network. If you examine the primary image within the coaching set, you will see that the pixel values fall in the range of 0 to 255
   d) Display the primary twenty five pictures from the coaching set and show the category name below every image. Verify that the data is in the correct format, and we're ready to build and train the network. [15]
   e) The first layer in this network transforms the format of the images from a 2d-array (of 28 by 28 pixels), to a 1d-array of 28 * 28 = 784 pixels. Think of this layer as unstacking rows of pixels within the image and lining them up. This layer has no parameters to learn; it solely reformats the information.

Before the model is ready for training, we need to look over a few things. [16] These are added during the model's compile step:

Loss function :

- This measures however correct the model is throughout coaching. Need to minimize this function to "steer" the model in the right direction.
- Here 'sparse_categorical_crossentropy' [17] is used, the conventional way is to have the target outputs converted to the one-hot encoded array to match with the output shape, however, we can skip that step and keep the integers as targets.

Optimizer:

- This is however the model is updated supported the information it sees and its loss operate.
- Here 'adam' [18] is used as instead of the classical stochastic gradient descent procedure to update network weights iterative based in training data.

Metrics:

- Used to monitor the training and testing steps.
- 'sparse_categorical_accuracy' [19] is used when 'sparse_categorical_crossentropy' is used as the loss function.

Training the neural network model requires the following steps:

1) Feed the training data to the model—in this example, the train_images and train_labels arrays.

2. The model learns to associate images and labels.

3. The model makes predictions about a test set—in this example, the test_images array. Verified that the predictions match the labels from the test_labels array. [20]

- Evaluate accuracy :
- It seems, the accuracy on the take a look at dataset could be a very little but the accuracy on the coaching dataset. This gap between coaching accuracy associate degree take a look at accuracy is an example of over fitting. Overfitting is when a machine learning model performs worse on new data than on their training data. [21]
- After using model.fit(), evaluate function [22] is used to find the Test Accuracy.

Make predictions:

- With the model trained, can be used to make predictions about some images.
- Now here model.predict() [23] is used to test model against Test Dataset which generates output predictions for the input samples.
- Fashion MNIST with Logistic Regression

1. First 3 steps same as KerasImport the model you want to use In sklearn, all machine learning models are implemented as Python classes.

2. Training the model on the data, storing the information learned from the data

3. Uses the information the model learned during the model training process, While there are other ways of measuring model performance (precision, recall, F1 Score, ROC Curve, etc), going to keep this simple and use accuracy as the metric.

VI. Result & Analysis

1) Fashion MNIST with Keras

In CNN or Convolution neural network building up of layers in a neural network applying different activation functions at different levels image is passed through filter then through Conv, Maxpool, Flattening then through dense layer, and get the output in the required format hence CNN gives better results. [24]

TABLE I
ACCURACY WITH DIFFERENT BATCH SIZE AND EPOCH [25]

S.NO.	OPTIMIZER	BATCH SIZE	EPOCH	ACCURACY
1	ADAM	32	10	0.8830
2	ADAM	50	10	0.8869
3	ADAM	20	5	0.8838
4	ADAM	80	4	0.8897
5	ADAM	100	20	0.8944

2. Fashion MNIST with Logistic Regression

When the model is fit using Logistic Regression the loss function is 1/1+e^-z and it gives value at 0.5 hence the model chose all values below 0.5 as 0 and above as 1 hence it is binary classification of data giving the accuracy as shown.

TABLE II
ACCURACY WITH DIFFERENT SOLVER [26]

S.NO	SOLVER	ACCURACY
1	lbfgs	0.8381
2	newton-cg	0.7931
3	liblinear	0.8102
4	sag	0.8201
5	saga	0.8001

The following predictions were made when CNN was using tensorflow and keras. Here the blue graph shows the correct prediction for correct_label and red shows for incorrect ones. Total test accuracy is of 88.11%. [27]

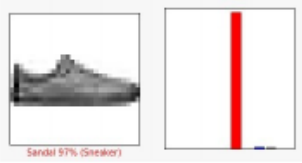

Fig. 4. Sample Prediction

Fig. 5. Sample Prediction 2

VII. APPLICATIONS

The apparel image classification mainly used in the field of social media such as(TV shows, movies), E- Commerce and criminal law.

VIII. CONCLUSION

In this paper description of our approach is done to classify an apparel from a given image using convolutional neural networks with batch normalization and dropout which have been proven to perform remarkable well in the field of image classification, using CNN with fashion-MNIST as a dataset with accuracy of 90%.

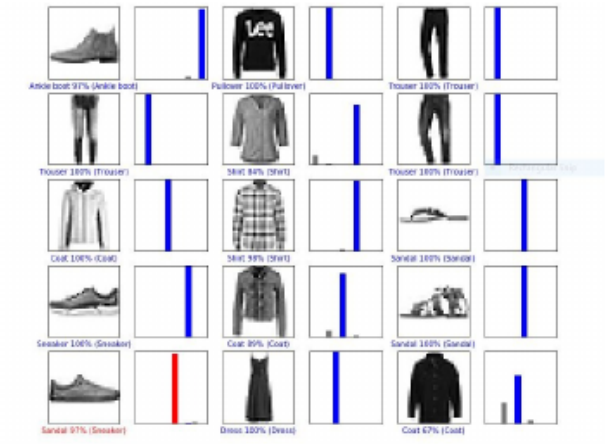

Fig. 6. Predictions of Test Labels

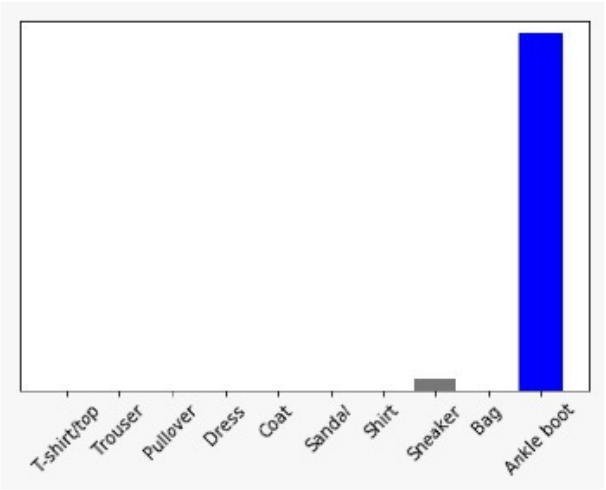

Fig. 7. Prediction Graph of element at 1st Position

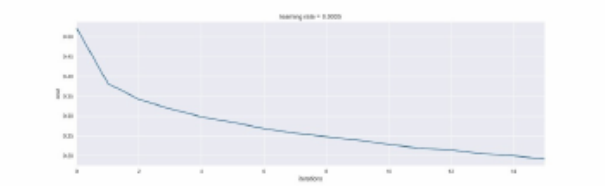

Fig. 8. Iterations V/S Cost of Fashion MNIST

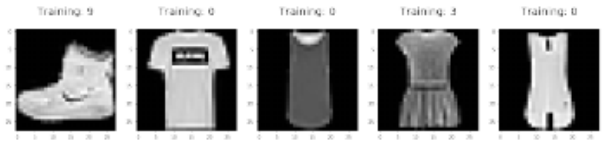

Fig. 9. Training Labels

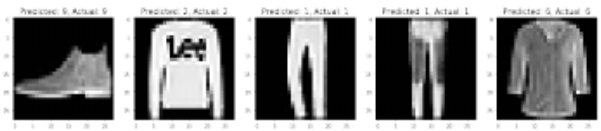

Fig. 10. Training Labels V/S Test LA

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