

Evaluation of CNN and Face-Mask Dataset by Supervised learning on Confusion Matrix

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Abstract— Techniques from Machine learning and deep learning are usually helpful in classification of data. A dataset is processed through a CNN before it is used for classification. Text mining, image processing, and score prediction techniques are very much important in the field of analytics. In paper, we used classification and data prediction methods to demonstrate image and numerical analysis. Analytics show that traditional backup methods have been improved with better ways of managing data. This process of supervised learning produces comparable present outcomes with accurate predicted values.

Keywords: Accuracy, precision, confusion matrix, text mining.

INTRODUCTION

Data in a summary of model evaluated can be expressed as a score 'numeric' or 'image' or as according to the specifications required by a specific model. There comes an important concept called 'confusion matrix', explained by British statistician called Karl Pearson in the year 1904. When a data is image the processed information needs to be identified from dataset which shall be expected to be accurately correct one. Convolutional neural network play a role here, image processing at a performable accuracy is a deal. Data acquisition is followed up as numeric classification of arrays of scores. Next is matching of individual data, what makes a common relation between the identified data scores. Co-relational data are then studied up with their factors. Model designing and its data discussion on a subject is ment to validate the data and the data validated is more accurate to be predicted. The term confusion matrix is built up of two main factors, confusion is the different data variation property in all the fields and matrix is the collection of data into a dataset. A confusion matrix is all built up with such data arranged to study in terms of rows and columns now the model is finally classified and we measure of how well the model is going to perform. Data specified express limitless properties and tabular arranged data helps analyse and predict the data collected.

The work explains on how to module a pre trained model into CNN. Later on analysing every measure of the data to understand both the image and numeric data

A dataset is being produced to a CNN before training. A trained, classified dataset is given further to supervised classification. Trained CNN models with linear regression and confusion matrix are built to calculate the accuracy of the model

As in formal approach one of the method is hierarchy based classification later probabilistic formulated theorems make a complex call in defying the outcome of a training model so deep learning comes in practice were machine learning models play a vital performance and return the expectations through prediction using confusion matrix. Furthermore the usage of confusion matrix to the attribute level gives us 'attribute confusion matrix', the fields of computer vision and text mining come up in the light as more applicative form of confusion matrix. Sentimental analysis of a raw data is one of the major example that hides the method of classification and completes data processing, image processing techniques in computer vision. A binary based approach or a multilevel approach or regression based approach is studied in detail by looking into the data traces.

Probabilistic methods involve calculation of data outcomes by intersection and union of data sub-sets. The input data can be in a tree method, random forest method or k-model. For example take a tree model data classified into subsets and many small data packets are given to the training model. As said before, the smaller data sub-sets are classified into lambda or gamma datasets and the collective group outcome is analysed of all the factors. Proper grouping is done and for each row and column the precision recall and accuracy of the data is calculated. The final model with its data analysers are compared and studied with the confusion matrix thereby. All the method is focused from the idea that the data controlling factor values are important, it can lead to a study in binary or multi-level.

Before the unsupervised techniques, the supervised techniques are focussed in the ideology here. Data fetching means retrieval of data from the dataset. Deep learning uses data many levels of data handling from data visualization, grouping to detection.

Not all the time data is taken from the dataset collection of data can be live, or redundant (placed before) or can be instantly reflective.

The main idea behind using confusion matrix is that it takes the data collected to the next stage, it gives a total report of ingredient quantity. Well, all the algorithms doesn't work the same from start to end, what I mean is data categorisation to detection, KERAS and SEABORN are one such examples. Data fetched doesn't have the same idea to be just collected or classified or detected, not all the time the intentions defined are the same. Ultimately all the such data is well categorised aims into predicting the scores of binary confusions.

The another part discusses where data is just imagined as a dimensional data and then compared with the dataset, while the first part treats data to be a quantity (redundant or non-redundant). Cross validation is another idea of this study. The trained dataset or CNN models are cross validated with the dataset. The objective of analysis satisfies all the conditions that are to be met from an application point of view as discussed. Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections A-D below for more information on proofreading, spelling and grammar.

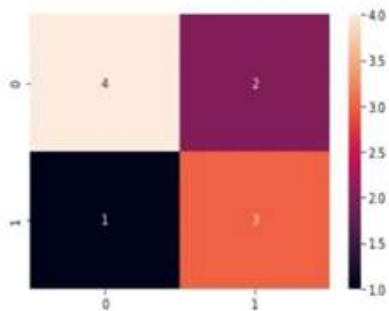
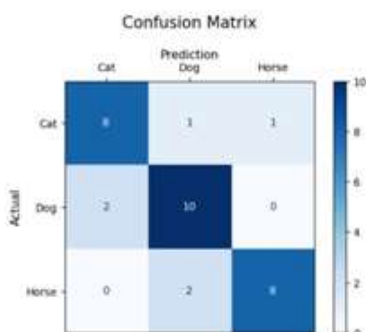


Fig. Visualize confusion matrix using seaborn



Recall of matrix, is the measure of number of positives the model can recall, from the original data in the model.

$$\text{Recall} = \frac{\text{TruePositive}}{\text{TruePositive} + \text{FalseNegative}}$$

Precision of matrix, is the measure of ratio of the total number of correct positive predictions to the total number of positive predictions in the model.

$$\text{Precision} = \frac{\text{TotalPositive}}{\text{TotalPositive} + \text{FalsePositive}}$$

F1 Score of matrix, gives measure of the net harmonic mean of precision and the recall in the model

$$\text{F1} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

Accuracy of matrix, is the measure of number of the predictions the model predicted as right out of the total number of predictions in the model.

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FP} + \text{FN}}$$

Specificity of matrix, is the measure of the ability to correctly identify the negative instances from the model given as.

$$\text{Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}}$$

Calculations of Accuracy deals with True positive and True negative .and that of F1 Score deal with False positive and False negative

C. Binary classification of data using the confusion matrix

- Firstly, import the necessary libraries
- Create numpy array for the actual and predicted labels.
- Compute the confusion matrix
- Using the seaborn heatmap create a visual representation of the confusion matrix .heatmap

D. Multi-class classification of data using the confusion matrix

- Firstly, import the necessary libraries
- Create numpy array for the actual and predicted labels.
- Compute the confusion matrix
- Print output classification report

In this matrix, each cell tells you how often a specific digit was correctly or incorrectly identified. Think of it as a “True Label” or actual value vs. “Model’s Guess” or predicted value map.

The Diagonal Cells – The numbers running from the top-left to the bottom-right (the brightly coloured squares) are the True Positives. It means the model’s guess matched the actual digit. In Row 0, Column 0, the number is 976. This means 976 times, the image was actually a 0 and the model correctly called it a 0.

The Off-Diagonal Cells – Any cell not on that main diagonal represents a specific type of error. It means the model got confused between two different digits on how to read them,

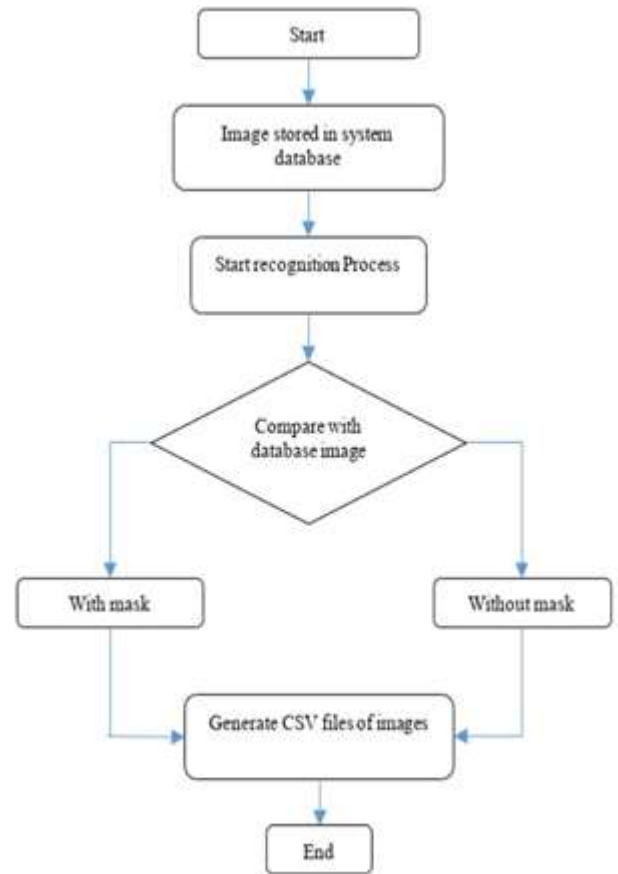
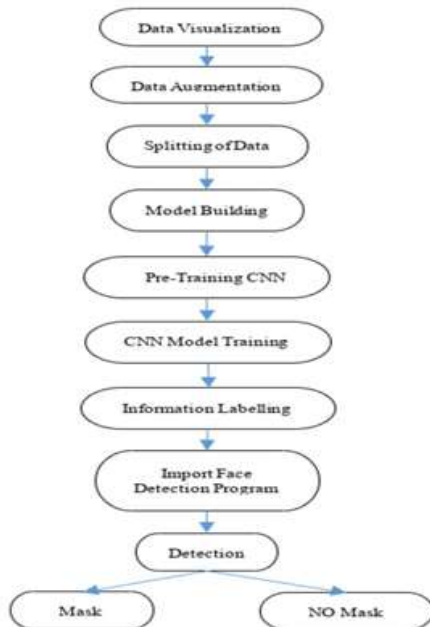
the Row is for what the digit actually was, and the Column is for what the model thought it was. At Row 9, Column 4. There is a 4. Actual: 9 Predicted: 4 Meaning: 4 times, the model saw a 9 but mistakenly labelled it as a 4.

Summary of the Totals – Total of Horizontal Row: Adding across a row tells you the total number of actual images for that digit in your dataset (e.g., all the actual “5”s). Total in Vertical Column: Adding down a column tells you the total number of times the model guessed that digit, regardless of whether it was right or wrong. In the cell at Row 9, Column 9, the value is 1000. The Meaning: Actual Label (Row 9). The image was truly the digit 9. Predicted

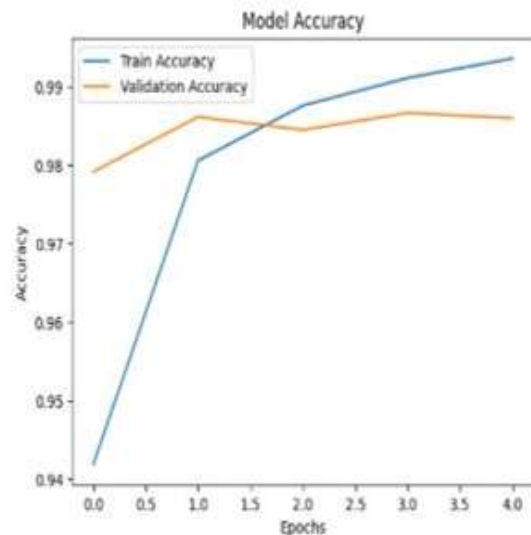
Label (Column 9): The model correctly guessed the digit 9. Result: This represents 1000 True Positives. Out of all the “9”s in your test set, 1000 of them were identified perfectly by the model. Since this number sits on the diagonal line, it indicates a correct classification

Test Accuracy : 0.9876000285148621

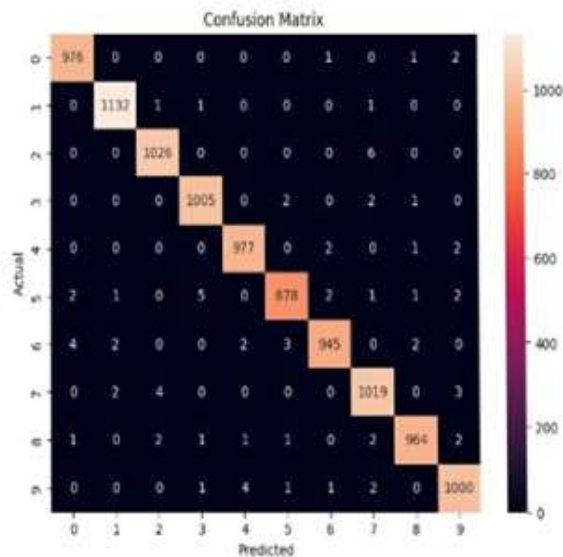
- **High-Level Performance Top Performer:** Class 1 has the highest number of correct predictions (1,132), suggesting the model finds vertical lines very easy to distinguish.
- **Most Difficult Class:** Class 5 has the lowest number of correct predictions (878). It also shows the most spread in errors, being occasionally confused with classes 0, 1, 3, 6, 7, 8, and 9.



- **Overall Accuracy:** By looking at the counts, your model appears to have an accuracy well above 98%.



	precision	recall	f1-score	support
Cat	0.80	0.80	0.80	10
Dog	0.77	0.83	0.80	12
Horse	0.89	0.80	0.84	10
accuracy			0.81	32
macro avg	0.82	0.81	0.81	32
weighted avg	0.82	0.81	0.81	32



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