**Major project on**

**MULTI-LABEL CLASSIFICATION USING DEEPNEURAL NETWORK**



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**ABSTRACT**

Feature extraction - known to be an effective way in reducing computational complexity and increasing accuracy of multi-label image classification.While deep convolutional neural networks (CNNs) have shown a great success in single-label image classification, it is important to note that real world images generally contain multiple labels, which could correspond to differentobjects, scenes, actions and attributes in an image.In this project we aim to extract feature from image using CNN and label using KNN algorithms in MS COCO 2017 dataset.

**INTRODUCTION**

Image classification involves the extraction of features from the image to observe some patterns in the dataset. Using an ANN for the purpose of image classification would end up being very costly in terms of computation since the trainable parameters become extremely large.

The convolutional neural network (CNN) is a class of **deep learning neural networks**. CNNs represent a hugebreakthrough in image recognition. They’re most commonly used to analyze visual imagery and are frequently working behind the scenes in image classification.

Multi-label classification is a predictive modeling task that involves predicting zero or more mutually non-exclusive class labels.Neural network models can be configured for multi-label classification tasks.

**LITERATURE SURVEY**

|  |  |  |  |
| --- | --- | --- | --- |
| **SL NO** | **PAPER AND YEAR OF PUBLICATION** | **FINDINGS** | **RELEVANCE TO PROJECT** |
| 1. | CNN-RNN: A Unified Framework for Multi–Label image Classification (2016) | The CNN part extracts semantic representations from images; the RNN part models image/label relationship and label dependency | The proposed framework combines the advantages of the joint image/label embedding and label co-occurrence models by employing CNN and RNN to model the label co-occurrence dependency in a joint image/label embedding space. |
| 2. | Automatic X-ray COVID -19 Lung Image Classification System based on Multi-level Thresholding and Support Vector Machine(2020) | Classifies the corona affected X-ray images from others through usage of the deep features. The technique is useful for the clinical practitioners for early detection of COVID-19 infected patients | The model presents high accuracy where the average sensitivity, specificity and accuracy of the lung classification were 95.76%,99.7% and 97.48% respectively. |
| 3. | Visual Attention in Multi-Label Image Classification (2019) | Results show that the new saliencysub-network improves multilabel image classification performance | Analysisofthe correlation between visual attention and multi-label image classiﬁcation. |
| 4. | Accurate Multilevel Classification for Wildlife images(2021) | Presents an exhaustive study of different methods to perform multilevel classification from colour images applied to the problem of classifying wild animals and plant species. | Experiments show that increasing the resolution of the images impact on the ﬁnal accuracy, as the ﬁner details are very important to determine the exact species of each being are preserved. |
| 5. | Multi-Label Classification Methods for Image Annotation(2016) | Represents the comparison between different multilabel methods is conducted on image categorization by using scene, flag , corel5k and Nus-wide5k datasets. Experimental results determine that Multi-Label k Nearest is the best performance algorithm. | The graphical performance illustration of accuracy result shows that the classification accuracy of all methods is less than 70% for all datasets including scene, flag, corel5k, NUS-WIDE-5K. |

**PROBLEM DEFINITION**

* Multi-Label Classification is more acceptable than Multiclass classification and binary classification for images.
* The main challenge in multi-label classification is data imbalance.
* Binary classification is dichotomization applied to a practical situation. In many practical binary classification problems, **the two groups are not symmetric, and rather than overall accuracy, the relative proportion of different types of errors is of interest**.
* Convolutional neural networks (CNNs) have shown a great success in single-label image classification but real world images generally contain multiple labels.

**SOLUTION STRATEGY**

Multilabel classification means a classification problem where we get multiple labels as output.Multilabel classification is used when there are two or more classes and the data we want to classify may belong to none of the classes or all of them at the same time.

The MS COCO (Microsoft Common Objects in Context) dataset is a large-scale object detection, segmentation, key-point detection, and captioning dataset.

The main advantage of KNN over other algorithms is that KNN can be used for multiclass classification. Therefore if the data consists of more than two labels or in simple words if you are required to classify the data in more than two categories then KNN can be a suitable algorithm.

It works on all kinds of data on which the classification is to be performed.

**Algorithm: --**

Step 1: Load the training data.

Step 2: Prepare data by scaling, missing value treatment, and dimensionality reduction as required.

Step 3: Find the optimal value for K:

Step 4: Predict a class value for new data:

Step1: Calculate distance(X, Xi) from i=1,2,3,….,n.  
where X= new data point, Xi= training data, distance as per your chosen distance metric.

Step 2: Sort these distances in increasing order with corresponding train data.

Step 3: From this sorted list, select the top ‘K’ rows.

Step 4: Find the most frequent class from these chosen ‘K’ rows. This will be your predicted class.

**DESIGN**

Diagram

Description automatically generated

Image: Multi-Label Classification(having 4 Classes)

The final score for each class should be independent of each other. Thus we can not apply softmax activation, because softmax converts the score into probabilities taking other scores into consideration.

We use the sigmoid activation function on the final layer. Sigmoid converts each score of the final node between 0 to 1 independent of what the other scores are.If the score for some class is more than 0.5, the data is classified into that class. And there could be multiple classes having a score of more than 0.5 independently.Thus the data could be classified into multiple classes.

**GANTT CHART**

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