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A Survey on Irrelevant Image Flagging in Online Social Network

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Abstract: *Social media are interactive computer-mediated technologies that provides facility for users around the world to share information, ideas or any forms of expressions via virtual communities and networks. Sometimes users may post irrelevant (unwanted) content in social networking platforms meant for a specific cause. Flagging irrelevant images is of much importance in keeping social media platforms safe and of relevance to other users. Researchers have worked on various machine learning techniques to classify the images with accuracy. Neural networks is widely used in image classification. In this paper we have listed and performed a comparative analysis on some approaches used in Image Classification.*
Keyword: *Deep learning, Neural Networks, Image flagging, image classification*

I. Introduction

According to statistics the number of social media users worldwide in 2018 is 3.196 billion and growing. Such tremendous amounts of users share posts related to their day to day life. Some sub sections of such social networking platforms do not entertain content posted having no relevance to that section or posts that may be offensive or inappropriate to other users. So in order to control such content we need to classify the images as per relevance. Images pertaining to the irrelevant post class should be flagged. In computer vision Image Classification plays a very important role, The significance of Image Classification is prevalent in our work and life.

The process of Image Classification includes image preprocessing, extraction of key features, image segmentation, and matching identification. Latest technological advances provides us with various Image Classification techniques using which we get the image information faster than before, it's applications being usage in scientific experiments, traffic identification, authentication and security, medical equipments, face recognition and other fields.

Amid the rise of deep learning, feature extraction and classifier has been unified into a machine learning framework which overcomes the traditional method of feature selection difficulties. Multiple levels of representation can be discovered using Deep learning, hoping that high-level features represent more abstract connotations of the data. Onekey technique of deep learning in image classification is the using the Convolutional architectures.

Accurate recognition of the features present in an image is the main objective of image classification. Image classification is categorized as supervised and unsupervised classifications. In supervised classification, we make use of a trained dataset including human intervention. In tcase of unsupervised classification, it is entirely computer operated and human intervention is not at all needed. The support vector machine (SVM) is a new machine learning technique which is applicable to both regression as well as pattern recognition.

In machine learning, support vector machines (support for vector networks) are supervised learning models which operate on the associated learning algorithms which is employed to analyze data and recognize the hidden patterns. They are used for classification purpose as well as regression analysis.

II. Image Classification Approaches

On The Basis Of Training Sample being used:

A. Supervised Classification:

The process of using samples of previously known informational classes (called training sets) to classify pixels which are not known. Example: parallelepiped algorithm, minimum distance to means algorithm, maximum likelihood algorithm[1]

B. Unsupervised Classification:

In this type of classification is a technique which inspects a large number of unknown pixels and divides it into number of classes depending on natural groupings existing in the image values. Computer

determines class which is spectrally separable and further defines their information value. No comprehensive prior knowledge is needed. Example: K-means clustering algorithm. [2]

On The Basis Of Presumption Of Parameter on Data:

A. Parametric Classifier:

The parameters such as mean vector and covariance matrix are used in Parametric Classifiers. Gaussian distribution is presumed in this classifier. The parameters, mean vector and covariance matrix are generated intermittently from training samples. Example: linear discriminant analysis, Maximum likelihood.[3]

B. Non Parametric classifier:

There is no presumption about the data. Non-parametric classifier does not use statistical parameters for calculation of class segregation. Example: decision tree classifier, Artificial neural networks(ANN), support vector machine(SVM), expert system.[4]

On The Basis Of Pixel Data Used:

A. Per pixel classifier:

Generation of signature by a Conventional classifier making use of the combination of the spectra of entire training-set pixels from a provided feature. The contributions of all elements present in the training-set pixels is present in the resulting signature. It could be parametric or non-parametric, Due to the impact of mixed pixel problem, the accuracy may not meet up. Example: maximum likelihood, support vector machine, ANN, and minimum distance.[5]

B. Subpixel classifiers:

The spectral value of individual pixel is assumed to be a linear or non-linear combination of defined pure items called end members, providing proportional membership for individual pixel to each end member. Subpixel classifier possesses the ability to handle the mixed pixel problem, convenient for medium and coarse spatial resolution images. Example: subpixel classifier, spectral mixture analysis, Fuzzy-set classifiers.[6]

On The Basis Of Number Of Outputs For Individual Spatial Element:

A. Hard Classification:

Hard Classification, also called as crisp classification In this technique each pixel is required or enforced to present membership to a single class. eg artificial neural network, decision tree, maximum likelihood, minimum distance, and support vector machine.[7]

B. Soft classification :

Soft Classification also called as fuzzy classification In this each pixel may present numerous and partial class membership. It produces more accurate result.[8]

On The Basis Of Spatial Information:

A. Spectral Classifiers:

Pure spectral information is used by this Image classification technique. Example: Maximum likelihood, minimum distance, artificial neural network.[9]

B. Contextual Classifiers:

This image classification technique makes use of the spatially neighboring pixel information. Example: frequency-based contextual classifier.[10]

III. Literature Survey

A. Artificial neural networks(ANNs):

Artificial neural networks (ANNs) are statistical learning algorithms that are inspired by properties of the biological neural networks. They are used for a wide variety of tasks, from relatively simple classification problems to speech recognition and computer vision.

ANNs are loosely based on biological neural networks in a sense that they are implemented as a system of interconnected processing elements, sometimes called nodes, which are functionally analogous to biological

neurons. The connections between different nodes have numerical values, called weights, and by altering these values in a systematic way, the network is eventually able to approximate the desired function.[11]

Each node in the network takes many inputs from other nodes and calculates a single output based on the inputs and the connection weights. This output is generally fed into another neuron, repeating the process. When equipped with the information given in the last sentence, one can easily envision the internal hierarchical structure of the artificial neural network, where neurons are organized into different layers, as depicted below. The input layer receives the inputs and the output layer produces an output. The layers that lye in between these two are called hidden layers.

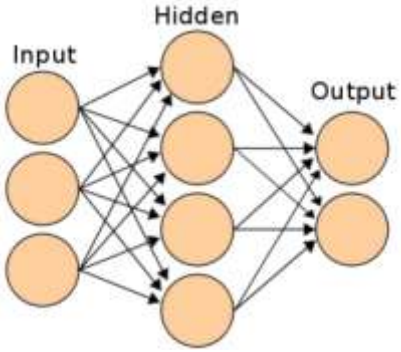

Fig 1.1 A simple neural network with one hidden layer.

Some types of Artificial Neural Networks used in Image Classification are Convolutional Neural Networks(CNNs), Restricted Boltzmann Machine(RBM), and Deep Belief Networks(DBNs).
According to performance evaluation conducted by Meiyin Wu and Li Chen for CNN and DBN on the MNIST database .The classification accuracy rate of CNN and DBN was found to be 99.28% and 98.12% respectively.

B. Decision Trees:

Decision tree (DT) classifiers are non-parametric type of classifiers. There is no requirement of any a priori statistical assumptions with concern to distribution of data. The structure of the decision tree constitutes of a root node, some non-terminal nodes, and a set of terminal nodes. With accordance to the defined classifier framework the data is recursively divided along the Decision Tree. A special case of a decision tree is a binary tree. Kulkarni made use of a binary decision tree for classifying pixels in multispectral images, using a subset of features at each non-terminal nodeto classify the samples. One of the most popular algorithms for constructing a decision tree is ID3 algorithm as recommended by Quinlan.

The ID3 algorithm makes use of information gain to decide as to which attribute is the best. For each attribute, the we calculate information gain by finding the difference in entropy using (1), where D is the observation vector, m is the number of classes, and p_i is the probability that D belongs to class i.

$$entropy(D) = -\sum_{i=1}^{m} p_i \log(p_i) \qquad (1)$$

The information gain is calculated by subtracting the entropy before the split and after the split using (2), where A is the attribute which is being processed. In (2) v is the number of distinct values of attribute A, and $|D_j|/|D|$ shows the weight value of the j^{th} split. The process is repeated again for the remaining attributes.

$Gain(A) = Info(D) - Info_A(D)$ (2)

Where

$$Info_A(D) = \sum_{j=1}^{v} \frac{|D_j|}{|D|} \times Info(D_j)$$

C. Support Vector Machines (SVMs):

Support Vectors Machines (SVM) have projected their ability in pattern recognition and classification [Vapnik, 1995]. Naturally, given a set of points which belong to either of two classes, a linear SVM finds the hyperplane separating the largest possible fraction of points of the same class on the same side, while maximizing the distance of either class from the hyperplane. Using this hyperplane the risk of misclassifying examples of the test set is minimized.

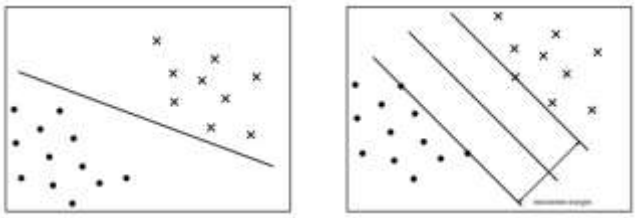

Fig 1.2

Fig 1.2 Both hyperplanes separate the training examples correctly. But the Optimal Separating Hyperplane on the right hand side has a greater margin and better generalization is obtained.
Support Vector Machines are used for binary classification. When dealing with concerned classes, as in object recognition and image classification, one needs an appropriate method.
Different possibilities are :
- Modifying the design of the SVM, as in [Weston and Watkins, 1998] so as to incorporate the multi-class learning directly in the quadratic solving or
- Combining several binary classifiers: – "One against one" [Pontil and Verri, 1996] – "One against the others" [Blanz et al., 1996] According to a comparison study [Weston and Watkins, 1998], the accuracy of these methods is almost the same, but we may choose "one against the others" since it has lower complexity.[12]
According to performance evaluation conducted by Vladimir, the dataset of images classified using decision tree classifiers gave a 50% classification error rate while the same dataset of images classified using Support Vector Machines minimized the error rate to 14.7% which is nearly a fourfold reduction.

Classification method	Advantages	Disadvantages
Artificial Neural Networks	-This classifier is non parametric in nature. -capability to represent funtions such as OR, AND, NOT. -handles noisy inputs efficiently. -high computation rate.	-Semantically poor classification. -training of ANNs is time consuming. -the over fitting problem needs to be solved. -difficulty in making choice for type of network architecture.
Decision tree	-Can handle nonparametric training data. -Does not required an extensive design and training. -Provides hierarchical associations between input variables to forecast class membership and provides a set of rules n are easy to interpret. -Simple and computational efficiency is good	The usage of hyperplane decision boundaries parallel to the feature axes may restrict their use in which classes are clearly distinguishable. - Becomes complex calculation when various values are undecided and/or when various outcomes are correlated.
Support Vector Machine	-It gains flexibility in the choice of the form of the threshold. -Contains a nonlinear transformation. -It provides a good generalization capability. -The problem of over fitting is eliminated. -Reduction in computational complexity. -Simple to manage decision rule complexity and Error frequency	-Result transparency is low. -Training is time consuming. -Structure of algorithm is difficult to understand -Determination of optimal parameters is not easy when there is nonlinearly separable training data.

IV. Proposed System

Most present classification and regression machine learning methods are shallow learning algorithm. It is problematic to represent complex function effectively, and its generalization capability is limited for complex classification problems.

So as to overcome this problem of shallow representation and manually extracting features, we propose a deep learning model using artificial neural networks. Deep learning has become a hotspot of the Internet big data and artificial intelligence. The nature of Deep learning is self-learning by build multilayer model and train it with vast amounts of data

It can improve the accuracy rate of the classification or prediction We will be using deep convolutional neural networks.

The Convolutional Neural Networks (CNN) is one of the most eminent deep learning approaches where multiple layers are trained in a robust manner. It has been found highly capable and is also the most commonly used in diverse computer vision applications.

V. Conclusion

This paper attempts to study and provides a brief knowledge about the different image classification approaches and different classification methods. This survey gives theoretical knowledge about different classification methods and provides the advantages and disadvantages of various classification methods. Also we have proposed a deep learning model – Convolutional Neural Networks for accurate feature extraction and classification of images.

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