

Illicit Image Filtering and Classification Techniques

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Abstract— Adult images have become a threat to social networking, which are having a negative impact, on society. We often hear the stories of blackmailing for adult images which is a serious crime. This should be stopped somewhere, further we will see various techniques to do so. We present a method to classify images into different categories of pornographic content to create a system for filtering illicit images from network traffic. Even though different systems for this application were offered in the past, which are based on simple skin color features and have quite poor performance. Latest advances in the image recognition field in particular for the classification of objects have shown that bag-of-visual-words-approaches are a good method for many image classification problems.

Keywords—*Bag-of-Visual Words (BoVW), Explicit Content, Neural Network, Region-of-Interest (ROI), Skin Detection*

I. INTRODUCTION

The inevitable fact that technology is becoming more intertwined in the daily life of the individual will lead to an increase in court cases and in crime. Due to such image uploads as people have different mentality and culture which causes several serious issues and may revolve into crime. So here we are presenting some of the techniques of filtering and classification of pornographic images. The internet has made people access more information than any time before and has become the major source of information. In the other hand, it also shows the dark side. Among the millions of Web sites, there are over 500,000 web sites linked to pornography and other issues that are as dangerous as poison to the children. Ideally, a pornographic image filter is created once and then the filter administrator can simply select which types of images he wants the filter to remove and which types of images are allowed, in the literature, different illicit image filtering techniques will be presented.

In the literature, different illicit image filtering techniques were presented: In the mid of 90s, the first algorithm to detect naked person in images was researched. The algorithm distinguish whether or not the filtered skin color is matched to an exact body part in the full image, rather than extracts primitive features helping effectual classification. A further approach had researched; the algorithm was based on image contents, and classified illicit

images by extract skin regions and feature vectors that are helpful for the image classification. The feature vector has essential features such as “color, texture, contour, placement, and relative size information” for a given region. Neural Network based technique focus on the study of decision-boundary surface telling adult images from non adult images via the computer-based classification rule, called Perceptron. Afterward a new algorithm to detect explicit images is proposed. In this technique, first the images are altered from the color model to discriminate objects in the image of no interest. After that the image is filtered using skin detection, which intends to segment a human being within the image. Then we can approximate the probability of the image as an image with illicit content, by counting all pixels with some skin tone. Newly the bag-of-visual-words (BOVW) models, which were originally planned for texture classification, are motivated by the bag-of-words models in text classification where a document is characterized by an unsorted set of the contained words.

II. IMAGE CLASSIFICATION AND FILTERING TECHNIQUES

A. Neural Network Based Adult Image Classification

“A neural network is a massively parallel distributed processor made up of plain processing units that has a ordinary propensity for storing experimental knowledge & making it available for employ” [1]. The support vector machine (SVM) technique is a new image classification method. The principle of the method is to find decision lines or surfaces distinguishing data from others like the technique using neural networks. The technique using the neural networks is just to discover decision surfaces classifying the training data. But, SVM is to locate decision surfaces maximizing the distance of two sets.

B. Explicit Content Image Detection

Skin detection can help detect a person limb, torso, or face in a picture. Recently various methods of skin identification within a digital image have been developed. Skin color has established to be a helpful and robust method for face recognition, localization and tracking. Here a number of researchers who have looked at using color information to detect skin. In this system a novel explanation using the HSV color model, which is extremely parallel to the RGB color model, is planned. Once the conversion of color model has been made, the next stage is to continue to pixel detection with human skin.

This was accomplished by viewing a number of images, which are a threshold where most people with different skin color within the image can be segmented. To determine the threshold it was essential to make an analysis of the histograms in the HSV color model. With the intention of finding naked people, there are other types of features such as the percentage of pixels detecting similar skin color. Based on these features, a process of segmentation is carried out in color images.

A few examples are illustrated in figure below which illustrate people with different skin color and can be seen that the threshold used works properly.

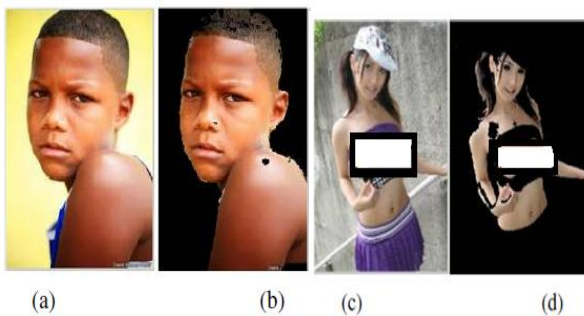


Fig. 1. Skin color segmentation (a) and (c) Original Images, (b) and (d) Segmented Images

The system formed a classifier, using the HSV color model, which allows us to identify texture in the image, and this way can detect skin to know if there are pixel areas with some skin tone, and the value of the probability that the input image was an image with explicit content can be estimated. Skin detection can be used as the basis for detection of the images with explicit content because there is a considerable relationship between the images with huge areas of skin and illicit images or with explicit content.

The system can make use of different type of images, as images in different lighting conditions and images with different size. The input images for testing are categorized in: a) images of naked people or with explicit content and b) ordinary images. In the images with explicit content people Asians, Caucasian, Europeans, Latin Americans and a little amount of people with black skin can be found. In natural images there are different types of images such as: clad people, animals, plants, cars, cartoons, landscapes and others were as well found from Internet.

First the input image is changed from the RGB to the HSV color model. Next step using the threshold the image is filtered using the skin detection to recognize the areas that enclose some skin color, and in this manner merely get the image of the person or people within the input image. At this point, all skin areas detected are taken, and continue to count the amount of pixels that there are within the image to approximate the probability that this image is classified as an image with explicit content or not.

C. Bag-of-Visual-Words Models for Adult Image Classification and Filtering

Bag of visual words model is motivated by the bag of word model in which an image is characterized by an unsorted set of discrete visual words, which are accomplished by discretization of local descriptors. For illicit image detection, we follow the BOVW method, where images are characterized as a histogram of visual words. The visual words indicate local features extracted from the images and the vocabulary is learnt task-specifically from a training database. As local features, we extract image patches around difference-of-Gaussian interest points which are scaled to a common size and then PCA (Principal Component Analysis, it is a statistical method that uses orthogonal transformation to translate a set of observations of probably correlated variables into a set of values of linearly uncorrelated variables) transformed leaving 30 coefficients to diminish their dimensionality. To form a visual vocabulary, we employ the training algorithm for unsupervised training of Gaussian mixture models. This algorithm creates a set of $2^{\#splits}$ densities by iteratively splitting each existing density in the direction of its variance starting from a single Gaussian [2, 3]. The so learned visual vocabulary is able to capture frequently occurring patterns in the given training data. The BOVW model is capable to capture almost enough color information that an added skin color model is not necessary.

D. ROI and Color Moments based Bag-of-Visual-Words Models for Adult Image Classification and Filtering

The standard BoVW technique clusters visual words from the patches in the entire image and assumes the weighting schemes of hard assignment. An additional name of patches is keypoints in some methods. There are two dissimilarities between the method of BoVW based on ROI and the standard BoVW method. Firstly, we intended to form visual words in ROI for adult image detection. The patches in ROI are more analytical to adult contents than those in the entire image. So it can develop the representative power of visual words for adult image detection. Secondly, soft-weighting scheme is implemented to improve the performance of BoVW further. Furthermore, CM is elected by estimating some commonly-used global features.

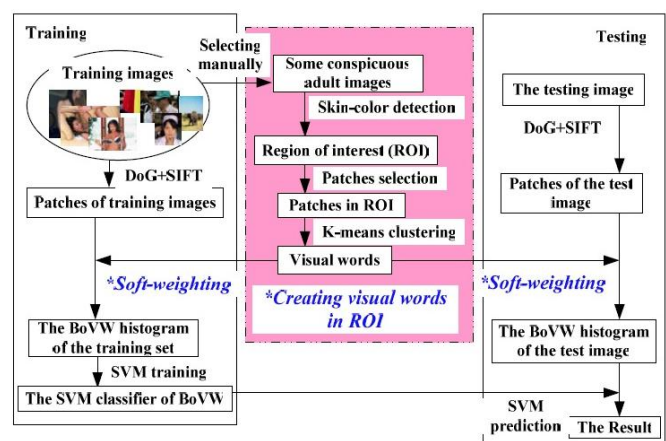


Fig. 2. BoVW based on ROI

As shown in Fig. 2, we use the process of BoVW based on ROI to improve the performance. ROI (Region of Interest) implies the subareas having illicit parts or poses in the field of illicit image detection. Skin-color regions contain these illicit subareas. So, we relate the type of skin-color models to capture ROI. Weighting schemes play a vital role in creating the BoVW histogram and accordingly have enormous effects on the performance of BoVW. CM offers a measurement for color resemblance between images. In CM, we find out the first 3 moments of 3 channels in Lab color space over 5×5 grid partitions, and merge the features into a 225-dimension feature vector [5]. The supported vector machines (SVM) classifier has been one of the most accepted classifiers for BoVW-based image classification and illicit image detection based on global features.

III. CONCLUSION

To filter illicit contents flourishing on the Internet effectively, we have presented different novel techniques of illicit image classification and recognition. “The explicit content image detection” method has given an algorithm to detect images with explicit content in color images, by the HSV color model and a method of skin detection which works efficiently, while the “bag of visual words” technique method permits for establishment of a flexible content filter that can be easily modified for the user’s requirements. BoVW evidently outperforms state of the art methods in this task on a standard task. To filter illicit contents growing on the Internet effectively, a novel technique of illicit image detection is used which merges BoVW based on ROI and CM. It creates visual words in ROI and adopt soft-weighting method to improve the performance of BoVW. The patches

in ROI are more analytical than those in the entire image. The evaluation with the state-of-the-art methods shows that “Adult image detection combining BOVW based on region” method is capable to really improve the performance.

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