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Locating and Detecting Nipple for Pornographic Image Identification

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Abstract **-** In this paper, a fast and robust algorithm for identification of nude images based on the examination of skin color regions and nipple locating and detection is presented. The skin color information fundamentally provides regions of interest. So as to segment human skin area from non-skin areas in view of color, we require a dependable skin color model that is versatile to individuals of various skin hues and to various lighting conditions. We utilized a model of skin color in the YCbCr color space for separate out skin color region.
We adopted edge detection and circle identification to locating nipple region. Once nipple located the final decision is made by analyzing SURF futures with dataset for identification of nipple.

Keywords **-** Skin color segmentation, Object detection, Recognition, Porn image identification

I. INTRODUCTION

Finding pornography on the Internet is as easy as Googling the word "sex," From a survey of students in India of 400 students [11]:
70% of boys began watching porn at age 10.
93% of boys said that porn was addictive as drugs.
86% said that porn led to sexual activity.
Critics worry about online pornography's effects on adults' work and family lives, but even more about its impact on children and teens. The Impact of Pornography on Children & Youth is [12]

- The impact of pornography is relevant to prevention of child sexual abuse and exploitation for a variety of reasons.
- Exposure to pornography is common in adolescence.
- Exposure to pornography has negative effects on healthy development and relationships.
- Pornography exposure contributes to sexual aggression in some users.

Aggressive marketing tactics and tricks are used to target and prey upon innocent children. Therefore, a filtering system is necessary for blocking nude images. The majority of the filtering systems hinder the entrance to frightful sites by looking at IP address/URLs records. However, the internet is very dynamic and web sites are always changing, these methods have a limitation on refreshing lists. Therefore, an image analysis technique is needed in order to classify objectionable images and block accessing to objectionable sites.
This paper presents a simple, fast and robust method of detecting adult image. Images were filtered by skin color model at first, the edge detection and circle identification approach to determine possible location of nipple and using SURF future to identify nipple. An ultimate choice is made by examining the aggregate skin range rate and the biggest associated skin territory rate and picture contain areola or not. The paper is composed as follows. Section 1 we give a Introduction. Section 2 we give related works. Segment 3 we give technique. Section 4, we give experiment and result and section 6 conclusion are given.

II. RELATED WORKS

The current vulgar picture identification strategies can be assembled into three classes: keyword-based, blacklist-based and content-based. Keyword based systems attempt to recognize pictures by analyzing the substance that names or incorporates them on a site page. In any case, numerous words that have a place with the pornographer's vocabulary moreover appear in site pages for education purposes. Consequently, keyword based systems may screen out accommodating pictures while surrender lecherous substance. Blacklist-based techniques screen out pictures gathered from boycotted web tends to where erotic entertainment is esteemed liable to tumup. Yet, erotica has demonstrated a speedier focus than such records can get. Content-based procedures assess pictures by coordinate picture content examination. The pioneer work was done by Forsyth et al. [1], [2], who merged color and texture properties to get a filter for skin locales which are then passed to a geometric direct in light of body plans. Wang et al. [3] developed the WIPE system that uses a physically demonstrated color histogram model as a pre-filter. Pictures are finally classified based on wavelet filters. Jones and Rehg [5] used adult and non-adult pictures to set up a neural framework classifier of skin and non-skin classes. Drimbarean et al. [4] proposed to use

fuzzy classification to coordinate skin tones and use shape affirmation techniques to coordinate countenances and distinctive parts of the human body. Aside from skin color base recognition of bare picture, some researcher additionally proceeds. They used to recognize body part like areola or skin area is human body or not. Yue Wang [9] used Adaboost algorithm that is quick speed in object identification and the quality of areola segments for adaptable areola ID. Qing-Fang Zheng, Chi-Yoon Jeong [6] utilized half and half approach, skin shading as well as distinguish face in picture.

III. METHODOLOGY

The Nude detection system contains five major modules as in figure 1. The skin color extraction and content based skin color analysis to classify the non-nude images. The nipple segmentation and identification and lastly based on skin color analysis and presence of nipple to identification whether images are "nude" or not.

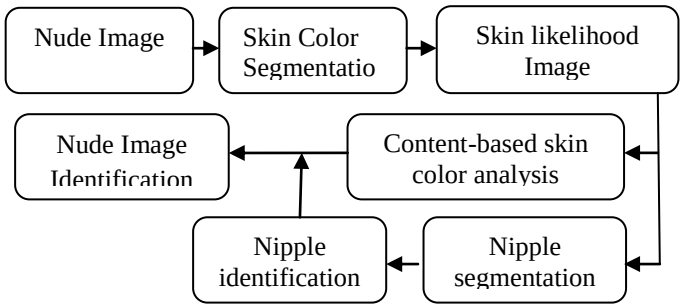


Fig. 1. Nude detection system

3.1 Skin Color Segmentation

Representation of human skin color is vital for pornography image identification in a color image. We must choose appropriate color space. The YCbCr color model is reasonable for skin color segmentation on the grounds that the basic RGB portrayal of color pictures is not appropriate for describing skin-color. In the RGB model, the three components (red, green, blue) tells not only to color but also luminance. Luminance may differ over a man's skin because of the encompassing lighting and is not a dependable measure in isolating skin from non-skin region. Luminance can be expelled from the color portrayal in the chromatic color space. The distribution of skin color can be represented by a Gaussian model G (m, C), with the mean

$$m = E(x) = (\bar{C}_r, \bar{C}_b)^T$$

Where x = $(\bar{C}_r, \bar{C}_b)^T$ is the chrominance vector, and the covariance

$$C = E[(x-m)(x-m)^T] = \begin{bmatrix} \sigma_{Cr,Cr} & \sigma_{Cr,Cb} \\ \sigma_{Cb,Cr} & \sigma_{Cb,Cb} \end{bmatrix}$$

The like hood of skin for any pixel of an image is gotten by Gaussian fitted skin color model. If a pixel having chromatic value (Cr, Cb) the like-hood of this pixel [10] can then be computed as

$$Likelihood = P(r,b) = \exp[-0.5(x-m)^r C^{-1}(x-m)]$$

where: x = $(r,b)^r$

The skin-probability picture will be a gray shaded picture whose gray values speak to the probability of the pixel having a place with skin. Utilizing adaptive thresholding, the gray scale pictures can then be further changed to a black and white picture indicating skin areas and non-skin areas.

3.2 Content-Based Skin Color Analysis

Once the essential skin regions are diagnosed, depending on skin area a decision can be take whether or not an photograph includes pornographic content material or not.. A standout amongst the most mainstream techniques to do this on self-assertive skin maps was created by Rigan Ap-apid [7]. This set of rules calculates number of pixels from the largest three skin regions of a picture. The percentage of skin pixels in the vicinity is then used for classification. Other crucial capabilities are the whole amount of skin pixel within the image, the number of three skin regions and the sizes of the three biggest skin regions. The thought at the back of this association of heuristics is that skin maps from pornographic content are massive areas, even as popular photographs show those regions indifferent by using clothes. Our work utilized the Rigan Ap-apid algorithm to be one criterion for images are "nude" or not.

3.3 Nipple Segmentation

Nipple color is darker than the rest of our skin and they are circular. To locating nipple we used the image which have only skin pixel. This image we can easily obtain through skin color segmented and original image. Use of this image reduces the locating false nipple. Then following steps list below perform to locate the nipple.

a) Apply Canny edge detection.
b) Performs morphological closing in both vertical and horizontal direction
c) Fills holes
d) Invert the image
e) Apply Hough transform circle detection

The circular region can be nipple. To identify the nipple, taking the diameter size length of square and fit it to center of circle and take that portion from original image. Using this portion the process of identification is detailed in the next section.

3.4 Nipple Identification

To identify nipple, the segmented nipple image we compared with our dataset. For comparing we used the SURF algorithm to extract the feature. The following steps list below performs the nipple identification.

a) Covert 'SI' segmented images to gray-scale.
b) Extract SURF interest points of 'SI'.

c) Obtain features of 'SI'.
d) For each image 'DI' in dataset
   i. Covert 'DI' images to gray-scale
   ii. Extract SURF interest points of 'DI'.
   iii. Obtain features of 'DI'.
   iv. Match features of 'SI' & 'DI'
   v. Find the percentage of matched features P
   vi. If P having highest value than its previous then we keep new value of P otherwise we keep previous one.
   vii. Here we get the maximum percentage of match features of 'SI' & 'DI' then we check out the P ≥ 0.5 if yes then we say that segmented image is nipple image otherwise non nipple image.

3.5 Nude Image Identification

Once we checked out that any one located nipple region are really nipple or not and using Rigan Ap-apid algorithm we Identify that Image is nude or not.

IV. EXPERIMENTAL RESULTS AND DISCUSSIONS

4.1 Content-Based Skin Color Analysis

The enter pics for testing is categorized in: a) pictures of bare people or with explicit content material and b) natural pix. Within the images of uncovered people Asians, Caucasians, Europeans, Latin people and a bit measure of individuals with dark skin may be discovered. A natural images one that with the aid of its nature does now not comprise explicit or pornographic content material. In the arrangement of characteristic pictures there are numerous varieties of pics, for instance, dressed people, creatures, flowers, autos, toons, scenes and others were likewise get from net. Labeling the skin region manually, using Photoshop.

The color distribution of skin shades of various people turned into located to be grouped in a small area of the chromatic color space. Regardless of the reality that skin colors of various people beings seem to trade over a wide range, they comparison significantly less in color than in brightness. As it were, skin colors of various people beings are near, but they assessment for the maximum part in intensities. With this discovering, we ought to hold to build up a skin-color model within the chromatic color space.

A total of 367500 skin nibble from 1764 color pictures (25 × 25 size 3 skin images from 196 countries) were used to determine the color distribution of human skin in chromatic color space.

The skin color recognition result as shown in table1. There is 0.93 accuracy and 0.066 miss classification rate. The true positive and false positive rare are 0.94 and 0.085 respectively. Figure 1 show the sample output of skin segmentation.

Table 1. Confusion matrix for skin color and non skin

	Predicted No	Predicted Yes	
Actual No	160	15	175
Actual Yes	13	217	230
	173	232	

Fig. 2. Sample of Skin color segmentation

Using the Rigan Ap-apid Algorithm to know the image is likely porn or not we apply it on our skin color segmented 50 nude images. The experiment shows that when images having only breast portion open and rest of portion covered with cloth it can't say that images are porn images. The accuracy of content-based skin color analysis is 83.46%. The table 2 show the some sample result of content-based skin color analysis.

Table 2 Content-based skin color analysis to detect porn images

Input Image	Size	Pixels	% skin pixel	Decision
	100×125	12500	8.2	Not porn
	100×133	13300	9.23	Not porn
	100×150	15000	36.7	Like porn

	100×149	14900	7.67	Not porn
	100×150	15000	6.32	Not porn

4.2 Locating and Detecting Nipple

Locating and Detecting Nipple algorithm has been simulated through the use of Matlab codes and examined to pornographic pix downloaded from internet. A database of 850 pictures, which includes 310 photos with 465 labeled nipples and 540 non-nipple pictures, is used for trying out. Fig. 3 and 4 shows some results of nipple detection and some nipple samples from our dataset respectively. Table 3 presents the confusion matrix of experimental results for this testing database. There is 0.83 accuracy and 0.13 miss classification rate. The true positive and false positive rare are 0.70 and 0.04 respectively.

Table 3 Confusion matrix for nipple recognition

	Predicted No	Predicted Yes	
Actual No	420	20	440
Actual Yes	120	290	410
	540	310	

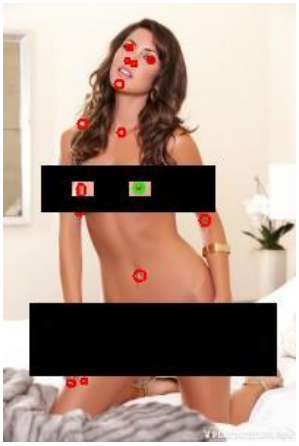


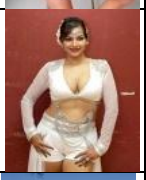
Fig. 3 Red color show the possibility of nipple location and Green color shows nipple detected

Fig. 4 Sample of Nipple Dataset

4.3 Nude Image Identification

Finally to identify the porn image we used same our skin color segmented 50 nude images. We apply Content-based skin color analysis algorithm and locating and detecting Nipple procedure. Any one gives positive response then we say that the image in porn image. The accuracy we get is 92.72%. Table 4 shows the some sample result of nude image identification using combination of content-based skin color analysis algorithm and locating and detecting nipple procedure.

Table 4 Combine approach to detect porn images

Input Image	Size	Pixels	% skin pixel	Decision
	100×125	12500	8.2	Not porn
	100×133	13300	9.23	Not porn
	100×150	15000	36.7	Like porn
	100×149	14900	7.67	Like porn
	100×150	15000	6.32	Like porn

V. CONCLUSIONS

In this paper, we proposed the locating and detecting nipple for nude photo detection gadget. it is novel in that nipple information used to categorise the nude pics. in addition, texture traits of the human skin are used to locate skin areas greater precisely. Experiment consequences display that proposed technique has an first rate performance in classifying nude pictures and detecting small nude photos in massive snap shots.

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