Retraction

Retraction: Improved Haar Cascade Feature Extraction and Access Control Framework for Rich Internet Applications (J. Phys.: Conf. Ser. 1916 012019)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1
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Improved Haar Cascade Feature Extraction and Access Control Framework for Rich Internet Applications

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Abstract. In the digital era, internet application access protection against malicious access is a major concern. The security aspects such as password, pattern lock, and biometric are commonly preferred in mobile applications. To enforce the security feature in all aspects the face recognition padlock framework is used to prevent unauthorized or malicious accesses. The proposed system will secure the rich internet applications from malicious accesses and threats. The improved haar cascade classifier effectively detects and recognizes the objects. The model will take a 4*4 feature matrix to train the positive and negative images. The positive image is the factual confident image whereas the negative image is everything else other than the confident image. The system will take 100 good samples to train the model. The internet application is eligible to access only when the confidence rate is greater than 90 percent. The confident rate is the match probability of the trained image and actual image.

Keywords: classifier, haar-cascade, confident level, face recognition, bounding box.

1. Introduction
To detect any object over the image, the algorithm will follow image classification, localization, and object recognition. The classification will envisage the type of object from the video or image. The localization framework will detect the bounding box for the detected objects. The object recognition will locate the object and the bounding boxes from the base video or image. Computer vision is widely used in autonomous vehicles, robotics, and cybersecurity, etc. Object recognition suffers from the quality of the image, lighting, and angle. The current research focuses on pattern recognition from high-resolution image pixels. The algorithm AdaBoost is effectively used to reduce the unwanted features during the classification. The defined haar features are also be enhanced to improve the prediction accuracy by adding a 45-degree angle in the line and edge feature [7]. The method named star-structure prediction model will give a better solution than a Violo model, but the accuracy is depending on the increased number of trained images. The feature classification is applied to all the
pixels on an image. The bigger challenge in object detection is to process the right features from the constrained image.

2. Related Work
SadiVural [1] et al, investigated object detection by the extended haar-feature. The approach includes all the features in terms of angle variation of 0, 30, 60, 90, 120, 150, and 180 degrees. The system uses the ANN-based decision logic to detect the nature of the objects. Also, the approach detects multi-view objects through neural network training. Ki-Yeong Park [2] et al, investigated the improved constant haar feature under various illuminations. The traditional haar feature prediction algorithm will detect the objects whenever the trained images and the sample contain the same illuminations. The approach included the variance normalization to train the images under various illuminations to detect the positive and negative images.

Y. Freund [3] et al, investigated the AdaBoost to train the classifiers for feature extraction. Also, it is used to detect and eliminate unwanted or redundant features from the classification. The approach will exhibit the strong classification from the sequence of weak classifiers. The model is used to extract the relevant features from the image and train the feature classifier. The training sample contains minimum expected error will be treated as a weak classifier. P. Viola, M. Jones [5] et al, investigated object recognition through the line, edge, and rectangle feature extraction. The ROI of the selected area is compared with the trained image to determine the accuracy of the mapping.

Hong Tian [6] et al, investigated the pedestrian's detection through the multiplex classifier by including the feature of haar and shapelet feature. The haar cascade will detect the objects more effectively. The haar-cascade filter will effectively filter the irrelevant features by the edge and line feature extraction whereas the shapelet feature will effectively detect the human shoulder, head, and body. P. Viola, M. Jones [9] et al, investigated the cascade classifier to discard the useless backgrounds and to rightly identify the objects from the image. The illumination model was also established in literature to learn the variation instigated by illumination [10][11][12].

Alexandros [13] et al, investigated cascaded support vector machine (CSVM) by the combined CSVM based on the histogram and fisher score selection. Sri-Kaushik [14] et al, investigated rapid object recognition by adding the extended featured over the traditional features. The weights are assigned in each of the pixels to differentiate the objects and non-objects.

3. Proposed Method
3.1 Haar Cascade Classifier

The Haar cascade classifier will detect the relevant features from the human face like lips, node, and eyebrow, etc. In general, the RGB image contains 16777216 color values. The feature extraction approach is difficult to implement with color images due to the color combination values. The improved haar classifier will take the input as a GRAY scale image for feature extraction and object recognition. The grayscale images have 0 to 255 black and white color values. The algorithm will compare the template with the ideal image. The template and the selected region mapping frequency should be near to ‘1’ will be assumed as the true object. Three feature detection strategies are classified from the Haar cascade classifier.

- **Edge features**

The edge features are detected by the black and white pixel values of the 1x2 or 2x1 matrix. The white pixels are represented by the gray value 255 whereas the black pixel is represented by the gray value 0 defined as the edge features shown in Figure 1.

![Figure 1. Edge features (top, bottom, left, right)](image-url)
• **Line features**

The line feature is like black surrounded by white or white surrounded by the black pixel values. The size of the region varies depends on the image and the pixel quality. Figure 2 shows the Non-haar linear line features.

![Figure 2. Non-linear Line features](image)

• **Four Rectangle features**

The four-rectangle feature is represented diagonally through the white and black pixel values in a 2*2 matrix. Figure 3 shows the four rectangles linear line feature.

![Figure 3. Four rectangle linear features](image)

### 3.2 Template Vs. Sample Feature

Figure 4 shows the template feature score for the black pixel as 0 and the white pixel as 255. The sample feature mapping and its values are represented in Figure 5. The set difference or the close approximation is estimated through Equation 3.1. The sign ¥ epitomizes the haar feature differences between the template and the sample.

![Figure 4. Template line feature](image)

![Figure 5. Sample feature mapping](image)

\[
\psi(t) = \frac{1}{n} \sum_{white}^{n} (x) - \frac{1}{n} \sum_{black}^{n} (x) \quad (3.1)
\]
3.3 Integral Image

The size of the feature is no limit to a 2x2 or 4x4 matrix. The cumulative pixel value of the 3x3 matrix is obtained by summing all the closed corners and their internal values.

\[
X = \begin{bmatrix}
  r_{11} & r_{12} & r_{13} \\
  r_{21} & r_{22} & r_{23} \\
  r_{31} & r_{32} & r_{33}
\end{bmatrix}
\] (3.2)

\[
r_{33} = r_{11} + r_{12} + r_{13} + r_{21} + r_{22} + r_{23} + r_{31} + r_{32} + r_{33}
\] (3.3)

To reduce the time complexity of the cumulative average calculation the concept called integral image is essential. Figure 6 shows the selective pixel average value of the 3x2 matrix from the 4x3 matrix values. The selective pixel average is estimated by Equation 3.4.

![Integral Image Table](image)

**Figure 6.** Selective pixel average

\[
\ell(x) = x - \alpha + \beta - \Gamma
\] (3.4)

The function \(\ell(x)\) indicated the quadric average of the region. The average value of the region is estimated by summing the quadric sum of the current region \(x\), upper left trap \(\beta\), and subtracting the upper left trap \(\alpha\), Lower left trap \(\Gamma\).

3.4 Adaboost

The algorithm takes 24x24 window sizes for the feature evaluation from the image. The image contains around 1,60,000+ features in terms of type, scale, and position. Among these, 1.5 percentage of the features are useful and the remaining features are useless or unwanted. To filter the useful features from the image the AdaBoost is essential. The algorithm AdaBoost will construct the strong classification by the linear connection of weak classification. The strong classification is estimated by Equation 3.5.

\[
F(x) = a_1g_1(x) + a_2g_2(x) + a_3g_3(x) + \ldots + a_ng_n(x)
\] (3.5)

Where, \(F(x)\) epitomizes the strong classifier and \(g_1(x), g_2(x), \ldots, g_n(x)\) are called weak classifier. The weighted combination of the harr features are used to evaluate and detect the objects. The weak classifiers is represented in terms of the boolean (0 or 1).

3.5 Improved Haar-Cascading

To recognize the human face, we need at least 2500 good features. By mapping all the relevant features to detect the human face leads to time complexity issues. The running time complexity is minimized by the cascade approach.
Figure 7. Image Cascading for Object Recognition

Figure 7 represents the image cascading and object recognition process flow. The 2*2 feature matrix will take a lot of iteration and time complexity to map the real and the trained images. To reduce the time and space complexity we have considered a 4*4 feature matrix. The improved method will reduce the good features by 60% over the 2*2 matrix feature. The linear and non-linear improved haar-cascade feature sets are represented in Figures 8, 9, and 10. Figure 11 shows the Haar-Feature with a different scale.
3.6 Face Recognition Process Flow

The process flow of the face recognition is and haar feature training model is represented in Figure 12 & Figure 13.

![Figure 12. Face Recognition skeleton](image-url)
Figure 13. Haar-Cascade Process Flow

- **Image capture**

The first step in face feature recognition is to capture an image from the real-time video. The video is split into frames for training as well as testing. To train the system the algorithm uses 100 good positive samples. To improve the confidence rate of the processed image, we can maximize the image samples. The following line of code is used to capture the video from the webcam.

```
cap = cv2.VideoCapture(0)
```

- **Image conversion**

Mostly the digital images are in RGB (Red, Green, Blue) form. But, for easy processing the RGB image is converted into gray scale. The method named as COLOR_BGR2GRAY are used for gray image conversion.

```
gray=cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
```

- **Bounding box**

To locate the object in an image the bounding box could be drawn. The outliers are eliminated and the face feature is cropped. The bounding box is detected by the following line of code.

```
for (x,y,w,h) in faces:
cv2.rectangle(resized, (x,y), (x+w,y+h), (127,0,255), 2)
```

- **Face Recognition**

The haar cascade algorithm will match the trained image with the sample image. Through the template matching approach, the sample image is compared with the trained image.

```
face_classifier = cv2.CascadeClassifier('Haarcascades/haarcascade_frontalface_default.xml')
```

- **Confident level**

The confidence level of the trained image is estimated with the trained image. The confidence interval rate is estimated by the following line of code.

```
confidence = int(100 * (1 - (results[1]/400))
```

4. Results and Discussion

The experiment is simulated in an anaconda Jupiter notebook. The system took 100 image samples to train the model. The system accuracy is based on the number of training samples and their true feature. The bounding box image is converted into a grayscale image for the training shown in Figure 14. The face accuracy is estimated by extracting the relevant feature from the image.
The sample and the confidence percentage of the tested images are represented in Figure 15. In our example, we have taken from 100 to 1000 different samples to train the system. The confidence rate is gradually increased depends on the number of image samples. Two opinions will be given by the trained system after getting a video or image. If the confidence level is from 90 to 100 percent then the system will give you the access rights to access the internet applications. If not, the system will not issue a right to access the application and it will notify the unauthorized access by the alarm. Figure 16 shows the authorized and unauthorized access control sample test output.
5. Conclusion

The application access protection is commonly done through the password and pattern. Sometimes the shadow of the pattern and password is possibly predictable. To prevent unauthorized application access from the user is restricted by face recognition. Exact facial features are deeply analyzed to understand the authorized person. The features such as the smile and expression are also used to training images. The confident percentage is estimated by the probability of the trained image and the testable image. The proposed system uses the improved haar-feature extraction approach to detect the authorized and unauthorized persons effectively. The proposed system provided a 94.73 percentage of the accuracy over the malicious access.

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