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CRIMINAL DETECTION THROUGH FACIAL RECOGNITION

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ABSTRACT

Crimes are at rise and becoming difficult for police to identify and catch the criminals. This increasing crime rate can be reduced by giving alert to the person before its occurrence. Our Proposed System will use Face Recognition Algorithms to detect Criminals and will also use face expressions detection to detect expressions of the person. Face Recognition and Face Expression begins with extracting the coordinates of features such as width of mouth, width of eyes, pupil, and compare the result with the measurements stored in the database and return the closest record (facial metrics).The system will be running in detection mode [i.e scanning].If a person is feeling uncomfortable with people surrounded by him/her, can scan their face and find out whether hat particular person has any crime record or not. If the person is having a crime record then the word criminal is displayed on the screen. If the person is not having any crime record but still he/she is feeling uncomfortable then they can use the emergency button, click on the emergency button then the location of user, image of the suspect and user, and a message for rescue is sent to the volunteers of the system. Here volunteers are the persons, who will register into the system in order to help the people in need.

KEYWORDS: *Criminal dataset, Face recognition, Detection.*

1. INTRODUCTION

Crimes are at rise and becoming difficult for police to identify and catch the criminals. This increasing crime rate can be reduced by using face recognition algorithm and by giving alert message to the person before its occurrence. Our Proposed System will use Face Recognition Algorithms to detect Criminals and will also use facial expressions to detect bad intent. Face Recognition and Face Expression begins with extracting the coordinates of features such as width of mouth, width of eyes, pupil, and compare the result with the measurements stored in the database and return the closest record(facial metrics).If a person is feeling uncomfortable with people surrounded by him/her, can scan their face and find out whether that particular person is having any crime record or not. If the person is having crime record then the alert message is displayed. If the person is not having any crime record but still he/ she is feeling uncomfortable then they can share the images and other details.

2. LITERATURE SURVEY

Mayuri S.Takore & Pallavi R.Wankhade, Criminal Face Identification System, International Journal for research in applied science and engineering technology, June 2018

In practice, identification of criminal in Malaysia is done through thumbprint identification. However, this type of identification is constrained as most of criminal nowadays getting cleverer not to leave their thumbprint on the scene. With the advent of security technology, cameras especially CCTV have been installed in many public and private areas to provide surveillance activities. The footage of the CCTV can be used to identify suspects on scene. However, because of limited software developed to automatically detect the similarity between photo in the footage and recorded photo of criminals, the law enforces thumbprint identification. In this project, an automated facial recognition system for criminal database was proposed using known python programming language. This system will be able to detect face and recognize face automatically. This will help the law enforcements to detect or recognize suspect of the case if no thumbprint present on the scene.

Yang Yang, Zheng-JunZha,HengTaoShenandTatSengChua, "Robust Semantic Video Indexing by HarvestingWeb Images", S. Li et al. (Eds.): MMM 2013

Semantic video indexing, also known as video annotation, video concept detection in literatures ,has attracted significant attentions recently. Due to the scarcity of training videos, most existing approaches can scarcely achieve satisfactory performances. This paper proposes a robust semantic video indexing framework, which exploits user-tagged web images to assist learning robust semantic video indexing classifiers. The following two challenges are well studied:(a) domain difference between images and videos; and(b) noisy web images with incorrect tags. Specifically, we first estimate the probabilities of images being correctly tagged as confidence scores and filter out the images with low confidence scores. We then develop a robust image-to-video indexing approach to learn reliable classifiers from a limited number of training videos together with abundant user-tagged images. A robust loss function weighted by the confidence scores of images is used to further alleviate the influence of noisy samples. An

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optimal kernel space, in which the domain difference between images and videos is minimal, is automatically discovered by the approach to tackle the domain difference problem. Experiments on NUS-WIDE web image dataset and Kodak consumer video corpus demonstrate the effectiveness of the proposed robust semantic video indexing framework.

Chih-Chin Lai; Ying-Chuan Chen, "A User-Oriented Image Retrieval System Based on Interactive Genetic Algorithm", IEEE Transactions on Instrumentation and Measurement, Volume: 60, Issue: 10, 2011

Digital image libraries and other multimedia databases have been dramatically expanded in recent years. In order to effectively and precisely retrieve the desired images from a large image database, the development of a content-based image retrieval (CBIR) system has become an important research issue. However, most of the proposed approaches emphasize on finding the best representation for different image features. Furthermore, very few of the representative works well consider the user's subjectivity and preferences in the retrieval process. In this paper, a user-oriented mechanism for CBIR method based on an interactive genetic algorithm (IGA) is proposed. Color attributes like the mean value, the standard deviation, and the image bitmap of a color image are used as the features for retrieval. In addition, the entropy based on the gray level co-occurrence matrix and the edge histogram of an image is also considered as the texture features. Furthermore, to reduce the gap between the retrieval results and the user's expectation, the IGA is employed to help the users identify the images that are most satisfied to the user's need. Experimental results and comparisons demonstrate the feasibility of the proposed approach.

Beecks,C.; Uysal,M.S.; Seidl,T.,"A comparative study of similarity measures for content-based multimedia retrieval", IEEE International Conference on Multimedia and Expo (ICME), 2010

Determining similarities among data objects is a core task of content-based multimedia retrieval systems. Approximating data object contents via flexible feature representations, such as feature signatures, multimedia retrieval systems frequently determine similarities among data objects by applying distance functions .In this paper, we compare major state-of-the-art similarity measures applicable to flexible feature signatures with respect to their qualities of effectiveness and efficiency. Furthermore, we study the behavior of the similarity measures by discussing their properties. Our findings can be used in guiding the development of content-based retrieval applications for numerous domains.

3.SYSTEM ANALASYS

EXISTING SYSTEM

In the existing system, we can see the details of particular information about the police stations in our state, the existing system has more workload for the authorized person, but in the case of Proposed System, the user can register in our site and send the crime report and complaint about a particular city or person.

DISADVANTAGES

- More man power
- Time consuming
- No direct role for the higher officials
- Damage of machines due to lack of attention

PROPOSEDMETHOD

The Proposed system will be using advanced algorithms and use the one which is better further implementing the system in a project. To make a proper Graphical User Interface based application so that the system can be easily used by anyone. Using all modules, making a criminal identification system integrated with human facial expression recognition. The facial recognition system can detect the expression of a person in camera view and displays the expression on the screen. In case of emergency, the user can share the images, location and other details.

ADVANTAGES

- HighestAccuracy
- ReduceTimeComplexity
- EasyToUse

3.1SYSTEM REQUIREMENTS SPECIFICATION SOFTWARE CONFIGURATION

- Operating System :WindowsPython,Version3.x
- Pip :Version19.x
- Database :MySQL

HARDWARECONFIGURATION

- **Processor : Inteli3orabove**
- **Hard Disk : 500GB**
- **RAM : 4GBorabove**
- **Module microcontroller : Arduino MEGA**

FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Requirement's analysis is very critical process that enables the success of a system or software project to be assessed. Requirements are generally split into two types: Functional and non- functional requirements.

Functional Requirements: These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily in corporate into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the non-functional requirements.

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Examples of functional requirements:

1) Authentication of user whenever he/she logs into the system
2) System shutdown in case of a cyber-attack
3) A verification email is sent to user whenever he/she register for the first time on some software system.

Non-Functional Requirements: These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are also called non-behavioral requirements. They basically deal with issues like**:**

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

Examples of Non-Functional Requirements

- Emails should be sent with a latency of no greater than12 hours from such an activity.
- Theprocessingofeachrequestshouldbedonewithin10seconds
- The site should load in 3seconds whenever of simultaneous users are > 10000

3.2SYSTEM ARCHITECTURE

The figure 1 illustrates a facial recognition-based volunteer emergency alert system. It begins with the admin logging in to manage the system, including adding volunteers and uploading criminal faces. These inputs are used for model training. Users also log in and interact with the system by tracking faces. If a tracked face matches a known criminal, the system detects an emergency and automatically sends an SMS alert to nearby volunteers. This integration ensures quick response and enhances public safety through coordinated volunteer support.

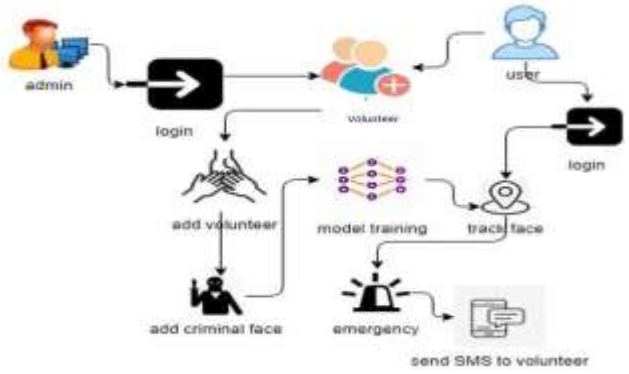


Fig1. Architecture Diagram

3.3. METHODOLOGYANDALGORITHMS

We have used two algorithms in our system. They are convolutional neural networks and local binary patterns.

Convolutional Neural Network

- CNN is a feed forward neural network that is generally used to analyze visual images by processing data with a grid like topology.
- CNN is also known as “ConvNet”.
- CNN was invented by“ YannLeCun”. He was the director of Facebook's AI research group and built the first CNN called LeNetin1988.

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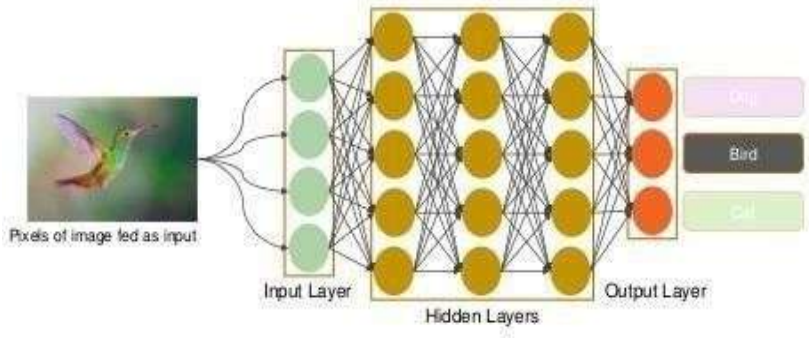


Fig 2: Convolutional Neural Network

The CNN architecture has three layers. They are:
Input Layer: Accepts the pixels of images as input in the form of arrays.

Hidden Layer
Carryout feature extraction by performing certain calculation and manipulation.This part where there organization of pictures is done in multiple ways until we get data easy to read by neural networks. There are multiple hidden layers like
1. Convolution layer: This layer uses a matrix filter and performs convolution operation to detect patterns in the image. In machine learning, filters are used in image processing. They are used to blur the image, sharpen the image, the edges of images etc. generally filters are 3x3 matrices. If the image array is greater than the filter array size then slide the filter matrix over the image and compute the dot product to detect patterns.
2. ReLu layer: Activation function is applied to the convolution layer to get a rectified feature map to image.
3. Pooling layer: The rectified feature map now goes through a pooling layer. It uses different filters to identify different parts of the image like edges, corners,eyes, etc.
4. Output Layer: It is also known as fully connected layer. After the flattening process the flattened matrix is fed as input to the fully connected layer to classify image.

3.4.LOCAL BINARY PATTERN ALGORITHM

Parameters :LBPH uses 4 parameters:
Radius: radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.

Neighbors: number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.

Grid X: number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resultingfeaturevector.Itisusuallysetto8.

GridY: number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

Training the Algorithm: First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID(it may be a number or the name of the person)for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed, let's see the LBPH computational steps.

Applying the LBP operation:The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

Extracting the Histograms: Now, using the image generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids.

Performing the face recognition: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and create a histogram which represents s the image.

4. RESULTS AND CONCLUSION

Overall the project is being developed to help the citizens as well as police to solve the crime or prevent it before its occurrence. Here only the admin can add the criminals into the system. When a person is in emergency there are two possible chances, one they are having time to scan the image of the suspect then they can scan and press the emergency button then the image of suspect along with user, location and user details are sent to volunteers. Second, the user is not having time to scan the image of the suspect then can directly click on the emergency button then the image of user, location and user details, along with the image of the things which is present in front of the camera at the click on emergency button.

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REFERENCES

1. *Mayuri S.Takore & Pallavi R.Wankhade, Criminal Face Identification System, International Journal for research in applied science and engineering technology, June 2018*
2. *Yang Yang, Zheng-JunZha,HengTaoShen and TatSeng Chua, "Robust Semantic Video Indexing by Harvesting Web Images", S. Li et al. (Eds.): MMM 2013.*
3. *Chih-Chin Lai; Ying-Chuan Chen, "A User-Oriented Image Retrieval System Based on Interactive Genetic Algorithm", IEEE Transactions on Instrumentation and Measurement, Volume: 60, Issue: 10, 2011.*
4. *Beecks,C.; Uysal,M.S.; Seidl,T.,"A comparative study of similarity measures for content-based multimedia retrieval", IEEE International Conference on Multimedia and Expo (ICME), 2010.*
5. *Aiswarya, S., & Renuka, R. (2019). Crime detection using face recognition. International Journal of Engineering Research & Technology (IJERT), 8(10). https://www.ijert.org/crime-detection-using-face-recognition*
6. *Deb, S., & Bhowmik, P. K. (2017). Face recognition for criminal identification: An implementation of Principal Component Analysis. AIP Conference Proceedings, 1891(1), 020002. https://doi.org/10.1063/1.5005345*
7. *Priya, G., & Divya, A. (2024). Detecting of criminals using facial recognition. International Journal of Engineering Research & Technology (IJERT), 13(1). https://www.ijert.org/detecting-of-criminals-using-facial-recognition*
8. *Nishitha, J., & Lavanya, V. (2023). Criminal investigation with the help of face recognition. International Journal of Engineering Research & Technology (IJERT), 12(2). https://www.ijert.org/criminal-investigation-with-the-help-of-face-recognition*
9. *Sharma, A., & Jain, M. (2021). Criminal face detection system. International Journal of Advance Research and Innovation, 9(2), 121–123. https://www.journalpressindia.com/international-journal-of-advance-research-and-innovation/doi/10.51976/ijari.922108*
10. *Agarwal, S., & Singh, R. (2022). Deep learning based face detection and identification of criminal suspects. Computers, Materials & Continua, 73(3), 4607–4623. https://doi.org/10.32604/cmc.2022.020157*
11. *Sun, M., Wang, Y., & Wu, J. (2024). Police facial recognition applications and violent crime control in U.S. cities. Cities, 145, 104696. https://doi.org/10.1016/j.cities.2024.104696*
12. *Jadhav, R., & Kulkarni, S. (2024). Real-time criminal detection system using deep learning technique. International Journal for Research in Applied Science and Engineering Technology (IJRASET), 12(4). https://www.ijraset.com/research-paper/real-time-criminal-detection-system-using-deep-learning-technique*
13. *Zhang, X., & Wu, Y. (2020). The criminality from face illusion. arXiv preprint. https://arxiv.org/abs/2006.03895*
14. *Albahli, S., & Rauf, H. T. (2021). An improved real-time face recognition system at low resolution based on local binary pattern histogram algorithm and CLAHE. arXiv preprint. https://arxiv.org/abs/2104.07234*