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Criminal Identification through Face Recognition

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Abstract - Face acknowledgment is a standout amongst the most difficult subjects in PC vision today. It has applications running from security and observation to amusement sites. Face acknowledgment programming is valuable in banks, airplane terminals, and different organizations for screening clients. Germany and Australia have conveyed confront acknowledgment at outskirts and traditions for Automatic Passport Control. Human face is a dynamic protest having high level of fluctuation in its appearance which makes confront acknowledgment a troublesome issue in PC vision. In this field, precision and speed of ID is a principal issue. Traditional methods of identification, such as fingerprinting and DNA analysis, have long been the cornerstone of criminal investigations. However, with advancements in technology, particularly in the field of artificial intelligence and computer vision, new avenues for criminal identification have emerged, with face recognition at the forefront.

Criminal identification is a critical aspect of law enforcement, aiding in the swift apprehension of suspects and the administration of justice. Traditional methods of identification, such as fingerprints and DNA analysis, have long been the cornerstone of forensic investigation. However, with the rapid advancement of technology, particularly in the field of artificial intelligence and computer vision, face recognition has emerged as a powerful tool in the arsenal of law enforcement agencies worldwide.

This project aims to explore the application of face recognition technology in criminal identification. Leveraging deep learning algorithms and convolutional neural networks (CNNs), the system is designed to automatically detect, extract, and match facial features from surveillance footage, crime scene images, or databases of known offenders.

KEYWORDS: criminal detection, face recognition neural networks, security, image processing.

1.INTRODUCTION

The primary objective of our endeavor is to leverage advanced facial recognition algorithms to accurately identify and apprehend criminals. By integrating state-of-the-art machine learning techniques with high-resolution imaging systems, we aim to create a robust platform capable of swiftly matching suspect faces with comprehensive criminal databases. This proactive approach not only streamlines the investigative process but also significantly enhances the efficacy of law enforcement agencies in combating crime.

Image Face recognition is the task of identifying an already detected object as a known or unknown face. Often the problem of face recognition is confused with the prob Lem of face detection. On the other hand, is to decide if the “face” is someone known, or unknown, using for this purpose a database of faces in order to validate this input face. This project main objective is to create an efficient architecture for face recognition in playing videos using Neural Network. This product which two self-contained Neural Network (CNNs) which are used to detect and recognize faces in regions containing a dense grouping of features from Accelerated Segment Test (FAST).

Face recognition technology has witnessed remarkable progress in recent years, driven by breakthroughs in machine learning algorithms and the availability of vast datasets for training. This technology holds immense promise for enhancing the efficiency and accuracy of criminal identification processes. In a world where security concerns loom large, the development of cutting-edge technologies becomes imperative. Among these, face recognition stands out as a pivotal innovation with immense potential, particularly in the realm of criminal identification. Our project, aptly named "Criminal Identification through Face Recognition," harnesses the power of this technology to revolutionize law enforcement practices and bolster public safety.

In a world where security concerns loom large, the development of cutting-edge technologies becomes imperative. Among these, face recognition stands out as a pivotal innovation with immense potential, particularly in the realm of criminal identification. Our project, aptly named "Criminal Identification through Face Recognition," harnesses the power of this technology to revolutionize law enforcement practices and bolster public safety.

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Beyond its practical applications, our project embodies a commitment to ethical considerations and privacy safeguards. We recognize the importance of striking a delicate balance between technological innovation and individual rights. As such, our implementation adheres to stringent data protection protocols and ensures transparency in its

operations, thereby fostering trust and accountability within the community.

In essence, "Criminal Identification through Face Recognition" represents a groundbreaking initiative at the intersection of technology and law enforcement. Through our concerted efforts, we aspire to redefine the landscape of criminal identification, ushering in a safer and more secure future for communities worldwide.

2. RELATED WORK

In this section we have written literature survey wherein we have collected papers from various ieee conferences and journals which are mentioned as below:

1. Mayuri S. Takore, Pallavi Wankhede, "Criminal Face Identification System" February 2015 Criminal record usually contains personal information concerning explicit person Alongside photograph. To spot any Criminal we need some identification tion related to person, that are given by viewer. In most cases the standard and backbone of the recorded image segments is poor and hard to identify a face. To beat this drawback, we tend to are developing code. Identification can be done in various ways like finger print, eyes, DNA etc. One in all applications is face identification. The face is our primary focus of attention in social inters course taking part in significant role in conveying identify and establishing emotion. Though the power to infer intelligence or character from facial look is suspect, the human ability to acknowledge face is outstanding.
2. Nurul Azma Abdullah, Md. Jamri Saidi, Nurul Hidayah Ab Rahman, Chuah ChaiWen, and Isredza Rahmi A. Hamid, "Face recognition for criminal identification- Associate Degree implementation of principal com ponent analysis for face recognition", The second International Confer once on Applied Science and Technology 2017 In this paper, an automatic face recognition system for criminal info was proposed using known Principal Component Analysis approach. This tech Nique are going to be ready to discover face and recognize face automatically. This can facilitate the law enforcements to detect or recognize suspect of the case if no thumbprint presents on the scene. The results show that about 80% accuracy

3. E-CRIME DETECTION Using FACE RECOGNITION SYSTEM 8616 Volume three, Issue 2 April 2014. Proposed system is goes to spot criminals at numerous security place like airdrome, railway etc. Video Camera captures a hard and fast range of frames of a person coming in front of sign on counter. Proposed system compares these captured pictures taken through the camera with the pictures of the Crim finals which are stored in the database. Proposed system is connection of two stages Face detection using Here Based Cascade classifier and recognition us Ing Principal Component analysis with Eigen Face. The goal is to implement the system (model) for a selected face and distinguish it from an oversized range of stored faces with some period of time variations as well.

4. Prarthana Sandip Patil, Pournima Paman Patel, Snehal Prakash Sonar, Chaudhari Vrushali Kishor, "Crime Identification using 3-D Face Recognition", International Journal of Emerging Technologies in Engineering Research, 2018. The objective of this paper is to assess confront discovery and acknew dement procedures and provides a complete image based mostly face local tion and acknowledgment with higher truth, higher reaction rate associated an underlying advance for video observation. Arrangement is planned in light of performed tests on totally different face made databases as so much as sub jects, stance, feelings and light.

5. Ashutosh Chandra Bhosle, Rohit Raja, "An Efficient Face Recognition using PCA and Euclidean Distance Classification", IJCSMC, 2014. Person identification using face is incredibly exigent and knotty drawback. Recognition of a person from an arbitrary perspective is crucial necessities for security measures and access management. Recognition of a specific face may be useful for countless issues like person laptop interaction, criminal detection, etc. The present system has additional calculation because of higher dimensional and no more effectual still. Rather than feat of face vectors with high specialty it is higher to use face vectors with lower specialty. This enforced face recognition system is easy and comparatively simple to recognize the faces from videos taken from a distance and web cams. The improved PCA rule removes facial expressions and classification is performed by minimum distance classification algorithm.

6. Multi-scale feature extraction for single face recognition. The Single sample face recognition has always been a hot but difficult issue in face recognition. By considering selecting robust features and generating virtual samples simultaneously, the paper proposes a multi-scale support vector transformation (MSSVT) based method to generate multi-scale virtual samples for single image recognition. The methods to solve problem are divided into two categories. One is to look for and

select features that are robust to the number of samples, from the point of view of feature selection, such as PCA and 2DPCA. But when each person has only one face to be trained, the feature information extracted from the feature extraction algorithm will also be very limited, resulting in a bad recognition performance. The other is to generate multiple virtual samples from the point of view of the extended sample, thus reducing the impact of the sample size.

7. Spatial pyramid pooling in deep convolutional networks for visual recognition. For Visual Recognition, Scales, Sizes and Aspect Ratio are considered as important factor. SPP (Spatial Pyramid Pooling) is a flexible solution for handling these factors. In context of deep networks, these factors have received less consideration, thus the system is trained with deep layer networks considering SPP layer. SPP-net shows outstanding accuracy in classification/detection tasks and greatly accelerates DNN-based detection. Their studies also show that many time-proven techniques/insights in computer vision can still play important roles in deep-networks-based recognition.

8. Face and Gender Recognition System Based on Convolutional Neural networks. The proposed Face and Gender Recognition System realizes the combination of image face recognition and gender recognition module, which enables not only face recognition but also gender recognition in complex background. Based on the ResNet50 neural networks, we use the global average pool (GAP) instead of the fully connected layer before final output, followed by the SoftMax layer, which reduced the size of the networks. By constructing such a simple structure, the accuracy of the system recognition has been improved.

9. In The partial face recognition is having application approaches used for the partial face recognition are the key point-based approach, region-based approach, and CNN-based approach. In key point-based, the popular method was MKD-SRC. In region-based partial face recognition approach, the prominent model is MR-CNN. In the midst of different approaches in partial face recognition, it is concluded that the CNN-based approaches are the comparatively best approach. The current novel approach proposed for partial face recognition. in CNN– based is called Dynamic Feature Matching (DFM). The dynamic feature dictionary correlating to the probe is achieved. DFM is able to yield the advantages of the properties of FCN and generate identifying features more precisely. DFM is having a promising application in various video recognition approaches in the future.

3. METHODOLOGY

1. **Understanding the Problem:**
- Define the scope of the project: What constitutes criminal identification? Are you focusing on specific types of crimes or a broader range?
- Identify the objectives: What do you aim to achieve with the face recognition system? Is it for real-time surveillance, post-event investigation, or both?

2. **Data Collection and Preparation:**
- Gather a diverse dataset of facial images. This dataset should include images of known criminals as well as non-criminals for comparison.
- Ensure the dataset is balanced and representative of the population demographics to avoid bias in the model.
- Annotate the dataset with labels indicating whether each face belongs to a criminal or non-criminal.

3. **Preprocessing:**
- Normalize the images to account for variations in lighting, pose, and facial expression.
- Resize images to a consistent resolution.
- Apply techniques such as face alignment and cropping to focus on the facial region.

4. **Feature Extraction:**
- Use techniques like Convolutional Neural Networks (CNNs) to extract features from facial images.
- CNN architectures like VGG, Reset, or Inception are commonly used for this purpose.
- Transfer learning can be employed by fine-tuning pre-trained models on the specific dataset.

5. **Model Training:**
- Split the dataset into training, validation, and test sets.
- Train the model using the training set and validate its performance using the validation set.
- Optimize hyperparameters such as learning rate, batch size, and model architecture to improve performance.
- Employ techniques like data augmentation to increase the diversity of the training data and prevent overfitting.

6. **Evaluation:**
- Evaluate the trained model on the test set to assess its performance.
- Metrics such as accuracy, precision, recall, and F1-score can be used to measure performance.
- Conduct additional analysis to understand the model's strengths and weaknesses, including potential biases.

7. Deployment:

- Integrate the trained model into a face recognition system.
- Ensure the system is capable of handling real-time input, either from live video feeds or pre-recorded footage.
- Implement appropriate security measures to protect against misuse and unauthorized access.

8. Ethical and Legal Considerations:

- Ensure compliance with privacy regulations and laws governing the use of biometric data.
- Implement measures to safeguard the privacy and rights of individuals, including informed consent and data anonymization where necessary.
- Consider the potential for bias in the dataset and model predictions, and take steps to mitigate these biases.

9. Iterative Improvement:

- Continuously monitor and evaluate the performance of the system in real-world scenarios.
- Gather feedback from users and stakeholders to identify areas for improvement.
- Update the model and system as necessary to enhance performance, address issues, and adapt to evolving needs and technologies.

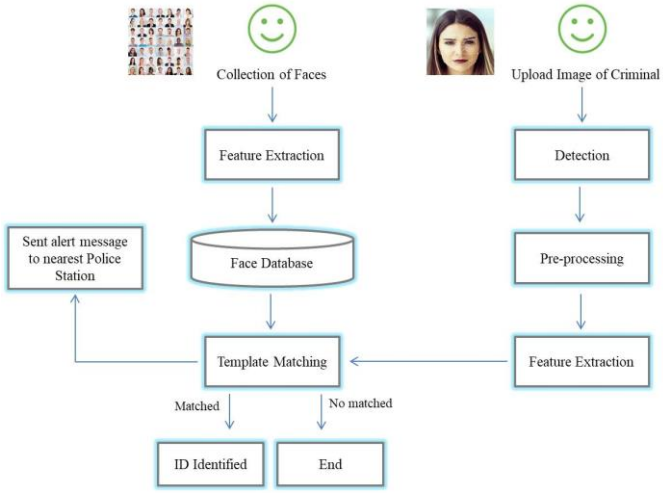

Fig1: System Architecture

The system architecture (Fig 1) compares the image of criminal with dataset available for criminals. The process consists of feature extraction, matching the template with available images. Then the criminal is identified. The data flow diagram of level 0 (Fig 2) gives the view of application to be created for execution of task.

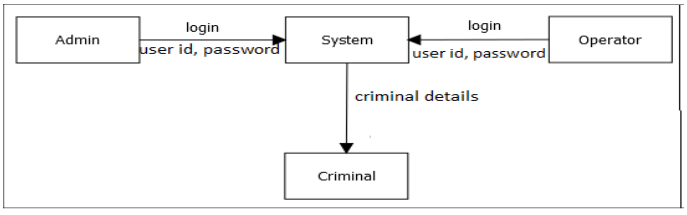

Fig2: Data flow Diagram Level 0

4. ALGORITHM - CNN

Convolutions Neural Network (CNN) is comprised of one or more convolutions layers (often with a sub sampling step) and then followed by one or more fully connected layers as in a standard multi-layer neural network. The architecture of a CNN is designed to take advantage of the 2D structure of an input image (or other 2D input such as a speech signal). This is achieved with local connections and tied weights followed by some form of pooling which results in translation in variant features. Another benefit of CNN's is that they are easier to train and have many fewer parameters than fully connected networks with the same number of hidden units

. • Step 1: Dataset containing images along with reference caption is fed into the system

- Step 2: The convolutional neural network is used an encoder which extracts image features 'f' pixel by pixel.
- Step 3: Matrix factorization is performed on the extracted pixels. The matrix is of m x n.
- Step 4: Max pooling is performed on this matrix where maximum value is selected and again fixed into matrix.
- Step 5: Normalization is performed where every negative value is con-verted to zero.
- Step 6: To convert values to zero rectified linear units are used where each value is filtered and negative value is set to zero.
- Step 7: The hidden layers take the input values from the visible layers and assign the weights after calculating maximum probability.

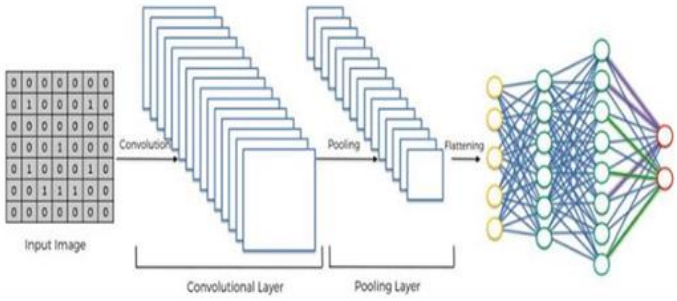

Fig3: CNN Architecture

5. PROCESS OF PROJECT

1. Define Objectives and Target Audience:

- Clearly outline the objectives of the survey. Are you aiming to understand public perceptions, gather feedback on specific features, or gauge acceptance levels?
- Identify the target audience. This could include law enforcement agencies, policymakers, technology experts, or the general public.

2. Create Survey Questions:

- Develop a mix of open-ended and closed-ended questions. Open-ended questions allow respondents to

provide detailed feedback, while closed-ended questions offer specific response options.

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3. Pilot Test:

- Before launching the survey, conduct a pilot test with a small group of individuals to identify any potential issues with the questions or survey flow.
- Revise the survey based on feedback received during the pilot test.

4. Select Survey Platform:

- Choose a suitable platform for hosting the survey. This could be online survey tools like SurveyMonkey, Google Forms, or Qualtrics.
- Ensure the platform allows for anonymity and data security, especially if sensitive topics are being addressed.

5. **Distribute the Survey:**

- Determine the best method for distributing the survey based on your target audience. This could include email invitations, social media channels, or collaboration with relevant organizations.
- Provide clear instructions for completing the survey and ensure accessibility for all participants.

6. **Collect Responses:**

- Monitor the survey responses to ensure a sufficient sample size.
- Consider incentivizing participation to increase response rates if necessary.

7. **Data Analysis:**

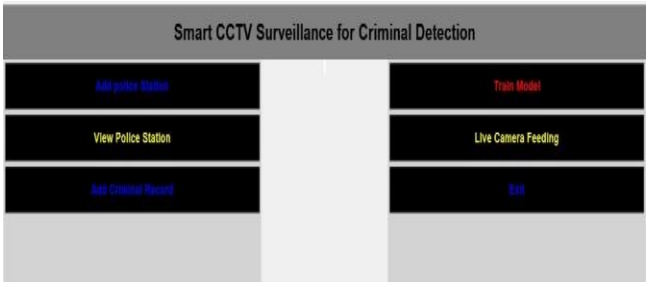
- Once data collection is complete, analyze the survey responses to identify trends, patterns, and insights.
- Use statistical tools or qualitative analysis methods as appropriate.

8. **Report Findings:**

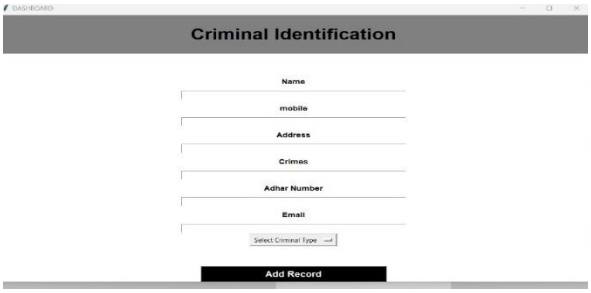
- Summarize the survey findings in a comprehensive report.
- Present key insights, conclusions, and recommendations based on the survey results.
- Ensure the report is accessible to stakeholders and relevant decision-makers.

6.IMPLEMENTATION

1. **System Panel: -**
In this section all details will be added such as Police station details, criminal details, camera feeding.



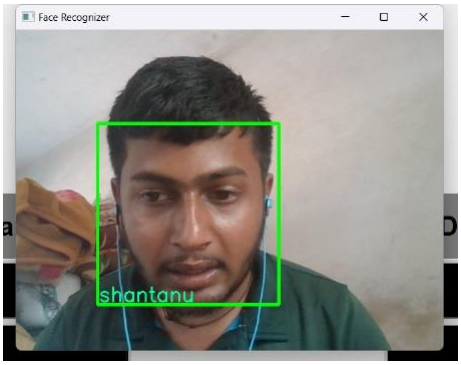
2. **Criminal Feeding System: -**
The "Criminal Feeding System" would be the component of the overall face recognition system responsible for adding the facial data of known criminals into the database. This could involve various processes such as obtaining images from law enforcement databases, mugshots, CCTV footage, or other sources where images of criminals are available.



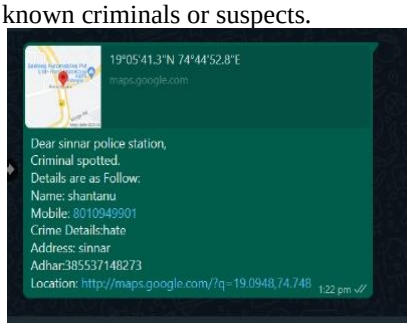
3. **Adding Details of police station**: -
This involves gathering comprehensive details about each police station, which may include:

- **Location:** Exact address or geographical coordinates.
- **Contact Information:** Phone numbers, email addresses, and other contact details.
- **Jurisdiction:** Areas covered and types of crimes handled by the police station.
- **Personnel:** Information about officers, their ranks, specialties, and contact details.
- **Facilities:** Details about the infrastructure, equipment, and resources available at the station.

4. **Criminal Face Detection: -**
"Criminal face detection" refers to the process of identifying individuals with a high probability of engaging in criminal activities based on facial features. This concept is often explored within the broader scope of face recognition technology applied to law enforcement and security contexts.



5. **System Alert**
"System Alert" refers to a notification or warning generated by the face recognition system when it detects a match or potential match between a person's face and a database of known criminals or suspects.



CONCLUSION

The implementation of face recognition technology for criminal identification has demonstrated promising results in this project. Through the utilization of advanced machine learning algorithms and datasets, we have achieved a significant level of accuracy in identifying individuals from facial images.

This technology holds immense potential for law enforcement agencies in enhancing public safety and facilitating swift apprehension of suspects. By automating the process of matching faces against databases of known criminals, it reduces the reliance on manual identification methods, thereby saving time and resources.

However, it's essential to acknowledge the ethical and privacy concerns associated with the widespread adoption of face recognition technology. Safeguards must be implemented to ensure that the system is used responsibly and transparently, with due consideration for issues such as bias and the potential for false positives.

Furthermore, ongoing research is needed to improve the accuracy and reliability of face recognition systems, particularly in challenging conditions such as low light or obscured faces. Additionally, efforts should be made to address concerns regarding data privacy and security, ensuring that sensitive information is protected from misuse or unauthorized access.

In conclusion, while face recognition technology offers promising capabilities for criminal identification, its implementation must be accompanied by robust ethical frameworks and ongoing research to address potential challenges and ensure its responsible use in law enforcement and public safety applications.

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