Missing Person Detection System Using Machine Learning

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Abstract— Enhancing missing person detection is a critical aspect of search and rescue operations, where the use of machine learning algorithms and OpenCV technology. As advancements in technology continue to evolve, the implementation of machine learning algorithms has become a focal point in improving the accuracy and efficiency of missing person detection processes. Additionally, the integration of OpenCV, a library for computer vision and machine learning, further enhances the capabilities of search and rescue systems by enabling real-time image processing and object detection. This comprehensive system combines the strengths of machine learning algorithms and OpenCV technology to create a robust framework for improving search and rescue operations. In this research paper, we delve into the significance of machine learning algorithms in enhancing missing person detection, explore the role of OpenCV in search and rescue operations, and discuss the components of a comprehensive system that integrates these technologies to enhance the efficiency and effectiveness of search and rescue missions.

Keywords—OpenCV, Machine learning, robust framework

I. INTRODUCTION

Missing Person Detection System is a transformative project at the intersection of compassion and cutting-edge technology in a world driven by technological innovation and a growing need for advanced solutions to societal challenges. This initiative is driven by the critical and time-sensitive nature of locating missing individuals, aiming to redefine the traditional search and rescue paradigm. By incorporating machine learning and facial recognition technologies into a web-based application, this project seeks to expedite the search process while also improving the precision and efficiency of identifying missing individuals. The system encourages public participation by enabling citizens to upload pictures of strangers; if the complaint number matches a reported missing person.

Beyond its immediate functionalities, the project embraces an expansive scope, recognizing the dynamic nature of technological advancements. The incorporation of advanced facial recognition algorithms and machine learning libraries positions the system as a versatile and adaptive tool. Moreover, the forward-looking scope includes potential integrations such as real-time video analysis and mobile applications, reflecting a commitment to staying at the forefront of technological innovation

II. LITERATURE SURVEY

[1] Face recognition using opencv. K.Sudarsana, V.D. Ninad Sakhare , Amit Panchabhai , Mangesh Ganvir , Kunal Wani, Rajat Thelkar. (2023)

Face detection and picture or video recognition is a popular subject of research on biometrics. Face recognition in a real-time setting has an exciting area and a rapidly growing challenge. Framework for the use of face recognition application authentication. This proposes the PCA (Principal Component Analysis) facial recognition system. The key component analysis (PCA) is a statistical method under the broad heading of factor analysis. The aim of the PCA is to reduce the large amount of data storage to the size of the feature space that is required to represent the data economically.

[2] A Review on Identification of Missing Persons and Criminals using Image Processing. Ms. Neha Ahirrao , Namarata.D.Ghuse .

Every day, thousands of individuals go missing around the world, including children, teenagers, the mentally challenged, the elderly with Alzheimer's, and so on. The vast majority of them go unnoticed. The police station's missing person's file has been updated. Using web camera technology, locate these individuals by comparing each person to the database. This technique was created in order to locate those who have gone missing. If a missing person is discovered on a Web Video Stream, the location of the missing person should be reported to the authorities. Send a location email to the police station if a missing individual is found in a Web Video Stream

[3] Finding the missing person using facial recognition Akansha, D. Patil, Raj, H.Dubey, Suraj R, Pawar, Omkar. N. Kewate, Prof. M. K. Gawali.(2023)

Every day, many thousands of people go missing for a variety of reasons such as age, mental or emotional disorders, Alzheimer's disease, and so on. The majority of them go untraced, and the effort of locating the missing person fails. This project prioritises the safety of police officers and the general public by expediting the search for a missing person. When a new case is filed, its information is saved in the application's database. When someone comes across such a person, he will take a picture of him and look up the record in the current database. If a match is found, they can submit the details into the database, save the present location when uploading, and the case will be reported to higher authorities.

[4] The Role of the Eyes: Investigating Face Cognition Mechanisms Using Machine Learning and Partial Face Stimuli. Ingon chanpornpakdi and toshihisa tanaka.(2023)

Face cognition mechanism has changed throughout the SARS-CoV-2 pandemic because of wearing masks. Previous studies found that holistic face processing enhances face cognition ability, and covering part of the face features lowers such an ability. However, the question of why people can recognize faces regardless of missing some clues about the face feature remains unsolved. To study the face cognition mechanism, event-related potential (ERP) evoked during the rapid serial visual presentation task is used. ERP is often hidden under large artifacts and needs to be averaged across the tremendous number of trials, but increasing the trial number can cause fatigue and affect evoked ERP. To overcome this limitation, we adopt machine learning and aim to investigate the partial face cognition mechanism without directly considering the pattern characteristic of the ERP

[5] A face recognition taxonomy and review framework towards dimensionality, modality and feature quality. Ipsita Pattnaik , Amita Dev , A.K. Mohapatra.(2023) .

This paper presents a comprehensive review of Automatic Facial Recognition Systems using integrative and systematic mapping approach. The review is grounded on criteria-attribute scheme formulated in proposed Face Recognition framework. The proposed framework provides a unified platform to identify, categorize and understand wholesome Face Recognition taxonomy based on different criteria (Modality, Dimensionality and Feature Quality) and their corresponding attributes (Unimodal-Multimodal, 2D-3D and PhysiologicalBehavioral). The framework facilitates a user to understand and select attributes across different criteria. The user selection of criteria-attribute is assisted through several selection parameters (Dataset Availability, Application, User Preference, System Complexity and Time Complexity). Depending on the user selection, a criteriaattribute scheme based model is formulated for Face Recognition. This paper also provides critical mathematical insights to understand each attribute extensively. Existing works are analyzed and compared comprehensively and quantitatively based on popular datasets and proposed criteria-attribute framework.

[6] The role of visual imagery in face recognition and the construction of facial composites. Evidence from Aphantasia Carla J. Dance, Graham Hole and Julia Simner.(2023)

People with aphantasia have a markedly impaired ability to form visual images in the mind's eye. Here, by testing people with and without aphantasia, we examine the relationship between visual imagery and face processing. We show that aphantasics have weaker face recognition than people. behavioural measures (Cambridge Face Memory Test). However, aphantasics

nonetheless have a fully intact ability to construct facial composites from memory (i.e., composites produced using EFIT6 by aphantasics and imagers were rated as equally accurate in terms of their resemblance to a target face). Additionally, we show that aphantasics were less able than imagers to see the resemblance between composites and a target face, suggestive of potential issues with face matching (perception). Finally

[7] Face recognition using ensemble statistical local descriptors .Alaa Eleyan.(2023)

The use of data fusion can be of a enormous help in boosting classification performance. Feature fusion is a data fusion technique that is being considered in this study. The effect of fusing different feature descriptors extracted by using histogram-based local feature extraction algorithms on the performance of the face recognition problem is investigated. Feature fusion/concatenation of more than one generated feature descriptor is applied. The impact of fused two and three feature descriptors on the system performance is evaluated when the training set is limited to only one-shot per person. Extensive experiments are carried out using two well-known face databases. Comparisons are conducted among different algorithms for extraction of the local statistical feature descriptors of the face images. The obtained results show that feature fusion of the descriptors can significantly improve the performance with certain feature descriptors

[8] A chaotic-based watermarking scheme for ensuring integrity of a face recognition system in public large gathering scenario . Basil Saud Alhazmi , Oussama Benrhouma , Adnan Nadeem.(2023)

Secure data transmission is critical in public video surveillance applications such as tracking missing persons in large crowd gatherings. It may help the security personnel to monitor & record the live feeds from multiple cameras. However, this live streaming could be falsified. Various cryptographic techniques have been proposed to ensure the integrity of transmitted images, but continuous attacks still pose serious challenges to ensuring the integrity and authenticity of transmitted images. This work proposes a new chaotic-based watermarking technique to ensure the integrity of the transmitted video frames, and since the frames come from multiple cameras, the scheme should be as simple as possible and as fast as possible, the simplicity manifests in designing a fragile watermarking scheme therefore, the watermark is to be embedded in the spatial domain by direct manipulation of the values of the cover's pixels. To ensure the security of the proposed scheme, chaotic maps have been deployed to reach an acceptable level of security with minimum computational overhead

[9] A face recognition system based on convolution neural network using multiple distance face. Hae-Min Moon, Chang Ho Seo. (2016).

The use of data fusion can be of a enormous help in boosting classification performance. Feature fusion is a data fusion technique that is being considered in this study. The effect of fusing different feature descriptors extracted by using histogram-based local feature extraction algorithms on the performance of the face recognition problem is investigated. Feature fusion/concatenation of more than one generated feature descriptor is applied. The impact of fused two and three feature descriptors on the system performance is evaluated when the training set is limited to only one-shot per person. Extensive experiments are carried out using two well-known face databases. Comparisons are conducted among different algorithms for extraction of the local statistical feature descriptors of the face images. The obtained results show that feature fusion of the descriptors can significantly improve the performance with certain feature descriptors.

[10] A practical implementation of mask detection for COVID-19 using face detection and histogram of oriented gradients. Salim Chelbi & Abdenour Mekhmoukh (2022).

Wearing a face mask is one of the effective barriers against the coronavirus COVID-19 pandemic. It offers protection according to the World Health Organization and many medical papers. This paper proposes a method for masked face recognition in order to force the population to put on masks and reduce the COVID-19 pandemic in the world. The ViolaJones algorithm is used to detect the face, and the Histogram of Oriented Gradients (HOG) technique was used to extract the relevant features from face images. The performance of the proposed algorithm is analysed for different data using two common image classification methods, including support vector machines and K Nearest Neighbor (KNN) algorithm for machine learning, which are used to classify the feature vectors. Their performance was compared and evaluated using accuracy. In this case, the experimental result shows that the support vector machine classifier achieved the highest accuracy and surpasses the KNN method in mask detection with an accuracy of 99.43%.

[11] Advancements in Real-Time Face Recognition Algorithms for Enhanced Smart Video Surveillance. Kanagamalliga S.(2023)

The refinement of a real-time face recognition system designed for video surveillance applications is the focus of this research. We proposed a technique that can effectively recognize faces in a variety of lighting situations, poses, and occlusions by utilizing innovative combination of Haar Cascade and Convolutional Neural Networks. To balance computational difficulties and increase scalability, the merging of edge computing and cloud-based solutions are also investigated. The performance of the proposed system is evaluated by vigilant evaluation, demonstrating its applicability in real-world circumstances. Our research aims to advance video surveillance technology with an emphasis on the synergy of real-time face recognition for more secure and effective surveillance systems

[12] BLUFADER: Blurred face detection & recognition for privacy-friendly continuous authentication. Matteo Cardaioli.(2023)

Authentication and de-authentication phases should occur at the beginning and end of secure user sessions, respectively. A secure session requires the user to pass the former, but the latter is often underestimated or ignored. Unattended or dangling sessions

expose users to well-known Lunchtime Attacks. To mitigate this threat, researchers focused on automated de-authentication systems, either as a stand-alone mechanism or as a result of continuous authentication failures. Unfortunately, no single approach offers security, privacy, and usability. Face-recognition methods, for example, may be suitable for security and usability, but they violate user privacy by continuously recording their actions and surroundings. In this work, we propose BLUFADER, a novel continuous authentication system that takes advantage of blurred face detection and recognition to fast, secure, and transparent de-authenticate users, preserving their privacy. We obfuscate a webcam with a physical blur layer and use deep learning algorithms to perform face detection and recognition continuously

III. PROPOSED SYSTEM

A. Facial Recognition Technology:

Choose an appropriate facial recognition technology or API based on accuracy, speed, and compatibility. Collect a diverse dataset of facial images of missing and non-missing persons. Ensure images are annotated and preprocessed for consistency. The Haar Cascade algorithm, is a machine learning-based approach for object detection, particularly effective in real-time face detection. a Haar-like feature
f , f can be expressed as $f=\sum i\in R1I(i)-\sum j\in R2I(j)$ where $I(i)I(i)$ is the pixel intensity at position ii, and $R1$ $R1$ and $R2$ $R2$ are two adjacent rectangular regions. To facilitate the rapid computation of these features, the algorithm uses an integral image, also known as a summed-area table. The integral image $I\text{int}(x,y)I\text{int}(x,y)$ at a point $(x,y)(x,y)$ is defined as $I\text{int}(x,y)=\sum i\leq x,j\leq yI(i,j)I\text{int}(x,y)=\sum i\leq x,j\leq yI(i,j)$, which allows the sum of pixel values within any rectangular region to be calculated in constant time

B. Real-Time Video Integration:

Integrate the facial recognition model with the system infrastructure to analyze live video feeds from surveillance cameras. Face Detection and Feature Extraction , Detect faces in video frames and extract facial features for comparison against the database. Compare extracted features with the database using similarity metrics or threshold-based algorithms

C. Database Management:

we utilize SQLite as the database management system (DBMS) due to its lightweight, efficient, and self-contained nature. SQLite is a C library that provides a relational database management system, which does not require a separate server process and allows for easy integration with the application. This makes it an ideal choice for applications where simplicity, reliability, and portability are critical. SQLite databases are stored in a single file, simplifying the management and deployment of the database. Additionally, SQLite supports most of the SQL standard. The database stores images and associated metadata, such as timestamps and identification details, securely and efficiently. It supports efficient indexing for quick retrieval of data, which is crucial for real-time performance in the detection system. Moreover, SQLite's transactional nature guarantees the integrity and consistency of the database, even in case of application crashes. By leveraging SQLite, the system ensures a scalable and reliable data management solution, facilitating effective and efficient face detection and matching processes.

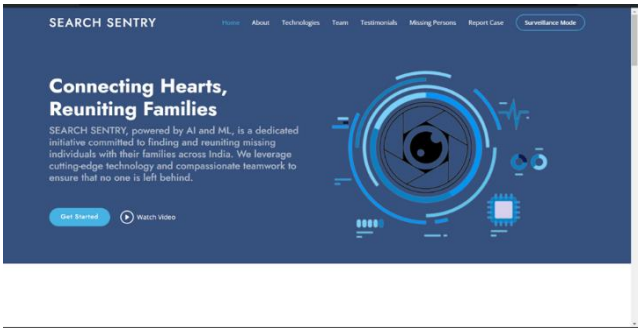
D. Alert Generation And Reporting:

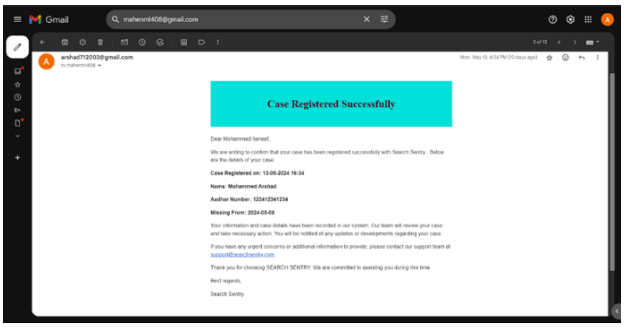
Alert generation and reporting are crucial components designed to ensure timely and effective communication when a potential match for a missing person is detected. When the system identifies a match with a high confidence score, an alert is automatically generated. This alert includes detailed information such as the matched person's image, timestamp, and confidence level of the match. Notifications are then promptly sent to relevant authorities and stakeholders via email or other communication channels. The system also logs all alerts in a centralized database for further analysis and record-keeping. This comprehensive approach ensures that critical information is rapidly disseminated, enabling swift action to be taken in the effort to locate missing persons

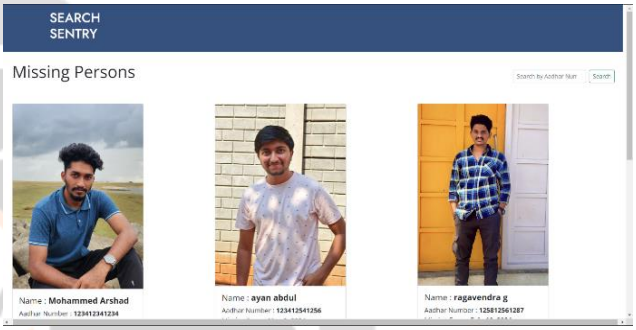
E. User Interface:

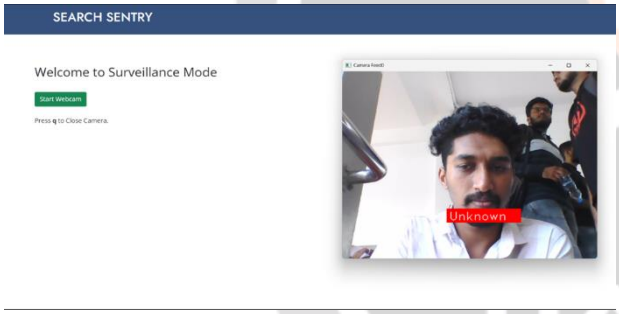
In the proposed system, the user interface (UI) is developed using HTML, CSS, and JavaScript to ensure a responsive, user-friendly, and interactive experience. HTML forms the structural foundation of the UI, defining the layout and content elements. CSS is utilized to style the HTML elements, providing an aesthetically pleasing and consistent appearance across different devices. JavaScript is employed to enhance the interactivity and functionality of the UI, enabling dynamic content updates, real-time data visualization, and smooth user interactions, review detected matches, manage alerts, and access historical data efficiently. The combination of HTML, CSS, and JavaScript ensures that the frontend is not only visually appealing but also highly functional, providing a robust platform for users to engage with the missing person detection system effectively.

IV. RESULTS









V. CONCLUSION

In conclusion, the "Missing Person Detection System" stands as a testament to the intersection of technology and social responsibility, providing an innovative solution to a critical societal issue. The integration of Python programming, machine learning, and web development has resulted in a powerful tool that has the potential to significantly impact the search and rescue efforts for missing individuals The envisioned future scopes, including enhanced facial recognition, real-time video analysis, mobile application development, and collaboration with law enforcement, demonstrate the commitment to ongoing refinement and expansion

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