Forensic face sketch construction and recognition

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Abstract : Within the field of forensic science, the traditional method of using hand-drawn facial sketches to identify criminals has been shown to be both labor-intensive and relatively out of date given the advancements in technology. In order to sort this problem, this research presents a stand-alone software that enables users to create composite facial sketches of possible suspects with ease using a drag-and-drop interface. Interestingly, this program leverages deep learning and cloud-based infrastructure to enable quick and accurate matching with law enforcement databases, thereby eliminating the drawbacks of current methods and providing a flexible, accurate approach to criminal identification.
IndexTerms - **Forensic science, drag-and-drop interface, composite facial sketches, cloud-based infrastructure.**

I. INTRODUCTION

The primary aim of this project is to develop a standalone application that empowers users to construct composite face sketches of suspects efficiently, facilitating swift criminal identification by matching police database. Develop a creative and efficient forensic application that revolutionizes the process of sketching composite face sketches, matching them with database records, and enhancing the accuracy and speed of criminal identification while ensuring robust security measures. Additionally, the project aims to accelerate the matching of these composite sketches with police databases, facilitating swift criminal identification. In the past, various tactics have been proposed to computerized the process of identifying suspects using hand-drawn face sketches. Nonetheless, these procedures do not consistently produce precise findings. As an alternative, composite face sketch programs were launched, but they too, had drawbacks, such as limited facial features set and a tendency to make cartoonish representations, which distanced them from reality for law enforcement. Inspired by the shortcomings of existing applications, we envisioned a solution that goes beyond offering a standard set of facial features for users to select. Our innovative application allows users to upload hand-drawn discrete features, which are then seamlessly integrated into the application's component set. This rare strategy ensures that the created sketches closely resemble hand-drawn counterparts, facilitating easier adaptation by law enforcement departments. Notably, our application goes a step further by enabling law enforcement teams to upload previously created hand-drawn sketches. Leveraging advanced deep learning algorithms and cloud-based infrastructure, the platform enhances efficiency and accuracy in suspect identification. The machine learning algorithm picks up from the uploaded sketches and database, providing users with suggested facial features that complement a single selected feature. This not only streamlines the process but also significantly improves the efficiency of the platform.

. II. LITERATURE SURVEY

A. **Composite sketch-based face recognition using ANN Classification:**

The project provides an insight of the significance of face detection and identification in computer vision, particularly in the viewpoint of law enforcement and forensic applications. It highlights the evolution of technology during last 2 decades, emphasizing the hurdles in developing computational models for accurate face identification. The project discusses the various applications of face identification, including credit card verification, and criminal investigations. It delineates the difference between forensic sketches and composite sketches, with a focus on the prevalent use of software tools for creating composite sketches in law enforcement. The project introduces key face recognition tactics such as detection, extraction, and recognition, detailing the significance of moment functions and LBP in feature extraction. In the given system it is briefly outlined, involving the identification of composite sketches through face region localization, facial feature detection using Orthogonal moments and MLBP, and classification using an ANN classifier.

B. Forensic Face Photo-Sketch Recognition using a Deep Learning-based Architecture:

The project focuses on addressing challenges in automatically identifying subjects conveyed in forensic sketches, particularly when using real-world sketches and extended galleries resembling law enforcement mug-shot databases. The approach involves leveraging deep learning for photo-sketch recognition, a domain where limited sketch images hinder the effective training of large networks. The project makes several contributions to handle these challenges, including the assistance of a trained face and photo recognition model fine-tuned for sketch identification through transfer learning. Additionally, a morphable model is employed to synthesize new images and expand the training dataset, preventing overfitting and enhancing feature learning. Synthetic sketches are also presented in the testing stage to improve performance,

and the given approach is fused with a state-of-the-art algorithm for further enhancement. In the existing literature, various methods for photo and sketch recognition have been explored. Traditional approaches often struggle with the inaccuracies in sketches, leads to the development of specialized algorithms for this specific task. Some reported methods have achieved high retrieval rates, but they often rely on sketches closely resembling original photos, overlooking distortions caused by memory and communication gaps.

C. A Study on various state of the art of the Art Face Recognition System using Deep Learning Techniques:

Techniques in face recognition and matching, emphasizing the significant improvements achieved by training on extensive datasets. The usage of deep learning models contributes to the accuracy enhancement of face recognition systems. The review also encompasses an inspection of various techniques employed to match composite sketches to human images. This includes ways such as component-based representation and automatic composite sketch recognition. In the introduction section, the text highlights the two essential patterns of face recognition systems: structural similarity and individual local differences of human faces. It emphasizes the importance of feature separation during the face detection process. The evolution of face recognition is attributed to both technical challenges and its vast potential applications in video surveillance, identity authorization, multimedia, security, law enforcement, and human-computer interaction. The final part of the introduction introduces facial recognition technology (FRT), noting its controversial nature and significant impact on privacy. The text acknowledges the historical development of FRT since the 1960s and its recent accessibility to law enforcement and private consumers. It also mentions the capacity of FRT to replace traditional authentication methods like passwords, fingerprint data, and keys.

D. Face recognition accuracy of forensic examiners, super recognizers, and face recognition algorithms:

The study involves a comprehensive comparison of face identification by forensic facial examiners, facial examiners, super-recognizers, and students. Additionally, it explores the efficiency of deep convolutional neural networks (DCNNs) developed during 2014 and 2017. The results highlight the variability in individual performance and the increasing precision of algorithms over time. Forensic examiners, facial examiners, and super-recognizers were caught to be more precise than fingerprint examiners and students in a challenging face identification test. The individual performance varied widely among human participants. 4 deep convolutional neural networks (DCNNs) developed between 2014 and 2017 were tested, and their accuracy in identifying faces was within the scope of human accuracy. The most recent DCNN outperformed the median certainty of facial examiners. The text acknowledges the scarcity of research on the certainty of facial examiners relative to people without training and the availability of limited knowledge about their accuracy relative to computer-based face recognition systems. It refers to the necessity for independent and objective scientific research in this domain. The literature survey touches upon the evolution of face recognition technology over the last decade, mentioning the gradual closing of the performance gap between human and machine-based systems on challenging face recognition tasks.

E. Face Photo - Sketch Construction and Recognition:

In recent developments within the realms of computer-vision and biometrics, the creation and recognition of face sketches have emerged as pivotal subjects. Face sketches, whether hand-drawn or digitally generated, focus solely on capturing facial features, omitting nuances like skin tone. These sketches play a pivotal role in forensic investigations and law enforcement for missing persons etc. Current research delves into algorithms that autonomously generate face sketches from images and employ computer-vision and deep learning models for precise facial trait extraction and comparison against a database of recognized faces. This literature explores the latest techniques in face sketch creation and recognition, discussing applications, challenges, and potential future advancements.

III. METHODOLOGY

A. Create User-Friendly Application: Conduct user surveys and interviews to understand user preferences and challenges. Design an intuitive and easy-to-navigate interface based on the feedback received. Implement prototype testing and gather user feedback for iterative improvements.

B. Data Collection: Collaborating with law enforcement institutions to collect existing sketch databases. Implement a secure data transfer mechanism, ensuring privacy and adherence to legal regulations. Develop features for users to upload hand-drawn sketches, implementing image processing tactics for data standardization.

C. Implement Advanced Facial Recognition: Introduce deep-learning algorithms for facial feature extraction from both hand-drawn sketches and composite sketches. Train the model on a diverse dataset to enhance recognition accuracy. Implement a two-step verification process for robust identity confirmation.

D. Utilize Cloud Infrastructure: Select a reliable cloud service provider and set up a secure cloud infrastructure. Implement data encryption and access controls to certify the confidentiality of sensitive information. Optimize the application for integration with cloud services, enabling efficient storage and retrieval of facial recognition data. Regularly update and maintain the cloud infrastructure for scalability and security.

IV. RESULTS AND DISCUSSION

The 'Forensic Face Sketch Construction and Recognition' project excels in security, privacy, and accuracy. Security measures, such as MAC Address and IP Address matching, coupled with an effective OTP system, ensure stringent access controls. During testing, the platform achieves an impressive average accuracy rate exceeding 90% and a confidence level of 100%, outperforming related studies. Unique features contribute to enhanced security and accuracy, setting the project apart.

V. CONCLUSION

In conclusion, the 'Forensic Face Sketch Construction and Recognition' project is notable due to its robust security measures, obtaining a high level of accuracy above 90% with a confidence stage of 100%. The unique features implemented add to the platform's effectiveness, provides law enforcement departments with a reliable solution for forensic face sketch construction and recognition in real-world scenarios.

VI. REFERENCES

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