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Forensketch: Cloud Based Forensic Sketch System Using JavaFX and AWS.

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Abstract: In forensic investigations one way of suspect identification is to create sketch based on eyewitness description. Forensic artists are responsible to create composite sketch of suspects. However traditional methods of matching sketches become complicated through human eye especially if sketches are not detailed enough. Forensketch is a system designed to assist forensic artists in creating and matching sketches. It allows users to draw sketch through a javaFX based interface where various features such as eyes, nose, mouth and face shape can be utilized to create a composite face sketch. The interface helps to reuse similar parts for creating sketches to save time. Analysing and matching sketches to faces is done using AWS (Amazon Web Services) which is a cloud technology. Two important services of AWS are utilized. AWS S3 for storage and AWS Rekognition for analysing to matching facial features for detailed comparison between sketch and real image.

Keywords: AWS, S3, Rekognition, Java FX, Java Swing, Face Creation, Face Matching, Composite Sketch creation, Indexing

INTRODUCTION

Composite sketch creation is a key part in Forensics. In case the image is not available of the culprit the witnesses describe its face and the artist create the sketch based on the description of the culprit to give slight clue to identification of culprit. In traditional method the artist used pen and paper to create the sketch based on description of culprit's face. Face matching to existing database of images involved matching the sketch manually done through human eye going every record for comparison. However, this method is highly time consuming as it involves creating sketch from scratch and matching the sketch by going through every single image

through record. Also, the sketches created sometime may not be detailed due to human error making the sketch look cartoonish or incomplete which would make matching difficult.

Forensketch is a system which allows digital creation of the sketch and leverages deep learning through cloud technology for face matching. The goal of Forensketch is to minimize time for composite drawing and face matching without compromising traditional methods.

The system is divided into two parts sketch creation and matching the sketch with images in the database.

The first part focuses on creating composite sketch images. JavaFX framework is used for entire interface. The interface consists of predefined facial parts like head, ears, eyes, etc.

The second part of the system focuses on uploading composite sketch to AWS cloud for analyzing and matching sketches to database containing images. It uses AWS S3 for storage and AWS Rekognition which contains advanced machine learning algorithms for face matching. The user interface is made using Java Swing Framework.

LITERATURE REVIEW

The literature review aims to visualize various approaches used for facial construction and recognition.

Banuppriya V., Rakesh L., Seventheesh T., and Gowdameshwar M. proposed an automated forensic face sketching and recognition system using Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANs). Their approach generates face sketches from textual descriptions and enhances identification accuracy in criminal investigation systems. The study was presented at the 2025 3rd International Conference on AI and ML Applications (AIMLA).Anisha P. Rodrigues, Pratham S. Shetty, Preethika Shet, Priyal M. Cornelio, Samarth N. Baliga, Roshan Fernandes, and P. Vijaya explored the application of deep learning techniques for forensic sketch recognition. Their work demonstrates how automated systems can improve sketch identification accuracy, especially in situations where photographs of suspects are unavailable. This research was published in the 2025 International Conference on AI and Data Engineering (AIDE). Devendra A. Itole, M. P. Sardey, Devendra A. Itole, M. P. Sardey proposed a forensic identification framework that integrates heterogeneous sketch-photo recognition techniques. The system improves retrieval accuracy GMM, LBP, and Chain Code feature extraction methods. Their work was presented at the 2025 6th International Conference for Emerging Technology (INCET). Shubhobrata Bhattacharya, Anwesha Sengupta, Anirban Dasgupta introduced the QDF dataset, a specialized forensic sketch-photo database designed to support accurate search and matching between sketches and photographs. Their dataset facilitates structured visual correspondence analysis in forensic investigations. This research appeared in the 2024 4th International Conference on Frontiers in Electrical & Electronic Technologies (ICEFEET). Shadma Khatoon and Mohammad Sarosh Umar developed a GAN-based model that improves sketch-to-photo transformation for forensic investigations. Their approach utilizes capsule neural network layers within GAN architecture to enhance discriminative capabilities and improve the reliability of face matching. The work was published in the 2022 5th International Conference on Multimedia, Signal Processing & Communication Technologies (IMPACT).S. Nikkath Bushra and K. Uma Maheswari proposed a crime investigation system based on Deep Convolutional Generative Adversarial Networks (DC-GAN). The model transforms eyewitness sketches into realistic face images that can assist law enforcement agencies in suspect identification. Their work was presented at the 2021 5th International Conference on Computing Methodologies and Communication (ICCMC). Rahul Mk, Fazin Faizal, D. Vanusha, and T. R. Vedhavathy developed SketchScan, a system that converts composite or hand-drawn sketches into refined digital images using deep learning techniques. The model helps investigators by enhancing sketch clarity and automating facial identification processes. This research was published in the 2024 OPJU International Technology Conference (OTCON). Gayathri Ravi, Heynes Joy, Jeffin Jitto, Jocelyn Joshy, and Jisha Mary Jose proposed a framework combining Diffusion Models and VGG-16 neural networks to generate and recognize facial images for forensic applications. Their approach improves sketch-to-face generation and matching accuracy in investigative scenarios. The work was presented at the 2024 11th International Conference on Advances in Computing and Communications (ICACC). Giuseppe Amato, Fabrizio Falchi, Claudio Gennaro, Fabio V. Massoli, and Nikolaos Passalis conducted an evaluation of CNN-based facial verification and recognition techniques in the context of digital forensics. Their work was carried out under the MULTI-FORESEE forensic project and highlights the importance of deep learning models in secure identity verification systems. This study appeared in the 2019 7th International Symposium on Digital Forensics and Security (ISDFS). Pillai Midhun, Vinayak Pulkuzhiyil, Jyothika Krishna, Naveen Wilson, and Veena proposed VisualBlend, a GAN-based hybrid method that combines sketch features with textual descriptions to generate realistic facial images. The system

improves reconstruction accuracy and recognition precision for digital forensic applications. This research was published in 2024 IEEE Recent Advances in Intelligent Computational Systems (RAICS).

METHODOLOGY

The project is divided into two parts face creation and face matching. The approach used to design interface for face creation is modular facial features assembly approach. In this approach individual facial parts like head , ears , eyes, etc is given where the users have to combine those parts to make a complete face. This approach requires drag and drop method. The drag and drop method help to align facial parts using pointing devices. The parts can be added/ removed based on the updates. The JavaFX library which comes under Java Environment. It is an successor of Swing and AWT which provides advanced GUI allowing to implement drag and drop method. It uses .fxml file for GUI and .java file for logic. Working on JavaFX becomes easier by using Scene Builder which provides GUI for modifying code in .fxml file.

It case of face matching AWS platform was used which provides cloud services. Two services of AWS are used AWS S3 and AWS Rekognition. The image selected for comparison is uploaded in AWS S3 renamed as test file. Then the AWS Rekognition matches the given image with the given database. AWS Rekognition abstracts all the process from face detection to face matching and directly gives similarity and confidence as output. APIs used for S3 are PutObject and GetObject APIs used for Rekognition are IndexFaces and SearchFacesByImage.In S3 PutObject API is used for uploading image to the server, GetObject API is used for downloading image from the server. In Rekognition IndexFaces API is used for indexing image into vectors and storing them into collection in AWS Rekognition. SearchFacesByImage API is used to match faces of the test image with the dataset uploaded to S3. The output from the server is either matched face, along with similarity and confidence or should print 'No faces matched.' The confidence is set to 70% so that it ensures the sketch selected contains a detailed face.

Indexing here is an process which does the abstracted tasks following in general representation of abstracted task indexing does

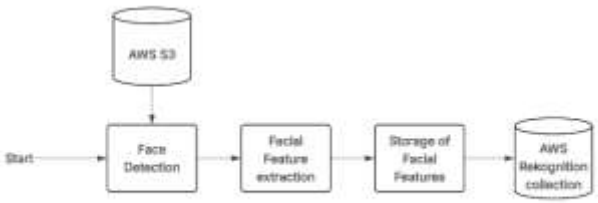

Fig 1: Indexing process

The process starts from detecting faces from AWS S3. Side note here all tasks are done using AWS Rekognition. It uses advanced ML algorithm i.e Deep learning Convolutional Neural Network. Then after detecting face it extracts the features into a feature vector. Then it stores the feature vector into collection database of AWS Rekognition created manually with each image receiving External Image ID and Collection ID. During face matching it does the same process on selected image except storing it into collection but searches for image having similar parameters.

SYSTEM ARCHITECTURE

Following is the proposed system architecture used for design and workflow of the Forensketch application

Minimum System Requirements

Hardware: Intel i3,4GB RAM,5-10 GB Free Storage, standard monitor, At least 5Mbps internet speed recommended
Software: JDK 10, Apache Netbeans IDE , AWS SDK for Java, Windows 10 or higher

Cloud Requirements: AWS S3, AWS, Rekognition , AWS IAM.

Security Features

Two Step Verification: The system supports a two step verification. First step will be login through email and password and second step is OTP given through registered email.

Centralized usage: The database will be stored in AWS S3. However, the server is centralized and any device with Forensketch application can only interact with that server only for uploading/matching retrieval of related data. The server can be

Database privacy: Database is stored in AWS S3 so using AWS security features like IAM, option to block public access, and Server-Side Encryption (SSE S3) the access can only be granted to those who have permission.

System Flow Diagram

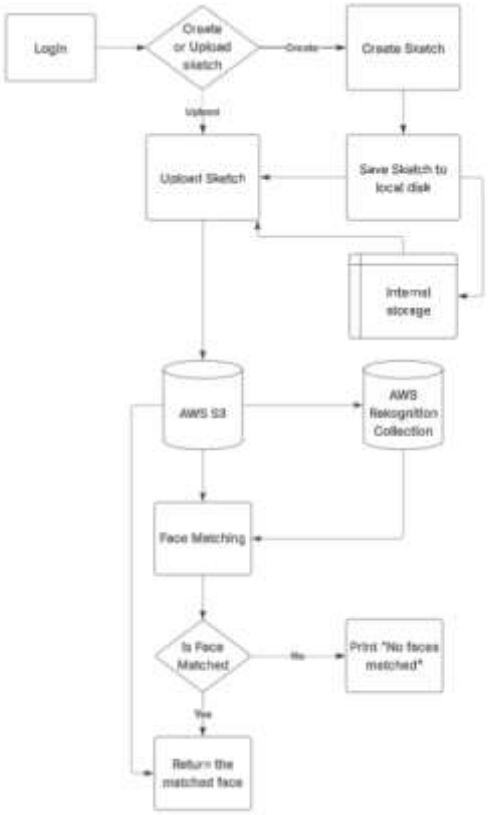

Fig 2 Overall System Flow

Fig 2 represents the overall system flow diagram of the system. The process starts with login where user enters their credential for accessing further services. The login process contains two step verification, password and OTP. Then the system allows us to choose whether to upload rough sketch or create using the Forensketch interface. If create the system redirects to interface which contains several tools to create sketch. Once the sketch is created it is saved in users storage system and can be uploaded to S3 where server does the face matching using AWS Rekognition.

A) Face Creation

First part of the project is face creation. The approach used for designing its interface is modular facial features assembly approach. The interface consists of toolkit options consisting of 7 main options head, hair, eyes, eyebrows, lips, nose, mustache. Additional parts like beards and ears can be found in more. Other buttons include back, save and reset. Following are pictures of some individual parts and interface.

Fig 3: Head component

Fig 4: Hair Component

Fig 5: Blank User Interface

Fig 6: User interface with a random chosen face creation

B) Face Matching

Face matching involves selecting and uploading sketch for face matching. Java Swing is used to create interface for this part. The interface consists of three buttons 'open sketch' for selecting sketch, 'upload sketch' for uploading to S3 and 'Find Match' for finding match from the database uploaded in S3. The server then returns the confidence, similarity and the image it is most similar to as an output to the interface.

Fig 7: Blank User Interface for face matching

Fig 8: User Interface after face matching

RESULTS AND DISCUSSION

The developed system successfully integrates face sketch creation, cloud storage, and face recognition using Amazon S3 and Amazon Rekognition. The application allows users to create or upload a facial sketch, store it in the cloud, and perform face matching against a pre-indexed collection of images. The system effectively detects faces, extracts facial features, and returns matching results along with similarity percentages and confidence values. Experimental testing shows that the system performs accurately when clear, high-quality images are used, and it successfully retrieves the closest matching face from the database. The integration of Java-based GUI with AWS services ensures a smooth workflow from input to output, demonstrating the feasibility of cloud-based face recognition in forensic applications.

JavaFX provides a good interface for advanced GUI tasks like drag and drop method. The integration of JavaFX with Scene Builder tool makes development of user interface more easier.

AWS cloud services provide a scalable storage and processing system in cloud. Due to AWS Rekognition developers can leverage advanced Machine Learning Models such as Deep Learning CNN which is trained with large amounts of data which cannot be achieved by a single average computer. Also integrating cloud server with applications is simpler due to use of API. However there are some limitations, the face creation currently does not support drawing. It does not currently support creating own parts by user. New parts can only be added by updating the application code instead. The AWS cloud services support pay as you go method. Thus the cost of the project depends on number of images stored and analyzed in cloud once the free tier comes to an end.

CONCLUSION

This project demonstrates the successful implementation of a forensic face recognition system by combining Java-based interface design with cloud-based machine learning services. By leveraging Amazon Rekognition, complex tasks such as face detection, feature extraction, and matching are efficiently handled without requiring local processing power. The use of Amazon S3 ensures scalable and reliable image storage, while the indexing and search mechanisms enable fast and accurate identification of faces. The system highlights the importance of proper image quality, correct indexing, and structured data handling for achieving reliable results. Overall, the project proves that cloud-based AI services can be effectively utilized to build intelligent, scalable, and real-world applicable face recognition systems, particularly useful in security and forensic domains.

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