

Criminal Face Detection System

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Abstract: Criminal record generally contains all the information both personal and criminal with the photograph of the person. In order to recognize Criminal, identification of some sort is required, designated by eyewitnesses. In most cases the resolution or/and quality of the recorded image sections is unsatisfactory and is difficult to recognize the face. Recognition can be achieved in various different ways like DNA, eyes, finger print, etc. One of the ways is face identification. In our proposed methodology, a database is created by storing both full and sliced images of the criminals along with all the personal and criminal details. Then one more database is created in order to identify the criminal; eyewitnesses with the help of a professional will try to build the criminal face using the stored slices stored in the database. Then with the help of the Amazon Rekognition, it predicts the criminal by matching the created image with the existing database, if the result is 70-80% of then that face is declared as a criminal.

1. Introduction

Amazon Rekognition was introduced in 2016, which is a cloud-based Software as a Service (SaaS) computer vision platform. This provides numerous amounts of features, few of them are face detection and analysis, face search and verification, labels, custom labels, text detection, content moderation, celebrity recognition and Personal Protective Equipment (PPE) detection [1]. Face match can brace various number of use cases [2]. For example, identify group of people and create a whitelist for the VIPs and blacklist for bad actors, or supporting logging scenarios. Also, many pictures can be saved of a single person in order to improve the match rate [3]. This can also help to expand the recognition model with many samples of different appearances like, one with beard and other without having one. One of the live examples of this is automatically tagging of friends on social media without inserting the name [4].

Indexing (blue flow lines) represents the process of importing images of facial features into the database for future reference. Analysis (black flow lines) is the process of suspecting the faces from database in order to match them within the index.

Though there are some weaknesses in facial recognition system, we cannot overlook the fact that there is a massive scope of the same in India and other parts of the World [9]:

1. In order to arrest the cheating at ATM's, the best way is to prepare a database of all the customers using a good resolution camera and a facial recognition system. So that whenever customer uses their ATM card, ATM machine automatically matches the photograph of the customer with the database.
2. In order to identify the duplicate voters, for this a database of all the voters have been prepared and at the time of the voting the voters face get matched with the database in order to prevent the fake or duplicate vote.
3. Using this, passport and visa verification can also be done.
4. Driving license verification is also become very easy after introduction of this technology.
5. This can also be helpful in detecting terrorist at airports, malls and railway stations.
6. This can also contribute in the security in defense ministry.
7. This can also contribute in university examination like MBA, MCA, SSC, Engineering, HSC, Medical, B-Pharmacy, Nursing Courses etc.
8. In private and government schools/colleges/offices this system can be used for recognition, corroboration and attendance.
9. This can be deployed in police stations for criminal detection.
10. In banks, this can be used to identify the authentic users for more security of vaults and lockers.

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11. Nowadays barcode system is using all around the world, but this can be easily hacked so that barcode can be replaced with face recognition.

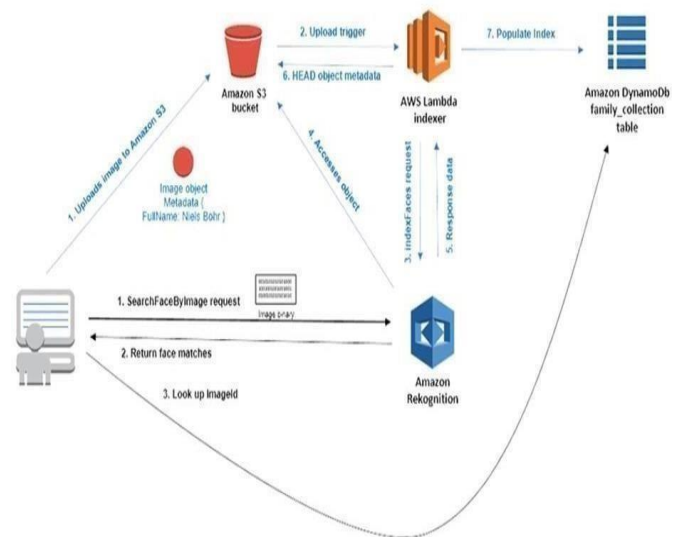


Fig. 1: Flow of images in face detection system

Table 1: Taxonomy of facial features

Levels	Humans And Machines	Machines Only
Level I	age, gender, race	Appearance-based methods (PCA, LDA, etc.)
Level II	measuring features	distribution-based feature descriptors (LBP, SIFT, etc.), shape distribution models, texture descriptors
Level III	birth marks, moles, scars etc.	high spatial frequency

2. Literature Survey

In the history, facial recognition was considered as an idea of science of fiction. As per the sayings, Woodrow Wilson Bledsoe is known to be the originator of facial recognition. The main principle is use of neural networks which are used in numerous applications like any sort of pattern recognition, recognition of character or object and automatic robot driving which we generally refer as driverless vehicles like that used in modern bullet train technologies all over the world and even in India [9].

In the 1960's, system was designed by Bledsoe that was able to arrange faces' photos by hand using the RAND tablet. Basically, tablet is a system which can be used by the people to enter vertical and horizontal coordinates on a framework. Using this system, the

coordinate areas of facial characteristics like eyes, nose and mouth can be recorded manually [6].

The prior work discussion on recognizing of face can be looked back at 1950-1960s. It is not the matter of advancement but need of face recognition has always been an important requisite in various industries especially in criminal cell where on daily basis criminals are captured and needof knowing the history of those criminals plays an important role in further investigation.

Over the past 20 years, the main focus of research was to make the system of face recognition entirely automated so that the problems of locating the parts of face of a given image or video and uprooting of features such as eyes, nose, mouth etc. There had been important advancement made in the outlining of feature classifiers for successful recognizing of face features [10].

As we put forward new systems with improved algorithms, comparing the performance of existing systems and the new systems build plays very crucial role so that we can see how muchgrowth we were able to make from past to present and all what is needed in future to implementin improved algorithm so that it can lead to a successful design and implementation.

The goal of face detection can be fragmented into two steps. The first step works on principle that whether the image given to has any face or not. If does not have any face, we will stop andwon't process further and if there is face present, we will proceed on to the next step that says find the location of the face and its facial features with utmost accuracy [11].

Recognition of face in last many years has received both attention and advancement technically. We can find many commercial systems relating to recognition of face in the market but their accuracy is not reliable, therefore can't be trusted. There had been notable efforts in the field of video-based systems having features of recognition, tracking and are integrated. Also, new datasets are being prepared for the study and evaluation of the recognition techniques. Saying that recognition of face and its features has become detachable part of most of the existing applications is not an overstatement and we are looking further so that these applications couldbe used with every field of science and research with reliable results and satisfactory success [12].

3. Design and Implementation of Proposed Methodology

Methodology plays a very crucial role in Software Development Life Cycle (SDLC) Model, as it dictates the whole requirement and procedure of the required software. If any changes are required in the coming future of the development cycle then the whole process undergoes againfor any formal changes.

3.1 Backend

Backend is the server-side of the website. It stores and arranges data, and also makes sure everything on the client-side of the website works fine. It is the part of the website that you cannot see and interact with. It is the portion of software that does not come in direct contact with the users. The parts and characteristics developed by backend designers are indirectly accessed by users through a front-end application. Activities, like writing APIs, creating libraries, and working with system components without user interfaces or even systems of scientific programming, are also included in the backend.

3.1.1 Advantages of using Amazon S3

Amazon S3 is intentionally built with a minimal feature set that focuses on simplicity and robustness. Following, are some of the advantages of using Amazon S3:

3.1.2 Creating buckets

Create and name a bucket that stores data. Buckets are the fundamental containers in Amazon S3 for data storage.

3.1.3 Storing data

Store an infinite amount of data in a bucket. Upload as many objects as you like into an Amazon S3 bucket. Each object can contain up to 5 TB of data. Each object is stored and retrieved using a unique developer-assigned key.

3.1.4 Downloading data

Download your data or enable others to do so. Download your data anytime you like, or allow others to do the same.

3.1.5 Permissions

Grant or deny access to others who want to upload or download data into your Amazon S3 bucket. Grant upload and download permissions to three types of users.

Authentication mechanisms can help keep data secure from unauthorized access.

3.1.6 Standard interfaces

Use standards-based REST and SOAP interfaces designed to work with any internet-development toolkit.

3.2 Cloud Based Analytical Tool

Some of the benefits of using Amazon Rekognition include-

3.2.1 Integrating powerful image and video analysis into your apps

You don't need computer vision or deep learning expertise to take advantage of the reliable image and video analysis in Amazon Rekognition. With the API, you can easily and quickly build image and video analysis into any web, mobile, or connected device application.

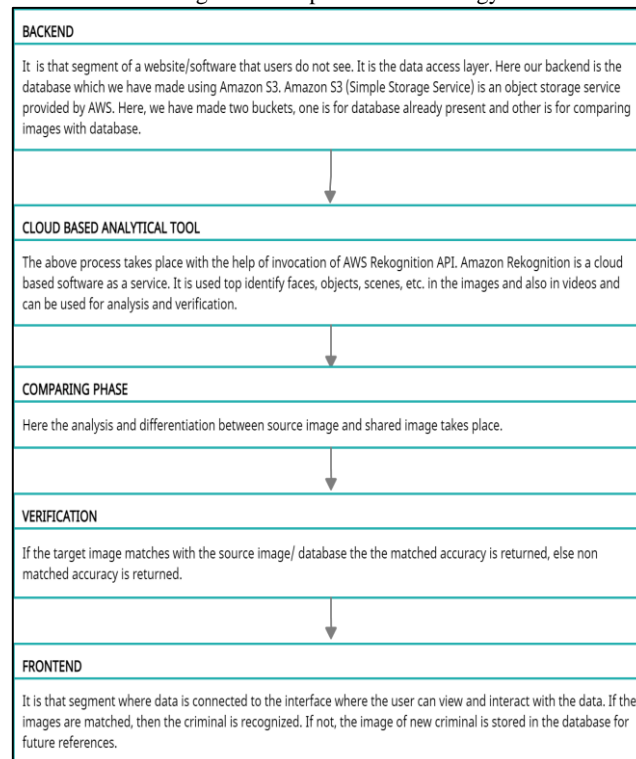
3.2.2 Deep learning-based image and video analysis

Amazon Rekognition uses deep-learning technology to accurately analyse images, find and compare faces in images, and detect objects and scenes within your images and videos.

3.2.3 Scalable image analysis

Amazon Rekognition enables you to analyse millions of images so you can curate and organize massive amounts of visual data.

Table 2: Block Diagram of Proposed Methodology



3.3 Comparing Phase

You pass the input and target images either as base64-encoded image bytes or as references to images in an Amazon S3 bucket. If you use the AWS CLI to call Amazon Rekognition operations, passing image bytes isn't supported. The image must be formatted as a PNG or JPEG file. In response, the operation returns an array of face matches ordered by similarity score in descending order. For each face match, the response provides a bounding box of the face, facial landmarks, pose details (pitch, roll, and yaw), quality (brightness and sharpness), and confidence value (indicating the level of confidence that the bounding box contains a face). The response also provides a similarity score, which indicates how closely the faces match.

3.4 Verification

The response also returns information about the face in the source image, including the bounding box of the face and confidence value.

3.5 Frontend

The part of a website that the user interacts with directly is termed the front end. It is also referred to as the 'client side' of the application. It includes everything that users experience directly: text colours and

styles, images, graphs and tables, buttons, colours, and navigation menu. HTML, CSS, and JavaScript are the languages used for Front End development. The structure, design, behaviour, and content of everything seen on browser screens when websites, web applications, or mobile apps are opened up, is implemented by front End developers. Responsiveness and performance are two main objectives of the Front End. The developer must ensure that the site is responsive that is, it appears correctly on devices of all sizes no part of the website should behave abnormally irrespective of the size of the screen.

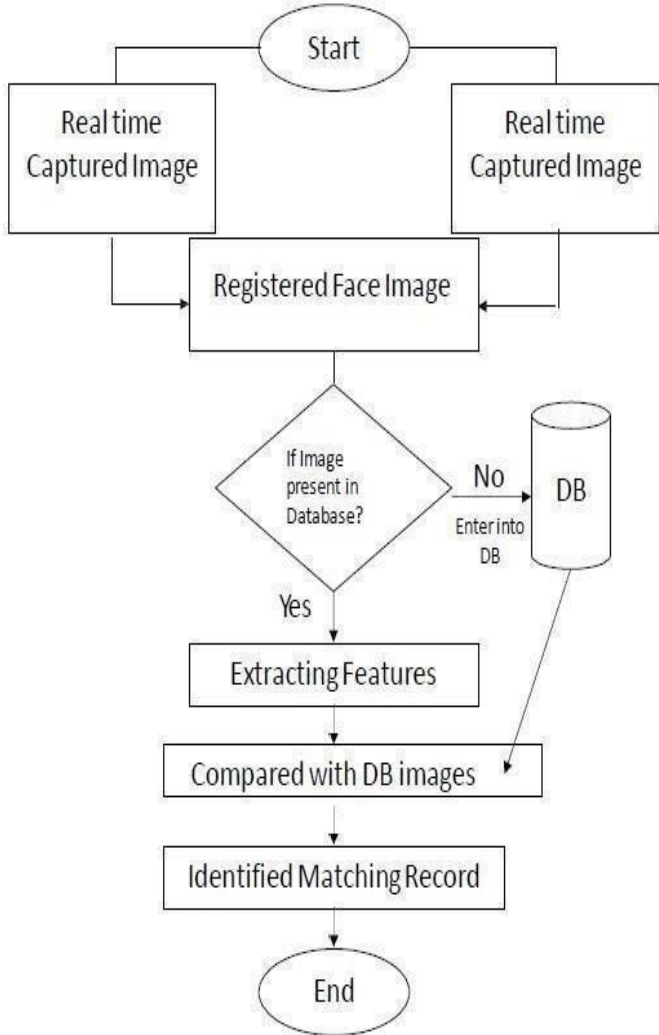


Fig.2: Flow Diagram of proposed methodology

Face Detection	Face Crop	Result	Rekogniti on Accuracy Rate
		Matched	(8/14) *100= 57.14
		Matched	(6/9) *100 = 66.66

	Matched	(3/5) *100 = 60
	Unmatched	(1/27) *100=3.7
	Matched	(1/7) *100 =14.28
	Matched	(7/11) *100= 63.63
	Unmatched	(1/21) *100=4.76
	Matched	(9/10) *100=90

Fig.3: Face matching accuracy table with images

Matching Percentage

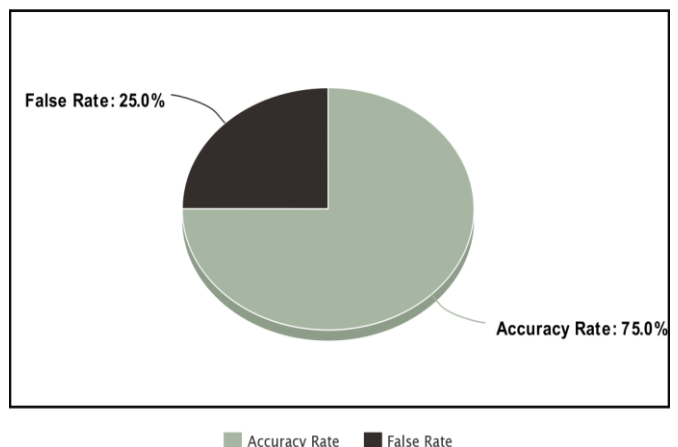


Fig. 4: Matching Percentage of faces

3.6 Custom Algorithm

Request Syntax

```

{
  "QualityFilter": "string",
  "SimilarityThreshold": number,
  "SourceImage": {

```

```

"Bytes": blob,
"S3Object": { "Bucket": "string",
"Name": "string", "Version": "string"
}
},
"TargetImage": {
"Bytes": blob,
"S3Object": { "Bucket": "string",
"Name": "string", "Version": "string"
}
}
}
}

```

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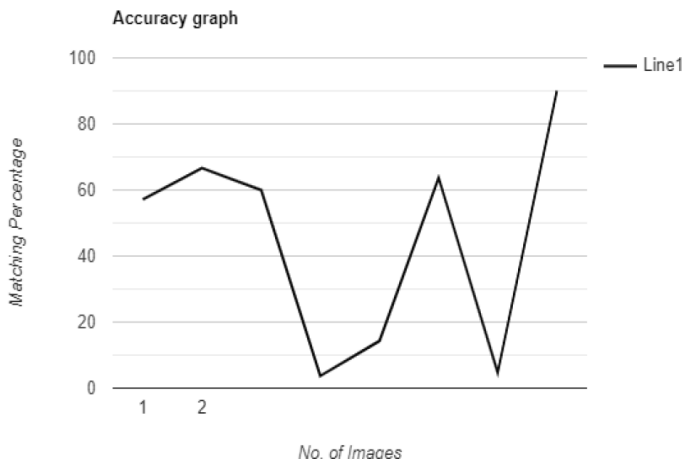


Fig. 5: Line graph of matching percentages

4. Experimental Result

Amazon Rekognition is an image recognition service that identifies objects, faces, etc. and find out the result from the database. This technology also has a feature to compare different faces, which is being used in the project.

Recognition Accuracy Rate is defined as the share of positive decisions i.e., number of matched images from the total number of decisions i.e., number of images stored in a database. Here, we are considering "\$" as recognition accuracy rate symbol.

Recognition False Rate is defined as the share of negative decisions i.e., number of unmatched images from the total number of decisions i.e., number of images stored in a database.

Recognition Accuracy Rate (\$) = (No. Of correctly identified images / Total no. Of images) * 100

If \$ >= 5, Face matches and,

If \$ < 5, Face doesn't match.

5. Conclusions

Still in the vast area of vision system, spotting of facial characteristics is a difficult problem to encounter. Because of its several applications introduced in various domains, it started receiving attention from the past few years. As this is the very costly method of identification, this technology has been generally implemented in the high-cost end projects only. Due to increasing processing power and integration, the cost of the core technology is falling down gravely. But now at this post of technology evolution, some applications become very cost effective, extremely accurate and authentic as well. Which finally results into the worldwide disposition of facial technology without having any technological and financial barriers.

In the coming years, facial technology is expected to grow and will create enormous revenues. Basically, surveillance and security industries are majorly influenced industries. Along with that, schools, universities and healthcare centers also taking a step towards the implementation of facial recognition technology in their premises for betterment of the management. Complicated science used in this field is heading towards robotics field.

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