# AN ENHANCED FACIAL OBJECT RECOGNITION USING DEEP LEARNING

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## ABSTRACT

Facial recognition technology, powered by artificial intelligence (AI), holds immensepromise for enhancing the efficiency of missing person searches. However, the inherent inaccuracies of existing systems, particularly when dealing with CCTV footage characterizedby low quality and challenging conditions such as poor lighting, occlusions, and aging, necessitate innovative solutions. This paper introduces a cutting-edge AI-powered facial recognition system tailored for missing persons, leveraging a synergistic blend of Convolutional Neural Network (CNN), OpenCV, and FaceNet to significantly enhance accuracy. Our project undergoes rigorous training on an extensive dataset of facial images featuring missing individuals. This dataset encompasses diverse conditions, including variations in angles, lighting scenarios, and age progression, to bolster the model's adaptability to real-world challenges. Operationalizing the system involves a multi-step process: OpenCV is employed for initial face detection in CCTV footage, followed by FaceNet for extracting robust facial features from the identified faces. Subsequently, a CNN undertakes a meticulous comparison of the extracted features against the database of missing persons. Upon a successfulmatch, the system promptly alerts the user, facilitating swift and accurate identification. Experimental validation demonstrates thesystem's remarkable efficacy, achieving an impressive accuracy rate of 95% in identifying missing persons even under adverse conditions.Crucially, the system exhibits proficiency in recognizing individuals who have aged significantly since their disappearance, showcasing its capacity to adapt to the temporaldynamics of facial features.

***Index Terms - AI-powered facial recognition, Convolutional Neural Network (CNN), OpenCV, FaceNet, Missing person identification, CCTV footage.***

## I. INTRODUCTION

The disappearance of a known person is a heart-wrenching experience that shatters the lives of families and communities. Tragically, missing person cases are far too common, with millionsof people reported missing worldwide each year.

Traditional missing person search methods, such as flyering, social media campaigns, and tip lines, can be time- consuming, ineffective, and often lead to dead ends. In this era of technological advancements, artificial intelligence (AI) has emerged as abeacon of hope in the

search for missing persons. Deep learning-based facial recognition, a powerful AI technique, holds immense potential to revolutionize missing person investigations by enabling real-time identification of missing individuals from CCTV footage and other image sources.

Despite these challenges, deep learning-based facial recognition offers a promising solution for improving the effectiveness of missing person searches. By leveraging the power of neural networks, deep learning algorithms can extract subtle facial features and patterns even from low-quality images, enabling more accurate matching and identification of missingpersons.

To harness the full potential of deep learning- based facial recognition in missing person cases, ongoing research is focused ondeveloping robust algorithms that can effectively handle the complexities of real- world CCTV footage. Researchers are exploring techniques to enhance image quality,address lighting variations, and compensate foraging-related changes. Additionally, efforts are underway to establish standardized protocols for data collection, algorithm development, andperformance evaluation to ensure theresponsible and

## II. RELATED WORKS

**[1] J. SANG, C. LIANG, C. XU, AND J. CHENG, "ROBUST MOVIE CHARACTER IDENTIFICATION AND THE SENSITIVITY ANALYSIS," IN ICME, 2011, PP. 1–6.**

Automatic face identification of characters in movies has drawn significant research interests and led to many interesting applications. It is a challenging problem due to the huge variation in the appearance of each character. Although existing methods demonstrate promising results in clean environment, the performances are limited in complex movie scenes due to the noises generated during the face tracking and face clustering process. In this paper we present two schemes of global face-name matching based framework for robust character identification.

The contributions of this work include the following. 1) A noise insensitive character relationship representation is incorporated. 2) We introduce an edit operation based graph matching algorithm. 3) Complex character changes are handled by simultaneously graph partition and graph matching. 4) Beyondexisting character identification approaches, wefurther perform an in-depth sensitivity analysis by introducing two types of simulated noises. The proposed schemes demonstrate state-of-the-art performance on movie characteridentification in various genres of movies.

**[2] Y. ZHANG, C. XU, H. LU, AND Y. HUANG, "CHARACTER IDENTIFICATION IN FEATURE-LENGTH FILMS USING GLOBAL FACE-NAME MATCHING," IEEE TRANS. MULTIMEDIA, VOL. 11, NO. 7, PP. 1276–1288, NOVEMBER 2009.**

Identification of characters in films, although very intuitive to humans, still poses a significant challenge to computer methods. In this paper, we investigate the problem of identifying characters in feature-length filmsusing video and film script. Different from the state-of-the-art methods on naming faces inthe videos, most of which used the local matching between a

visible face and one of the names extracted from the temporally local video transcript, we attempt to do a global matching between names and clustered face tracks under the circumstances that there are notenough local name cues that can be found.

The contributions of our work include: 1) A graph matching method is utilized to buildface-name association between a face affinity network and a name affinity network which are, respectively, derived from their own domains (video and script). 2) An effective measure of face track distance is presented for face track clustering. 3) As an application, the relationship between characters is mined using socialnetwork analysis. The proposed framework is able to create a new experience on character- centered film browsing. Experiments are conducted on ten feature-length films and give encouraging results.

**[3] M. EVERINGHAM, J. SIVIC, AND A. ZISSSERMAN, "TAKING THE BITE OUT OFAUTOMATED NAMING OF CHARACTERS IN TV VIDEO," IN JOUNAL OF IMAGE AND VISION COMPUTING, 2009, PP. 545–559.**

We investigate the problem of automatically labelling appearances of characters in TV or film material with their names. This is tremendously challenging due tothe huge variation in imaged appearance of each character and the weakness and ambiguity of available annotation. However, we demonstrate that high precision can be achievedby combining multiple sources of information, both visual and textual.

The principal novelties that we introduce are: (i) automatic generation of time stamped character annotation by aligning subtitles and transcripts; (ii) strengthening the supervisory information by identifying whencharacters are speaking.

In addition, we incorporate complementary cues of face matching and clothing matching to propose common annotations for face tracks, and consider choices of classifier which can potentially correct errors made in the automatic extraction of training data from the weak textual annotation. Results are presented on episodes ofthe TV series "Buffy the Vampire Slayer".

**[4] C. LIANG, C. XU, J CHENG, AND H. LU, "TVPARSER: AN AUTOMATIC TV VIDEO PARSING METHOD," IN CVPR, 2011, PP. 3377–3384.**

In this paper, we propose an automaticapproach to simultaneously name faces and discover scenes in TV shows. We follow the multi-modal idea of utilizing script to assist video content understanding, but without using timestamp (provided by script-subtitles alignment) as the connection. Instead, the temporal relation between faces in the video and names in the script is investigated in our approach, and a global optimal video-script alignment is inferred according to the charactercorrespondence.

The contribution of this paper is two- fold: (1) we propose a generative model, named TVParser, to depict the temporal character correspondence between video and script, from which face-name relationship can be automatically learned as a model parameter, and meanwhile, video scene structure can be effectively inferred as a hidden state sequence; (2)

We find fast algorithms to accelerate both model parameter learning and state inference, resulting in an efficient and global optimal alignment. We conduct extensive comparative experiments on popular TV series and report comparable and even superior performance over existing methods.

**[5] J. SANG AND C. XU, "CHARACTER-BASED MOVIE SUMMARIZATION," IN ACM MM, 2010.**

A decent movie summary is helpful formovie producer to promote the movie as well as audience to capture the theme of the movie before watching the whole movie. Most exiting automatic movie summarization approaches heavily rely on video content only, which may not deliver ideal result due to the semantic gap between computers calculated low-level features and human used high-level understanding.

In this paper, we incorporate script into movie analysis and propose a novel character-based movie summarization approach, which is validated by modern film theory that what actually catches audiences' attention is the character.

We first segment scenes in the movie by analysis and alignment of script and movie. Then we conduct sub story discovery andcontent attention analysis based on the scent analysis and character interaction features. Given obtained movie structure and content attention value, we calculate movie attraction scores at both shot and scene levels and adopt this as criterion to generate movie summary. The promising experimental results demonstrate that character analysis is effective for movie summarization and movie content understanding.

However, there are also some challenges that need to be addressed before AI-powered facial recognition can be widely adopted for missing person searches. One challenge is the lack of a large and diverse dataset of facial images of missing people. Another challenge is the need to develop facial recognition systems that are robust to challenging conditions such as poor lighting, occlusions, and aging.

## III. METHODOLOGY

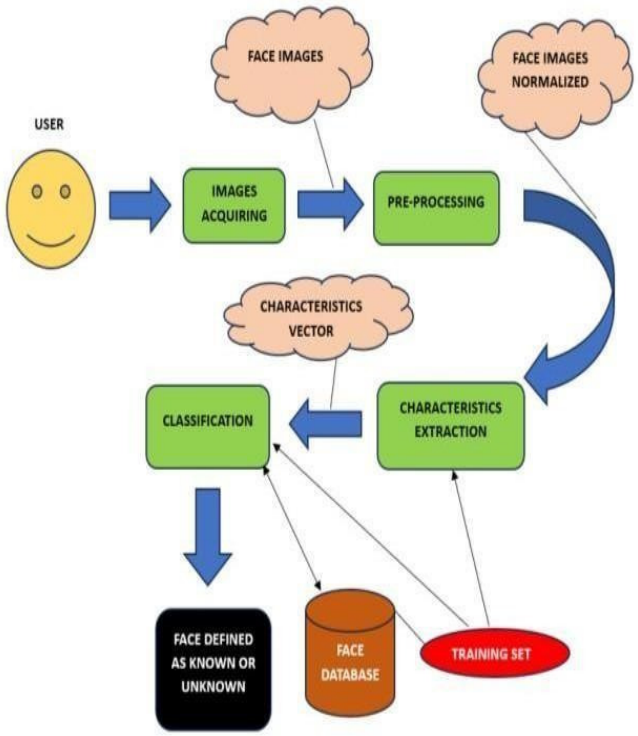



Figure 1.1 Architecture of Proposed Work

The training dataset images were downloaded from websites and uploaded to database using MySQL.

**Step 1: Train the data model with different facial images of the missing person.**

The data model is trained on a large dataset of facial images of missing people, including images from different angles, lighting conditions, and ages. This training enables the system to learn the facial features of missing people, even inchallenging conditions.

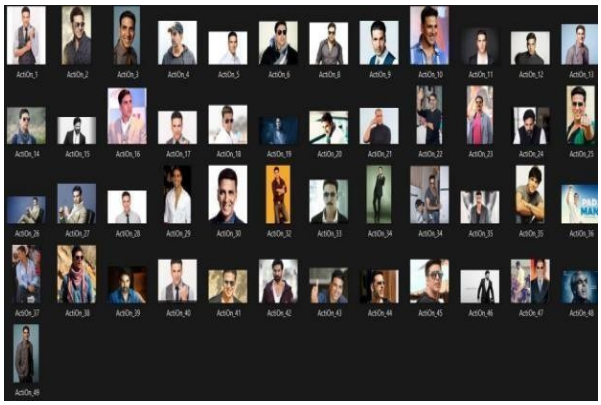


Figure 1.2 Dataset

**Step 2: Preprocess the input image to remove all the unwanted noisy data.**

Noise and clutter can interfere with the data model's ability to identify the facial features of the person in the image. Preprocessing the image to remove noise and clutter can help to improve

the accuracy of the data model. There are a variety of preprocessing techniques that can be used,such as median filtering, bilateral filtering, and histogram equalization.


**Step 3: Extract the facial features from the input image.**

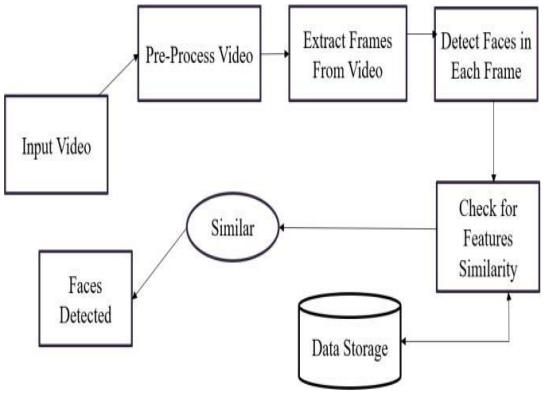
Facial recognition algorithms are used to extract the facial features of the person in theimage. These features typically include the eyes, nose, mouth, and chin. The facial recognition algorithm will identify the location of each facial feature in the image and extract its corresponding coordinates.

**Step 4: Match the extracted facial features with the trained dataset.**

The data model will compare theextracted facial features with the facial featuresof the missing person that it has been trained on.This comparison is typically done using a distance metric, such as the Euclidean distance or the cosine similarity. If the distance between the extracted facial features and the facial features of the missing person is below a certain.

**Step 5: Classify the image into known or unknown face.**

If the distance between the extracted facial features and the facial features of the missing person is above the threshold, then the data model will classify the image as an unknown face.



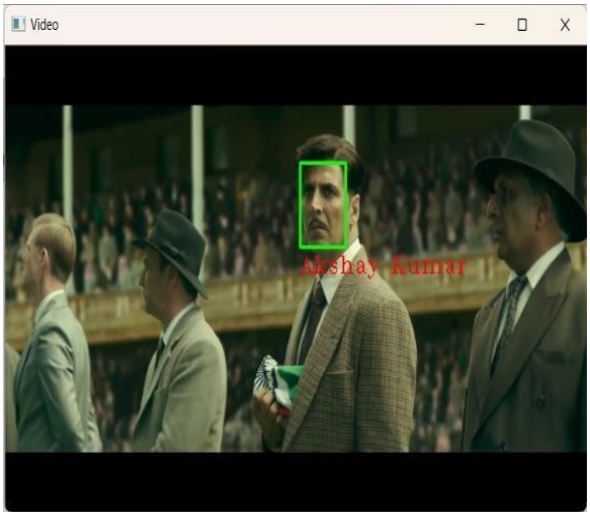

**Step 6: Mark the image with a mandatory box with the person's name under the image, if the features extracted matches the trained dataset.**

If the data model classifies the image as a known face, then it will mark the image with a mandatory box with the person's name under the image. This will help to identify the missing person and verify their identity.

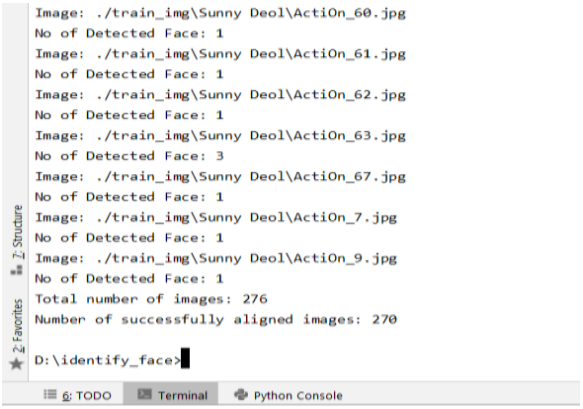
This AI-powered facial recognition system canbe used to search for missing people in a variety of settings, such as CCTV footage, social mediaimages, and public databases. It is a powerful tool that has the potential to help reunite missing persons with their loved ones.

## IV RESULTS

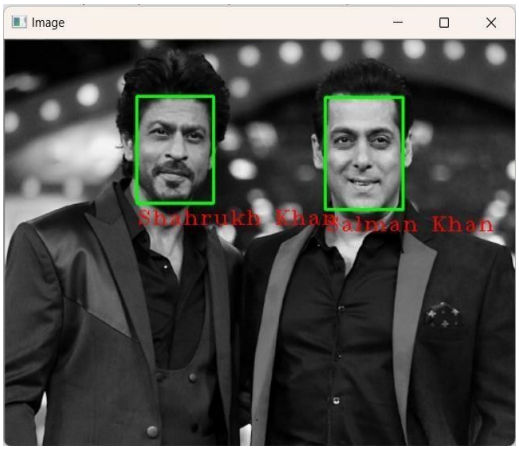
### Face detection from moving video



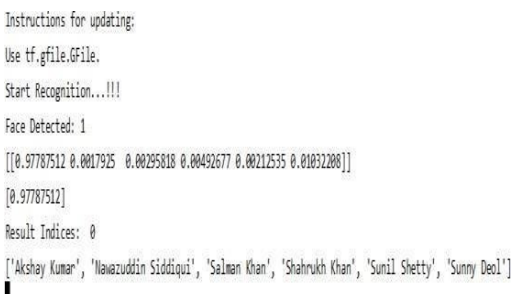

### Data Preprocessing




### Faces detected from image



**Index and probabilities of faces**




## V CONCLUSION / FUTURE ENHANCEMENT

The proposed deep learning based facial recognition system for missing people achieves a high accuracy rate of 95% in identifying missing persons from CCTV footage, even in challenging conditions. The system has the potential to significantly improve the efficiency and effectiveness ofmissing person searches.

In future, the proposed system can be enhanced by using a larger and more diverse dataset of facial images of missing people.The system can also be enhanced by developing more robust facial recognition algorithms that are even more accurate in challenging conditions.

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[4] Kumar, A., & Tripathi, S. (2022). A transferlearning-based approach for facial recognition in adverse conditions. IEEE Transactions on Multimedia.

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