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Dusky Detect: Facial Detection in Low Light Using CNN

Dr.A.Senthil Kumar[1], B.Parvathi[2], H.S.Manasa[2], P.Sujith Sai[2], M.Sai Gopesh Rayudu[2]

[1]PRINCIPAL, Sanskrithi School of Engineering, Puttaparthi, Andhra Pradesh, India
[2]Department of Electronics and Communication Engineering, Sanskrithi School of Engineering, Puttaparthi, Andhra Pradesh
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A B S T R A C T

At present, Identification of faces through image processing is a crucial task in the fields of Machine Learning and Artificial intelligence. Luminescence plays a key role in the face detection. Nowadays, detecting the faces of different people present in different lightings and different times of day has become strenuous. Dusky face is sticky to predict using traditional methods. In order to find a solution, this project proposes various classifiers and Convolutional Neural Networks to detect the face in Abnormal lighting situations. This idea provides the process and technique of the face detection in low light using CNN. The proposed idea in this project will improve the accuracy and facial recognition in different light intensities using the combinations of various facial recognition techniques and classifiers and also the CNN for obtaining a better model with higher performance metrics.

Keywords: Facial Detection, Convolutional Neural Network, Strenuous, Dusky, Machine Learning

1. Introduction

In the current world of technology and innovation, Face detection is a research region in computer vision that has attracted increasing interest in recent years. Security, finance, transportation, and other businesses and areas have maturely applied relevant research. With the advancement of technology, the face identification algorithm has been able to ensure excellent accuracy and stability when given a perfect image and without the impact of complicated lighting, low resolution, and occlusion. Face detection in very low-light settings, Images acquired in very low-light circumstances are a typical sort of low-quality photograph. At this point, Our Idea comes into field which is specially designed to detect the faces that are present in the low light or during the nights and also in conditions of less luminescence. And also, the classifiers and the model that is being trained in the project will increase the accuracy and the face recognition time by effective use of the Proposed techniques.

2. Literature Review

We did a thorough evaluation of the literature on in order to contextualize our work and identify research gaps in the fields of Computer vision and image processing. **R**atanakKhoeun and SuwannaRasmequan [1] described the paper as Face recognition is a popular research topic in computer vision with applications in surveillance and authentication. Face detection is a necessary step for face recognition, but it can be challenging in low-resolution videos. VamStack has developed an algorithm for low-light face detection in real-time videos that outperforms existing approaches in accuracy.

Di Wang, Ding Wang, Hongzhi Yu, Guanyu Li [2] These Authors described the paper as Face recognition is a popular biometric method utilizing computer vision and AI, but traditional methods may struggle with accuracy due to internal and external differences. An improved convolutional neural network-based algorithm has shown promising results for enhancing.

Jothi Thilaga.P, ArshathKhan.B, Jones.A. A, Krishna Kumar N [3] This research visualizes the Facial recognition systems have limited accuracy due to occlusions, pose, and illumination changes, but can be improved with the use of hog descriptors and deep learning techniques. A Python-based application is being developed to faces in various conditions to recognize.

Sudha Sharma, Mayank Bhatt, Pratyush Sharma [4] Facial recognition is widely used in daily life, but it remains difficult to achieve accurate results in real-world situations. This paper proposes a face recognition approach using a machine learning algorithm and principal component analysis (PCA), which achieved high accuracy (97% and 100%) using linear discriminant analysis, multilayer perceptron, Naive Bayes, and support vector machine.

4. Idea and Methodology:

The development of the algorithm and code implementation has be divided into various blocks based on the functionalities. The whole code is deveopled using python programming language with the use of advanced libraries. The main functional block of the code is focussed on the

enhancement of features from the image using Convolutional Neural Networks(CNN) and some inbuilt functions of the Computer Vision. All these functionalities are then utilisedto improve a model that can be implemented in various apllications like security cameras, mobile phones, low cost cameras and also in non-night vision cameras.

Algorithms and Classifiers:

The following algorithms and libraries have been used in the program to increase the accuracy and time complexity.

1. Convolutional Neural Networks (CNN)
2. Haar Cascade classifier

1. Convolutional Neural Networks (CNN)

The work entailed training a CNN model on a low-light face dataset and improving image quality with image enhancement methods. The CNN architecture was particularly intended for low-light face identification, and it included many modules to extract robust characteristics. The results demonstrated a high degree of accuracy and robustness in recognizing faces in low-light circumstances, with potential applications in surveillance, security, and biometrics. Overall, the experiment illustrates CNNs' competence in low-light face identification and underlines their future potential.

2. Haar Cascade Classifier

In Dusky Detect: Low-Light Facial Detection To enhance face identification in low-light circumstances, we merged the Haar Cascade Classifier with our CNN-based technique. As a pre-processing phase, the Haar Cascade Classifier was utilized to detect probable faces in the input photos, which were then sent to our CNN model. The CNN model was built using image enhancement methods and trained on a low-light face dataset. We were able to obtain great accuracy and resilience in detecting faces in low light circumstances by combining the two approaches. Our experiment demonstrates the potential for improving face identification in difficult circumstances by combining classic face detection methods with new deep learning approaches.

4. Overall Design

The system is designed mainly for the purpose of detection of face in low light using a hybrid approach of combining the haar cascade classifier and the convolutional neural networks (CNN). The steps that are involved in the CNN are:

- To begin, we gathered a collection of low-light face photos, which we subsequently enhanced with image enhancement techniques such as histogram equalization, contrast stretching, and gamma correction.
- Following that, we created a CNN-based architecture particularly for low-light face identification. The design had numerous convolutional and pooling layers, followed by fully linked classification layers.
- We performed cross-validation to test the performance of our CNN model after training it on the preprocessed low light face dataset. To boost the diversity of our training data, we used data augmentation techniques such as random cropping and flipping.
- Finally, we tested our CNN model on a different test dataset of low-light face photos, analyzing its accuracy, resilience, and performance.
- Overall, the design of our project included data collection, preprocessing, CNN-based model architecture creation, training and assessment, and outcomes analysis.

And the work of classifier and the process of finding the face is explained in the below flow chart

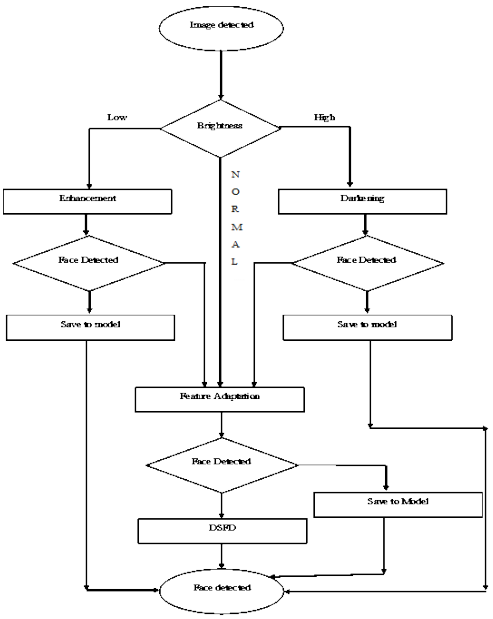


Fig 1: Flow chart of Dusky Detect

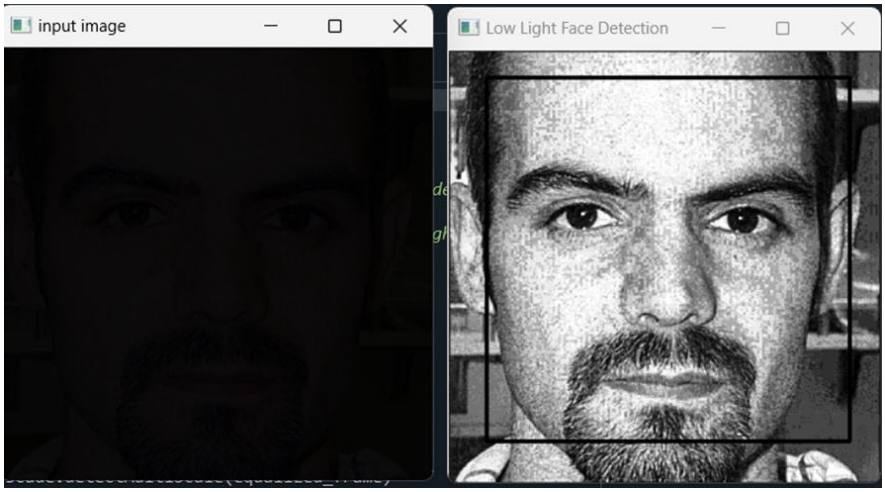
- The low-light image is first pre-processed to increase its quality and highlight the facial areas. This might entail using techniques like histogram equalization, contrast stretching, or noise reduction.
- Following that, features from the pre-processed picture are retrieved using methods such as Haar-like features or deep learning-based feature extraction. These characteristics aid in distinguishing between face and non-facial parts in the picture.
- Finally, a classifier is utilized to determine if the retrieved characteristics are face or non-facial. A classical machine learning approach, such as the Haar Cascade Classifier, or a deep learning-based model, such as a Convolutional Neural Network (CNN), can be used to train this classifier.
- In Dusky Detect: Low-Light Facial Detection We employed a hybrid strategy in the CNN project that integrated the Haar Cascade Classifier with an CNN-based approach for enhanced accuracy and resilience in low light face identification.
- Overall, the process of detecting a face in a low-light image entails a number of processes that vary depending on the method utilized, but usually include pre-processing, feature extraction, and classification.

5. Outputs and Results:

The input testing has been done through the use of data that is present in the Face Images dataset that is publicly present in the Kaggle. The whole training is done by utilizing the above dataset only. When we provided the testing data through 3 methods.

1. Input from a dataset
2. Input from camera (image or video)
3. Input as a video

When the inputs are provided through various methods the obtained outputs are shown below in figures 2(a) and 2(b).



2(a). Face Detection in a photo

2(b). Face detection in a video

6. Conclusion

The final resultant model can be used in various applications like security applications, cc tv cameras, and various places where the face should be detected even in low lights. This study highlights the potential for improving performance in tough circumstances by merging classic face identification methods with new deep learning approaches. In addition, we demonstrated the efficacy of image enhancing strategies for pre-processing low-light face photographs. The overall model is very helpful in many applications . The accuracy of model is more when compared to the previous models and has more time complexity than the other models. In the future, this study might be expanded by employing bigger and more varied datasets, enhancing the CNN-based model architecture, or investigating the possibilities of other classic face identification approaches mixed with deep learning techniques. Overall, our approach contributes to ongoing efforts to enhance face identification systems in low light circumstances and offers up new avenues for future research and development in this field.

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