Deep Learning-Based Face Recognition Using Convolutional Neural Networks: A Comparative Analysis with Real-Time Application

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Abstract

Face recognition technology is now a abecedarian operation in computer vision that facilitates biometric verification in security, surveillance, and smart bias. This work presents a face recognition system grounded on Convolutional Neural Networks(CNNs) trained from intimately available databases like LFW and FaceNet. A relative study between conventional face recognition styles and deep literacy models is bandied, emphasizing the delicacy, speed, and real- time perpetration capabilities of each approach. The introduced model is also enforced in a prototype operation to achieve real- time face discovery and identification. The attained results indicate that CNN- grounded models mainly outperform conventional algorithms, making them perfect for real- world perpetration in intelligent systems.

1. Introduction

Face recognition is a computer vision subdiscipline that solves the issue of relating or authenticating an individual from digital images or videotape frames. Deep literacy has largely bettered the delicacy and effectiveness of face recognition systems. Eigenfaces and Fisherfaces, the traditional approaches, have been surpassed by Convolutional Neural Networks(CNNs), which learn from largely dimensional data. The paper covers the transition from traditional to deep literacy approaches, with a focus on CNNs for face recognition.

2. Literature Review

Different face recognition ways have been explored. PCA and LDA were early ways that were n't dependable in handling variations in disguise and illumination. Contemporary ways influence deep literacy ways like DeepFace, FaceNet, and OpenFace that use CNN infrastructures for learning point embeddings. These models have been set up to parade significant enhancement over the recognition delicacy on standard datasets like LFW(Labeled Faces in the Wild).

3. Methodology

This paper uses a CNN- grounded face recognition model. The model armature includes multiple convolutional layers, ReLU activations, pooling layers, and completely connected layers. The LFW dataset with thousands of labeled face images is employed. The model is trained with a softmax loss function and Adam optimizer. For comparison, a birth Eigenface model is also employed. delicacy, perfection, and recall are used as the performance criteria . An OpenCV- grounded real- time face recognition prototype is enforced and integrated with the trained model.

4. Results and Discussion

The CNN model achieved a success rate of over 98% when estimated on the LFW dataset, while the Eigenface model achieved a success rate of roughly 85%. When tested in real- time, the CNN model was set up to be constantly correct and quick, as needed for real- time operations. The prototype system was suitable to descry faces under varying light conditions and acts with nearly zero quiescence.

5. Conclusion

This paper demonstrates that CNN- grounded face recognition algorithms outperform traditional approaches in terms of delicacy and real- time performance. The use of deep literacy models, i.e., CNNs, enables robust and scalable face recognition systems to be constructed. unborn directions include perfecting the generalizability of the model towards new data and employing other biometric features formulti-modal recognition.

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