WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Attendance Monitoring System of Face Recognition using KNN and OPENCV

Lalita Panika[1], Nomita[2], Anuradha Sahu[3]

[1]*Assistant Professor, Bhilai Institute of Technology, Raipur, Chhattisgarh, India*
[2,3,4]*Student, Bhilai Institute of Technology, Raipur, Chhattisgarh, India*

A B S T R A C T

In order to develop a reliable and effective face recognition system, this project investigates the integration of Open CV with the k-Neares Neighbors (KNN) algorithm. The suggested approach starts by using a camera or image dataset to capture facial images. Tasks like face detection, alignment, and feature extraction in picture preparation are handled by Open CV, a robust computer vision package. Based on these feature vectors, a straightforward but powerful machine learning approach called K-Nearest Neighbors is used for classification. Accuracy, precision, recall, and F1 score are among the common face recognition measures used to assess the efficacy of the suggested system. To sum up, this effort advances the field of face recognition by utilizing Open CV's adaptability and the KNN algorithm's simplicity to provide a workable solution for precise and effective face identification in a variety of settings. A classifier is trained using the KNN algorithm using the features that were taken out of the training set. The KNN classifier can be implemented more easily thanks to OpenCV's features. In order to recognize faces, an input image must be loaded or captured, preprocessed such that it resembles the training images, and features must be extracted for classification. Based on the input features, the KNN classifier finds the k-nearest neighbors in the training set; the input image is then labeled with the majority class's label.

Keywords- face rexognization, face classification, attendance system , k- nearest neighbour , opencv

1. Introduction of face recognization

A computer vision technique called Open CV and k-Nearest Neighbors (KNN) is used to identify and categorize faces in pictures or video streams. Face identification, alignment, and feature extraction are three critical preprocessing activities in this method that make use of the Open CV package. Following detection, faces are shown as high-dimensional feature vectors. Based on these feature vectors, the KNN algorithm—which is well-known for its simplicity and efficacy—is used for classification.The first step in the procedure is obtaining face images from a dataset or a camera. After that, these photos are preprocessed using OpenCV to guarantee consistency and extract pertinent facial traits. A face is classified using the KNN method by comparing it to the training set's k-nearest neighbors. The distance metric and 'k' selection in KNN have a big influence on face recognition accuracy. To maximize the system's performance, experimenting with other distance metrics (such as Manhattan and Euclidean) and adjusting the value of 'k' are frequently carried out. By addressing issues including changes in lighting, position, and facial emotions, this technique strengthens the face recognition system. Facial recognition is an intriguing and difficult issue that affects numerous critical applications, including personal identification, banking and security system access authentication, law enforcement identification, and more. For people, face recognition is an easy process, but for a computer, it's a completely other story. To date, relatively little is understood about human recognition, including how the brain encodes images, how to analyze them, and Does successful face recognition rely more on outside (hairline, head shape) or inner (eyes, nose, mouth) features? Our brain contains specialized nerve cells that react to particular local aspects of a scene, such as lines, edges, angles, or movement, as demonstrated by neurophysiologists David Hubel and Torsten Wiesel. Those meaningful features from an image, putting them into a useful representation and performing some classification

2. Purpose of this project

The main purpose of a project using K-Nearest Neighbors (KNN) and OpenCV algorithms would depend on the specific application and goals of the project. A project incorporating K-Nearest Neighbors (KNN) and OpenCV algorithms is likely focused on computer vision and image processing applications. OpenCV, a powerful computer vision library, provides tools for capturing, processing, and analyzing images or video streams. Its versatile features make it suitable for a range of tasks, from facial recognition to image segmentation. KNN. The combination of KNN's classification skills and OpenCV's image processing capabilities allows for the creation of applications like facial recognition, gesture identification, and medical picture analysis.

The main goal of a project using the K-Nearest Neighbors (KNN) and OpenCV algorithms would depend on the specific application and project.

1. **Classification and Recognition of Objects:** Computer vision and image processing activities can be performed with OpenCV. Using characteristics taken from photos, KNN can be used for classification and object recognition.For instance, in an image recognition project, you could preprocess images with OpenCV, extract pertinent features, and then use KNN to classify objects based on those characteristics.
2. **Recognition of gesture :** OpenCV offers tools for recording and analyzing video frames; KNN can be used to recognize hand motions recorded with a camera.
3. **Recognize of faces:** Facial feature analysis and detection in photos and video streams can be accomplished with OpenCV. Facial recognition applications can then be made possible by using CNN to classify faces based on attributes that are retrieved from facial images.
4. **Flexibility in utilization :** A vast array of applications, ranging from image segmentation to handwriting recognition, can be developed thanks to OpenCV's and KNN's versatility.The project's precise goal will depend on how well KNN's domain-specific classification skills work with OpenCV's image processing capabilities.
5. **Versatility in Applications:** From image segmentation to handwriting recognition, a plethora of applications may be developed thanks to OpenCV's and KNN's adaptability.The project's precise goal will depend on how well KNN's domain-specific classification skills work with OpenCV's image processing capabilities.

Method for face recognization system :

One well-liked facial recognition technique is K-Nearest Neighbors (KNN). It's a method of supervised learning applied to classification. It works by identifying a data point's closest neighbors and categorizing it based on the majority of those neighbors.

Following libraries are import to requirement of face recognization they are as foloows :-

3.1 Libraries :-

- **OpenCV:** The Open Source Computer Vision Library, or OpenCV for short, is a robust and open-source software library made to meet the complex requirements of machine learning and computer vision applications. . It includes pre-trained models for object detection, allowing developers to identify and track objects in images and videos
- **scikit learn:** An open-source machine learning package for the Python programming language is called Scikit-learn, or simply sklearn. Its purpose is to offer easy-to-use and effective solutions for tasks related to machine learning and data analysis.
- **Numpy:** Numerical Python, or NumPy for short, is an open-source, robust Python library for numerical computations. As the cornerstone of many other libraries in the Python data science ecosystem, NumPy is an essential package for scientific computing in Python.
- **Pandas:** A well-known open-source data manipulation and analysis library is referred to as "pandas." Pandas offers tools for working with structured data as well as data structures for effectively storing and managing huge datasets.
- **Joblib:** "joblib" is a flexible library intended to improve the performance of computational activities, especially those related to machine learning and data processing. Its main advantage is that it makes parallelization simpler and offers useful functionalities for carrying out activities simultaneously.
- **harcascade classifier :** Especially well-known for its effectiveness in real-time object recognition is the Haar Cascade Classifier.The idea of Haar features, or patterns used to identify things, is the foundation upon which the Haar Cascade Classifier functions.

The following steps inckudude to face recogniation system . they are as follows :-

3.2 Framework of Proposed System:-

The architecture for the suggested system, which makes use of OpenCV and K-Nearest Neighbors (KNN), provides a methodical way to create a facial identification and detection system. The componenent of framework is divided into three categories , they are as follows .

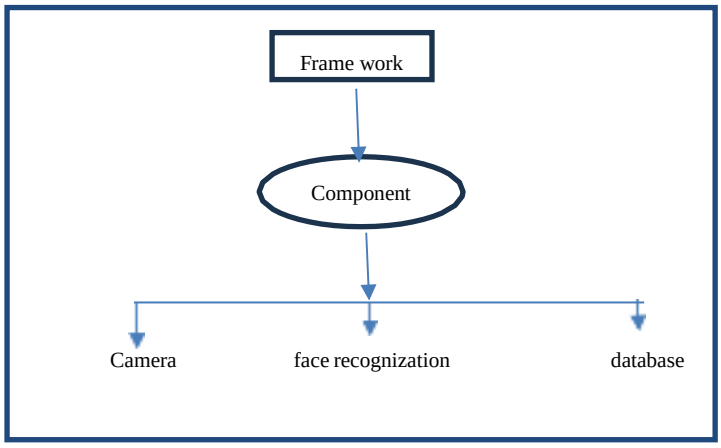

Fig 1 – framework of proprosed system The following steps are requird to fsce recognization system are , tyhy are as follows :

1. **first step of collect raw data -** First, taking pictures or frames from a camera, webcam, or other imaging equipment is how we gather raw data. Take pictures of faces using the camera or other imaging device. A variety of faces in various stances, expressions, and lighting settings should be included in your photo collection.

2. **Second step preprocessing image -** After data collection , it time to process the image, the main objective of this image to remove the noise of the image and convert in original quality of image . it is essential in classifier to clean image because its enhance the quality of the images and ensure consistency. through this processing we involve resizing, cropping, or adjusting the images.to remove noise of the image and provide original quality of image we use adobe photoshop tool .

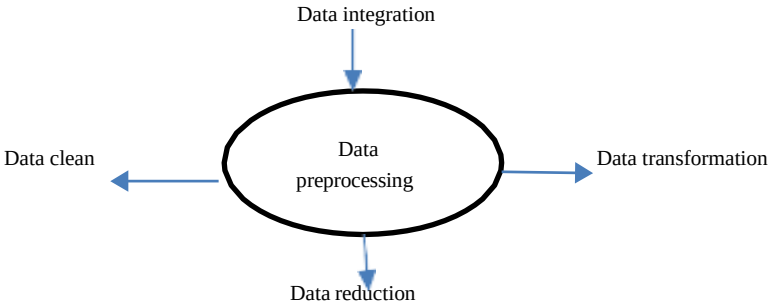

Fig 2- preprocessing image

3. **Third step Feature Extraction -** Important facial traits are taken out of the previously processed photos in this step. The locations of the mouth, nose, eyes, and other facial landmarks can be considered among these features. For feature extraction, a variety of methods and algorithms can be applied, including eigenfaces, Local Binary Patterns (LBP), and deep learning techniques.In the context of face recognition utilizing k-Nearest Neighbors (kNN) and OpenCV, "feature extraction" refers to the procedure of locating and obtaining pertinent data from face photos so that a machine learning model may be fed into it.

3.3 FR-based System :

Give the extracted face traits a format that can be used for categorization or comparison. One way to do this would be to create a feature vector for each face, in which each element would represent a different feature on the face.Specifically speaking, when someone says "OpenCV in Python,"

4. **Fourth step Face Representation**- Each face is then represented uniquely using the features that were extracted. In essence, this representation is a mathematical or numerical description that encapsulates the main features of the face.The term "face representation" describes the method of obtaining, Face representation frequently entails extracting pertinent facial features and encoding them in a way that makes them appropriate for comparison or classification in the context of K-nearest neighbors (KNN) and OpenCV.

Using K-nearest neighbors (KNN) and OpenCV:

K-nearest neighbors (KNN): For classification and regression applications, KNN is a straightforward and efficient machine learning technique. KNN can be used in the face representation context to categorize or identify faces based on their feature vectors.

OpenCV: OpenCV (Open Source Computer Vision Library) is a popular open-source computer vision and machine learning library Provide a format for the extracted face traits that can be used for categorization or comparison. For each face, this could entail making a feature vector with each element corresponding to a distinct facial feature.When someone says "OpenCV in Python," they are referring to Python.

3.4 Training Stage-

The acquired photos go through preprocessing to ensure consistency and ideal training settings by scaling, converting to grayscale, and normalizing pixel values using tools like OpenCV. This is the final stage of the FR train, which is used by the machine to detect faces.First, a dataset of face photos is gathered, each corresponding to a label for a particular person.

5. **Fifth step trainig dataset : The system must be educated on a database of recognized faces in order to recognize faces. The system gains the ability to link particular face traits to matching identities through training. For this, machine learning algorithms like deep neural networks, Support Vector Machines (SVM), and k-Nearest Neighbors (KNN) are frequently utilized.The KNN technique is used in this step to train the model.**

Here's a breakdown of the key concepts in the kNN algorithm. KNN algorithm :

- **Distance Metric:** The algorithm measures the simirity or proximity—a measure of similarity—between data points in the feature space using a distance metric, such as the Euclidean distance. The points are regarded as more similar the smaller the space between them.
- **Parameter k**: The number of closest neighbors to take into account while forming a prediction is represented by the parameter "k". The procedure examines the three data points that are closest to the questioned data point, for instance, if k = 3.
- **Boundary of Decision:** Rather, the training dataset is memorized, and predictions are formed in real time by analyzing the test point's neighbors. Depending on the distribution of the data, the decision boundary can be highly complex and dynamic.
- **Adjusting Hyperparameters: The choice of the distance metric and the value of k are critical hyperparameters that can impact the performance of the kNN algorithm**

OPENCV:

An open-source computer vision and machine learning library is called OpenCV, or Open Source Computer Vision Library.

- **Image Processing:** The Open Source Computer Vision Library, also known as OpenCV, is an open-source computer vision and machine learning tool.
- **Analysis of video:** Video analysis operations like feature extraction, processing, and capture are supported by OpenCV. It makes it possible to create video-based applications such as motion tracking and surveillance systems.
- **Calibration of Cameras:** In order to manage growing user loads, the deployment architecture must be scalable and may make use of cloud or distributed computing services. Thorough testing is necessary to guarantee system compatibility so that the face recognition model may be s eamlessly integrated with the application's other components and current security systems and access control devices.
- **Multi-threading and Parallelism:** The library supports multi-threading and parallelism, making it efficient for real-time image and video processing on multicore processors.

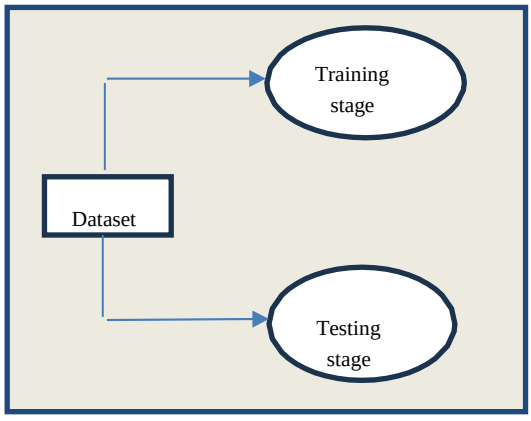

Fig 2 - split tha dataset

6. **sixth step face recognization--** OpenCV supports video analysis tasks, such as video capture, processing, and feature extraction. It enables the development of video-based applications like surveillance systems and motion tracking. • Camera Calibration: Scalability is crucial, and the deployment architecture should be designed to handle increasing user loads, potentially leveraging distributed computing or cloud solutions. Ensuring system compatibility entails rigorous testing to integrate the face recognition model seamlessly with existing security systems, access control devices, and other components of the application • Hyperparameter Tuning: Once the system is trained, it can recognize faces by

comparing the features of a new, unseen ace with those stored in its database. The system then assigns a label or identity to the recognized face. The face recognition algorithm, which can be implemented using techniques such.

7. **seventh step of evaluation**- Evaluate the performance of the face recognition system using metrics such as accuracy, precision, recal and F1 score. This step involves testing the model on a separate test set not used during training.
8. **Eight step Tuning and Optimization**- Evaluate the performance of the face recognition system using metrics such as accuracy, precision, recal and F1 score. This step involves testing the model on a separate test set not used during training. Tuning and optimization refer to the process of adjusting and fine tuning various parametertuning various parameter fine-tuning various parameters, configurations, or settings in a system, algorithm, or process to achieve improved performance, efficiency, or desired outcomes .
9. **Ninth step deployment**- Once satisfied with the performance, deploy the trained face recognition model in real-world applications. This could include integrating it into security systems, access control systems, or any other application requiring face recognition capabilities.It's essential to consider factors like real-time processing, scalability, and system compatibility during deployment to ensure the smooth and effective integration of the trained face recognition model into these applications.

In order to manage growing user loads, the deployment architecture must be scalable and may make use of cloud or distributed computing services. Thorough testing is necessary to guarantee system compatibility so that the face recognition model may be seamlessly integrated with the application's other components and current security systems and access control devices.

4. Benefit of face recognization system :

Facial recognition technology offers several benefits across different industries and applications. Following are the benefit are , they are as follows :

Benefit :-

- Enhanced Security
- Practicality and User Experience:
- Efficient Time and Attendance Management:
- Customer Experience:
- Investigating and Preventing Crime
- Persons Missing or Lost:
- Analytics and Insights from Data
- Health and Safety
- Preventing Identity Theft:
- Automation and Intelligent Environments:

5. Application of face recognition system :

Individuals can be identified using facial recognition software, which improves surveillance and management in high-security locations including banks, government buildings, and airports. The Python programming language and well-known libraries like OpenCV and face recognition can be used to create the face recognition system.

Key features of this e-learning website include:

- **Healthcare:** The highest patient acceptance rates are found in facial recognition apps used for patient tracking. Nearly 66% of patients believe it is appropriate for hospital systems to scan their faces for identification verification, according to study published in Plos One.
- **Preventing the spread of COVID-19:** Facial recognition technologies had a broader application during the pandemic outbreak and are currently being used to track individuals who are COVID-positive and need to stay at home. A smartphone app with facial recognition capabilities requests a selfie from the individual being quarantined and verifies their identification to ensure they follow the guidelines for self- isolation.
- **assisting with mental health treatment:** Face recognition tracks the patterns and behaviors of patients' mental health. It interprets the wearer's facial emotions and presents appropriate indications, such as "anxious" or "happy."

- **Education:** In order to verify the identities of anyone entering or leaving the campus, a facial recognition system scans the faces of those people and compares them to a database of people who have been granted permission, which includes parents, existing staff members, and students.
- **Attendance monitoring:** In this sense, facial recognition software provides a quicker and less disruptive method of identifying individuals in the room. It not only saves valuable instructional time, but it also enables curriculum designers to plan classes perfectly and create more accommodating learning environments..
- **Banking and finance:** It makes sense that customer verification processes would follow, given that financial services have virtually completely moved online. Enhancing eKYC, an electronic variant of the "know your customer" protocol that manages the validation and authenticity of a customer's information, financial establishments can now completely transition the customer onboarding procedure on the internet.
- **Increasing learning engagemen:** Building upon eKYC, the electronic equivalent of the "know your customer" standard that controls the verification and authentication of a client's data, financial institutions can now move the full customer onboarding procedure online.\

6. Result of face recognization :

An precise and efficient way to track attendance in a variety of situations, including offices, universities, schools, and other organizations, is with a face recognition-based attendance system. The way the system operates is by taking pictures of people's faces and comparing them to a database of people who are known to be alive.A person enters, steps in front of a camera, and the system takes a picture of their face. The attendance is then recorded for that person when the system matches the taken image to the database. Permitted personnel may access the attendance data that is kept in a central database.

An attendance system based on facial recognition has the following advantages:

1. **Precision:** The system's ability to precisely identify people lowers the chance of inaccuracies in the tracking of attendance.
2. **Effectiveness:** The system can manage numerous users at once and process attendance rapidly.
3. **Safety:** Unauthorized users cannot mark attendance on someone else's behalf thanks to the system.

The increased security of this system is an additional benefit. It is challenging for unauthorized people to mark attendance on behalf of others because it uses biometric data. This guarantees that only those who are permitted are present and helps avoid absenteeism. Nevertheless, this system may have several disadvantages. Data security and privacy are two issues. Another concern is the cost of implementing and maintaining the system. The initial investment in hardware and software can be significant, and ongoing maintenance and upgrades may be required.

Overall, a face recognition-based attendance system can be a reliable and efficient solution for attendance tracking in various settings. However, careful consideration should be given to privacy and data protection issues, as well as the cost and feasibility of implementation.

OpenCV (Open Source Computer Vision) is a popular open-source library used for computer vision and image processing. It provides a set of functions for image and video processing, object detection and recognition, and machine learning. KNN (K-Nearest Neighbors) is a machine learning algorithm used for classification and regression.

Overall, face recognition using KNN and OpenCV is a powerful technique for automating the process of identifying individuals from images and videos. It has numerous applications in various fields such as law enforcement, healthcare, and entertainment.

Fig 3- result of face recognization

6.1 Following are the steps of result of face ecognization :-

1. In this output of face recognization two different block .one block represent the afce recognization and anither block I used to represent the add new user .
2. when user come infront of camera then firstly it enter the new user name and new user id and click to add user..
3. the web cam is iniitiliza and camera take 50 pics of one perso and in background the model itself train according to this user data to enter in frontend .
4. after the model is trainec its tinme to used the camera and match original data and prediction data .
5. now, next step to click the recognize user after click that camera match original and predicted data .
6. if match the original and predicted data then it display the output.

6.2 Output:

Running the Application:

1. Install required dependencies: `pip install Flask opencv-python numpy scikit-learn pandas`
2. Ensure the Haar cascade XML file (`haarcascade_frontalface_default.xml`) is available.
3. Run the script: `flask run`
4. Open a web browser and go to `http://127.0.0.1:5000/` to access the application.

7. Future scope of face recognization :

There are various ways to improve face recognition using K-Nearest Neighbors (KNN) with OpenCV in the future. To improve the discriminative strength of the model, one possible path is to investigate more complex feature extraction methods, such as Histogram of Oriented Gradients (HOG) or Local Binary Patterns (LBP).

8. Conclusion :

The performance of a face recognition system built with K-nearest neighbors (KNN) and OpenCV is dependent on a number of variables, including feature extraction techniques, dataset quality, and parameter adjustment. .. The accuracy of the system can be raised by adjusting settings, testing with various distance measurements, and optimizing feature representations. Analyzing the trade-offs and restrictions of the selected method is crucial for a given application. Face recognition using K-nearest neighbors (KNN) with OpenCV involves several key steps. First, a dataset of facial images is collected and preprocessed, which may include tasks like resizing, normalization, and grayscale conversion. Feature extraction techniques are then applied to represent each face in a meaningful way. OpenCV offers tools for image processing and feature extraction, aiding in this stage When face recognition is done with K- nearest neighbors (KNN) and OpenCV, a dataset of face images—often with many people in them—is gathered. Preprocessing operations on this dataset include standardizing image sizing, normalizing pixel values, and possibly converting images to grayscale for simplicity.

9. Reference :

[1] Jamilah alamri1 , Rafika harribi, Slim ben chaabane ," Face Recognition based on Convolution Neural Network and Scale Invariant Feature Tran sform", 2021, from (IJACSA) International Journal of Advanced Computer Science and Applications

[2] Varalakshmi K, Dharma Prakash V, Noble Lourdhu, Deepika H, " 2023,Real-Time Facial Recognition Based Student Proctoring System Using KNN Algorithm" from https://jscer.org/wp-content/uploads/2023-Volume%206-Issue%204/Real-Time%20Facial%20Recognition%_20Based%20student %20using%20knn%20algorithm.pdf

[3] Aditya Kapse1, Tejas Kamble1, Ashutosh Lohar1, Shubham Chaudhari1, and Digambar Puri, Face recognition Attendance system using HOG and CNN algorithm ,"2022, from https://www.itm-conferences.org/articles/itmconf/abs/2022/04/itmconf_icacc2022_03028/itmc_onf_icacc2022 03028.html

[4] Hatim Batterywala, Kaustubh Pathak, Jayesh Dhakad,, Mrs. Hemlata Patel, Mr. Vivek Kuma,"r Gupta," real time attendance system using opencv and face recognization",2023. From

[5] K. Sanath, M. K, M. Rajan, V. Balamurugan and M. E. Harikumar, "RFID and Face Recognition based Smart Attendance System," 2021 5th International Conference on Computing Methodologiesand information Communication (ICCMC), 2021.