International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

Target Identification & Alerting System (TIAS)

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Abstract - *Abstract: The recent advances in the area of Computer Vision & Surveillance Networks have opened new doors to the way we have perceived our Environment. Yet this prodigious development has been not utilized effectively. Therefore, in the field of Surveillance, we propose a Better System which recognizes the potential of Computer Vision and creates a change in the way the Organizations, the Authorities, or any other institution regarding a vision on Surveillance Systems. Either Law Enforcement Authorities or colossal MNC's the need to secure their Assets and have them under surveillance is required. The proposed System requires the organization to infix precise & comprehensive information of the alleged individuals into the System, further, the System will deploy its Computer Vision and Machine Learning Algorithms. The result will be if the individual is a threat to the Organization, the Organization's relevant person will be cautioned via Notification & a respective Course of Action can be taken thereon. The proposed system forms a linkage between the Surveillance System, Machine Learning logic & the User Interface.*

Key Words: **Computer Vision, Machine Learning, Image processing, Security, Surveillance.**

1. INTRODUCTION

The world crime rate is gradually decreasing thanks to technology. Yet the importance of extraditing fugitives and bringing them before courts cannot be stressed enough. The authorities have taken necessary steps yet few criminals or suspects can't be identified and the authorities aren't alerted at first sight. Due to this, an immediate response can't be taken.

The issue of addressing unlawful activities is time-consuming in cases where the person is out of jurisdiction or surveillance of a majority of criminals is not a possibility. The need of the hour is to extend the grasp of law-enforcing authorities(LEA) and surveillance systems.

Image Processing(IP) is the process in which certain operations are performed on an image to enhance it or extract some essential information from it. IP technology plays an important role in crime and criminal cases. In investigations, the IP technology can provide evidence for the trial and the litigation of the case. The case investigators can take this as evidence/clue and thus bring fluent and speedy justice.

The proposed system creates a framework that identifies and alerts the authorities about the criminals or targeted person using data received from public places.

1.1 Literature Review

Often in the field of surveillance in Real-time involves mainly a face recognition model, the research of M. Madhu Latha et al[1] proposed a face recognition system using the Inception-V3 model (pre-trained on ImageNet datasets) of the Tensorflow platform based on transfer learning approach to train CNN model. The system used the pre-trained model to implement the training & testing sets specified by the researcher. The model is unique and the approach is precise, the initial proceeding a bit complicated but later a streamlined approach.

The models of face recognition can also be applied for a different application other than surveillance and the research of Nandani Nagendran et al [2] Proposed a feature that unlocks semiautonomous cars or autonomous cars safely and provides safety to the entry-level cars using Face recognization. They have utilized the Support Vector classifier which classifies on basis of Self -organizing Maps (SOM) generated through 2-Dimensional Direct Cosine change Transformation. They have used a DataBase to store pre-existing users of a vehicle thereby providing security in a contactless manner.

Efficient facial recognition is dependent on multiple factors like the face image variates with a difference in illumination, brightness, contrast, background, occlusions, etc. The research of Jamal Hussain Shah et al[3] proposed thereby to feature extraction of the face and comparing them via the euclidean distance of features of pre-existing images database. This model tries to solve the illumination issue in face recognition by using histogram normalization.

The Research of [4] to utilized the face recognition model in the campus to perform as a ledger of people entering the campus can also be extended to public spaces and can be converted into surveillance models by providing feature extraction and classifier modules and a pre-existing database of few targets.

In the field of facial recognition for surveillance the design complexity, speed as well reliability is of relevance, the

research of [5] have proposed to solve the problem of gradual changes in face issue countered in many models via Principal Component Analysis and using Eigenfaces which have helped reduce variability in the face(facial changes after aging, expressional changes) and deriving more information.

Recently the idea of smart cities is emerging which also involves creating safer cities by empowering law enforcement agencies with intelligence solutions. The many issues. The Research [6] has provided various solutions like Early Detection of Unusual Activities and also provided various insights in solving technical problems like Video surveillance over limited bandwidth and Dynamic Access Control.

The Feed from Surveillance videos is of low resolution causing impediment in the process of face recognition, many researchers have tried to resolve those through a model by using HOG features (face detection via object detection in image) and using the Feed Forward Neural Network Classifier to recognize faces from the pre-existing database.

False Positives is a burning issue in face recognition models as the models are designed to find the difference between two faces. The research [7] has tried to solve this by using Bayesian Deep Convolutional Neural Networks and Back-propagation Learning Technique. The model creates a general set of all facial feature extraction and measures the similarity of facial features thereby recognizing identical.

The research of [8] has aimed to solve the requirement of a low computational capacity in Real-Time running algorithm by using Skin color as an indicator for face detection in a frame of video thereby bounding around to the approximately same skin color pixels to further do recognition process rather than implicitly finding for facial features across the frame.

2. Proposed Solution

The Solution Proposed (TIAS) has been divided into three working parts:

1. The first part called "TIAS AUTHORITY FRONTEND(TAF)" involves the stakeholders which shall be the authorities who will be the main controllers of the system responsible for Security & Surveillance. The role of TAF in the system will be:
    a. To have an admin who will create & register a new Authorized User(AU) to engage with the TAF through Login.
    b. To input in the Database the information on Targets as precise as possible from the AUs.
    c. To Update information in Textual / Visual if available.
    d. To view the Real-Time Video Processing (RTVP) feed on the cameras connected to TIAS in the environment(outside world).
    e. To collaborate with multiple agencies from different jurisdictions and data consolidation.
2. The second part called "TIAS CLIENT FRONTEND(TCF)" involves the stakeholders which shall be the Normal User(NU) who will input data(textual, visual). The NU's can be Ticket providers at Public transports, Identity check-posts at the entry point of cities, states, or countries, or any place which involves identity processing. The role of TCF in the system will be:
    a. To provide a portal for NU's to log in and enter data received from their end.
    b. To input visual feed from cameras of the NUs for IP & RTVP.
    c. To send the received data to TIAS Backend for further Processing.
3. The third part called the "TIAS BACKEND (TIBA)" involves the Textual processing and Image processing of the data from TCF to compare it with the information on Targets from the TAF. The TIBA has three components:
    a. DataBase of Textual & Visual identity on Targets.
    b. The Textual, Image & Video processing models.
    c. The Alert sending Mechanism to the Authorities.
4. The TIBA work
5. s on a server in Real-Time to perform all the tasks.
6. The TCF and TAF are the portals that can be accessed via internet-connected Devices in a secured manner.

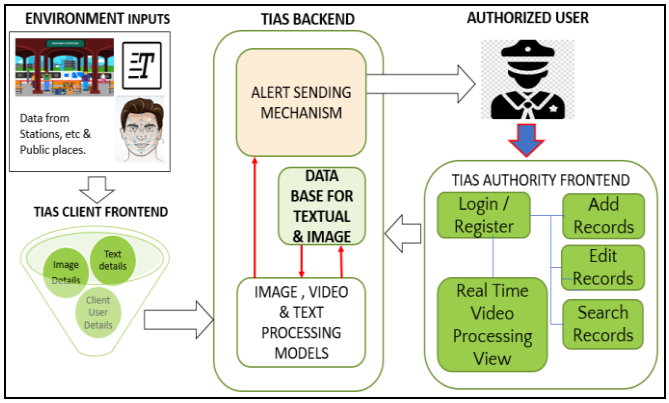

Figure-1:The overview of the proposed solution

They have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

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3. Algorithm

Image processing and Video Processing are performed via pre-existing Machine Learning Algorithms with certain changes as per the above data format.

This algorithm is the K-Nearest-Neighbors (KNN) algorithm for face recognition. This algorithm is useful when you wish to recognize a large set of known people and make a prediction for an unknown person in a feasible computation time.

1.1 Algorithm Description

The KNN classifier is first trained on a set of labeled (known) faces and can then predict the person in an unknown image by finding the k most similar faces (images with closet face features under Euclidean distance) in its training set, and performing a majority vote (possibly weighted) on their label.

For example, if k=3, and the three closest face images to the given image in the training set are one image of Pic1 and two images of Pic2, The result would be 'Pic2'.

1.2 Training Model

Loading the training data image one by one from the specific path local in the form of numpy array i.e image contents as numpy array
ace_recognition.api.load_image_file(*file*, *mode='RGB'*)
Locating the face in the loaded image contents as a numpy array.
face_recognition.api.face_locations(img,number_of_times_to_upsample=1 , model='hog')

Finding the feature from the image with the help of located face box co-ordinate. And Storing the face encoding features concerning the identity of the image.
face_recognition.api.face_encodings(face_image, known_face_locations=None,num_jitters=1, model='small')

Finding all the face-encoded feature arrays for all the images present in the dataset and store them into an array with the target array containing the image identity name.

Now, we form the Knn model for all the datasets of the encoded faces formed and save the model to a location.
Knn_mode =sklearn.neighbors.KNeighborsClassifier(n_neighbors=5, *, weights='uniform', algorithm='auto', leaf_size=30, p=2, metric='minkowski', metric_params=None, n_jobs=None, **kwargs)
Knn_mode.fit(X, y)
pickle.dumps(obj, protocol=None, *, fix_imports=True, buffer_callback=None)

1.3 Predictions

Passing the Image for the prediction should also be passed in the form of encoding of the face as the data was passed for the training of the model. First, the image contents should be converted to the NumPy array.
ace_recognition.api.load_image_file(*file*, *mode='RGB'*)
Now locating the face and forming the encoding of the face to give to the model trained with the trained data.

face_recognition.api.face_locations(img,number_of_times_to_upsample=1 , model='hog')
face_recognition.api.face_encodings(face_image, known_face_locations=None, num_jitters=1, model='small')

Load the model in the system, with the help of pickel library, now pass the encoded face features to the model to return the prediction or the nearest feature for which the model is already trained.

Knn_mode = pickle.load(file, *, fix_imports=True, encoding="ASCII", errors="strict", buffers=None)
Passing the encoded image to be predicted to the loaded model.
Knn_mode.predict(X)

Now, this model will return the nearest face encoding to the given encoding but it will not be the same or, taking a scenario that the image given to the prediction is new and never been trained but still this model will give the output of the nearest matching face encoding as output. So to avoid this type of situation there should be a threshold value concerning the length of the face located and its KNN model to get the approximate output. And if the value is less than the threshold value it will give output as given by the prediction model and if the value is greater than the threshold value it will give output as "Unknown". This the algorithm for face recognition using KNN Classification and Deep Learning Libraries.

2. CONCLUSIONS

Facial Recognition is a very challenging task and has many issues like Low-resolution images, high computational Requirements, False positives which need to be resolved to create a robust, reliable, and accurate surveillance system. The KNN algorithm is a low computational capacity requiring algorithm and simple to implement and also performs well in case of multiple faces as well.

The TIAS model aims to create a system that links the law enforcement with the surroundings, therefore, providing them early detections of target and thus necessary procedure can be undertaken. Also to create a network of LEAs of the inter-jurisdiction alerting mechanism leading to growth in prosecution further depleting crimes and a step towards having a safer world.

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