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Facial Recognition Using Neural Network and Its Correlative Process under Video Analytics

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Abstract --- This paper recognizes that Facial recognition dynamically compare images of individuals from incoming video streams against specific database and immediately send alerts when a positive match occurs. Furthermore in exclusive environment a biometric facial recognition system enables the staff to be aware of important individuals (VIPs) and respond in an appropriate manner. Video analytics involves fast, safe, multiple translation capability that means rapid integration of any third party equipment protocols. Video analytics system to meet specific requirements, delivering a customisable event/alarm monitoring structure that provides the operators with effective control over the surveillance system whilst minimising false alarms and automating specific activities, providing dynamic responses and reducing the operator workload.

Keywords - recognition, neuroph studio training, PCA, LDA, IPoIP, surveillance, security management

I. INTRODUCTION

Besides capturing and comparing images of suspects for applications in airports, banks, casinos and law enforcement, facial recognition system can also be deployed to identify customer gender, age range and demographics providing the capability to deliver relevant advertisements in a targeted manner. Images can be captured using traditional surveillance video cameras but also SLR cameras with a wireless card or smart phones. Security staff can in fact email snapshots from smart phone of suspected law breakers and receive an instant photo match with all known data Loss prevention department are also employing facial recognition system to identify known offenders or to register suspects and have the ability to automatically compare the images with watch list in order that the appropriate action can be promptly taken.

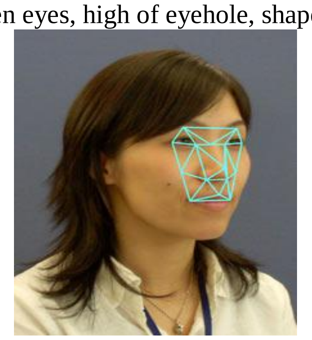
Video management software (VMS) is designed to easily integrate with any intelligent video analytics(IVA) solutions allowing specific types of events and activities to be recognised automatically and promptly alarming operator directly within the user interface when an event occurs.

STAR- sensation, translation, action and response

It allows information in many forms and countless protocols to trigger any of the wide range of responses possible. These include actions such as controlling recordings, directing PTZ cameras, switching display contents for all or specific users and emailing images and other information all using configurable 'rules'. Some of video analytics solutions are people counting and tracking, crowd analytics biometric facial recognition, queue management retail analytics, point of sales(POS) perimeter security, intruder detection, access control, automatic license plate recognition people and vehicle classification, loitering detection, object detection and removal, camera tampering

II. FACE RECOGNITION USING NEURAL NETWORK

System for face recognition is consisted of two parts: hardware and software. This system is used for automatic recognition users or confirmation of password. Input is used either digital pictures or video frame from same video. State institution and some private organization use this system for face recognition especially for identification face by video cameras like input parameter or for biometrics system for checking identity using cameras and 3D scanners. System must to recognize where is face on some picture, to take it from picture and to do verification. There are many ways for verification, but the most popular is recognition of face's characteristics. Face has about 80 characteristic parameters some of them are: width of nose, space between eyes, high of eyehole, shape of the zygotic bone and jaw width.



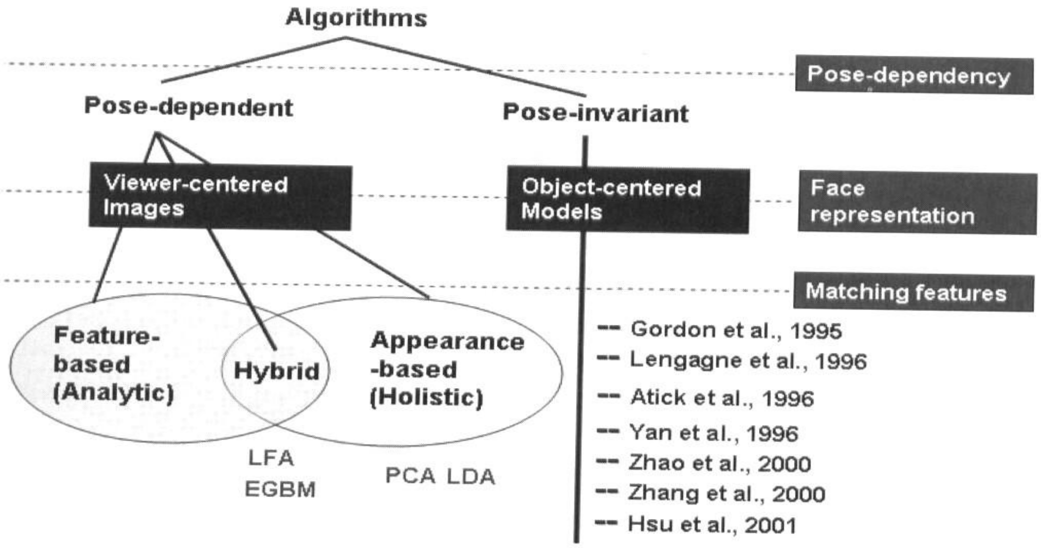
Face specification is made of these parameters and inserted in database as a representation of that person. Except this, there is a process of face recognition where system has a database with pictures taken from different angles. In this case, system first recognizes a position of face at picture, and with this information compares face with others from database in similar position.

Training Neural Network for Face Recognition with Neuroph Studio

In order to train a neural network, there are five steps to be made:

1. Create a Neuroph project
2. Create a training set
3. Create a neural network
4. Train the network
5. Test the network to make sure that it is trained properly

Taxonomy of face recognition algorithms



PCA

. Given an s-dimensional vector representation of each face in a training set of images, Principal Component Analysis (PCA) tends to find a t-dimensional subspace whose basis vectors correspond to the maximum variance direction in the original image space. This new subspace is normally lower dimensional (t<<s). If the image elements are considered as random variables, the PCA basis vectors are defined as eigenvectors of the scatter matrix.

Working with large data sets

(Think BIG: 10^8 signatures and greater)

Formulate PCA (NLPCA, MDS, and others) as an objective function

Use your favorite solver (Conjugate Gradient)

Map to massively parallel hardware (SIMD, MIMD, SPMD, etc.)

Ranger, NVIDIA GPUs, others

Massive parallelism needed to handle large data sets

10,000 video cameras = ~300,000 fps = ~300 GB/sec

Consider all of YouTube as a video archive

Our Supercomputing 2005 data set = 2.2M frames

Test YouTube dataset consisted of over 22M frames

Formulate PCA as objective function

$$energy = func(p_1, p_2, \dots p_n)$$

Calculate the PCA by passing information though a bottleneck layer in a linear feed-forward neural network

ICA

Independent Component Analysis (ICA) minimizes both second-order and higher-order dependencies in the input data and attempts to find the basis along which the data (when projected onto them) are - statistically independent .Bartlett et al. provided two architectures of ICA for face recognition task: *Architecture I* - statistically independent basis images, and *Architecture II* - factorial code representation.

LDA

Linear Discriminant Analysis (LDA) finds the vectors in the underlying space that best discriminate among classes. For all samples of all classes the between-class scatter matrix *SB* and the within-class scatter matrix *SW* are defined. The goal is to maximize *SB* while minimizing *SW*, in other words, maximize the ratio det|*SB*|/det|*SW* . This ratio is maximized when the column vectors of the projection matrix are the eigenvectors of (*SW^-1* × *SB*).

Adaboost - based Methods

For AdaBoost learning, a complex nonlinear *strong classifier* $H_M(x)$ is constructed as a linear combination of M simpler, easily constructible *weak classifiers* in the following form [9]

$$H_M(x) = \frac{\sum_{m=1}^{M} \alpha_m h_m(x)}{\sum_{m=1}^{M} \alpha_m} \qquad (1)$$

where x is a pattern to be classified, $h_m(x) \in \{-1, +1\}$ are the M weak classifiers, $\alpha_m \geq 0$ are the combining coefficients in $\mathbb{R}$, and $\sum_{m=1}^{M} \alpha_m$ is the normalizing factor. In the discrete version, $h_m(x)$ takes a discrete value in $\{-1, +1\}$, whereas in the real version, the output of $h_m(x)$ is a number in $\mathbb{R}$. $H_M(x)$ is real-valued, but the prediction of class label for x is obtained as $\hat{y}(x) = \mathrm{sign}[\mathrm{H_M(x)}]$ and the normalized confidence score is $|H_M(x)|$.

III. VIDEO ANALYTICS

Core Technology

Video analytics core technology is based on its patented software architecture “Image Processing over IP Networks” (IPoIP™). The IPoIP™ architecture was designed to allow for an optimal deployment of Video Analytics, especially in large scale installations, while maintaining an open architecture approach which allows the end-user to mix and match various other components into the surveillance system.

IPoIP™ architecture distributes the Video Analytics task between an edge device (IP camera or encoder) and a server. A “slim” software component is embedded within the edge device and performs a preliminary image processing task of “feature extraction”. The task requires only limited processing resources and therefore may be applied to most IP edge devices, without burdening the device’s processor. The image features extracted by the Agent are sent to a server for further analysis, where the actual analysis and detection is performed. The Video Analytics function performed at the server only requires processing of the features sent by the Agent, and not the entire image. Accordingly, a single server can handle a large number of video channels simultaneously

With unique architecture, a typical quad core server is able to simultaneously perform the full range of Video Analytics functionalities on up to 200 cameras, without compromising on Video Analytics performance

Architecture

Video surveillance systems typically include the following main components:

Video cameras

Network infrastructure

Storage

Video Analytics can be implemented in three different configurations, which correlate to the evolution of the Video Analytics and surveillance technologies:

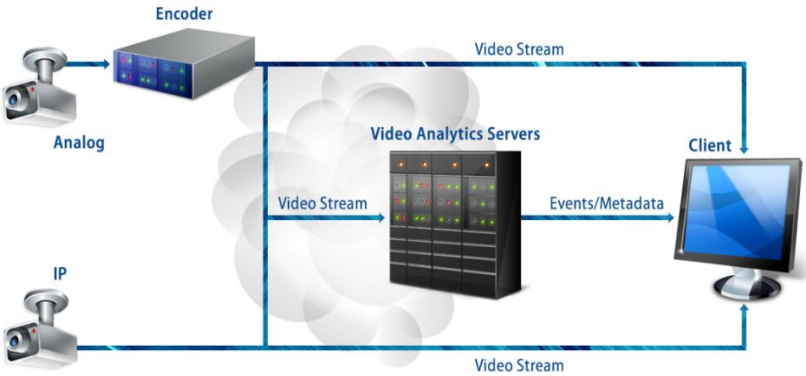
1. Server Based Implementation

In this approach, the Video Analytics is implemented through a dedicated server that pulls the video, analyzes it, and issues the alerts or analysis results. This approach is independent of the video cameras, and therefore, is applicable to most types of surveillance systems. The main disadvantages to this approach are:

The Video Analytics server requires the video to be transmitted to such server, and therefore causes an increase in network traffic load;

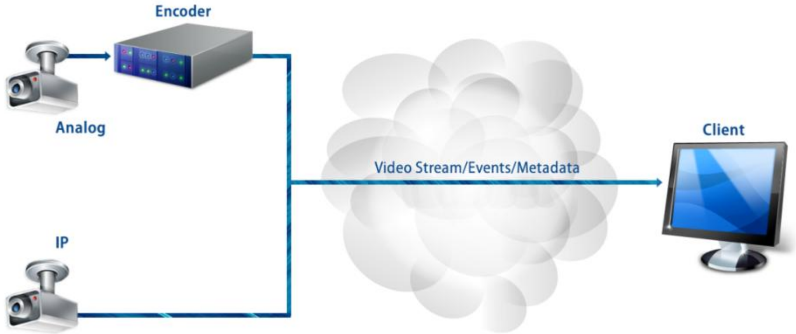
The video quality being analyzed by the Video Analytics server is usually degraded due to compression and transmission effects, and therefore, the Video Analytics performance may be compromised;

The Video Analytics server is limited by its processing power, and can typically handle no more than 16 cameras, with only limited Video Analytics functions, which makes it unattractive to large scale surveillance installations which deploy dozens or hundreds of cameras requiring a variety of Video Analytics functionalities.



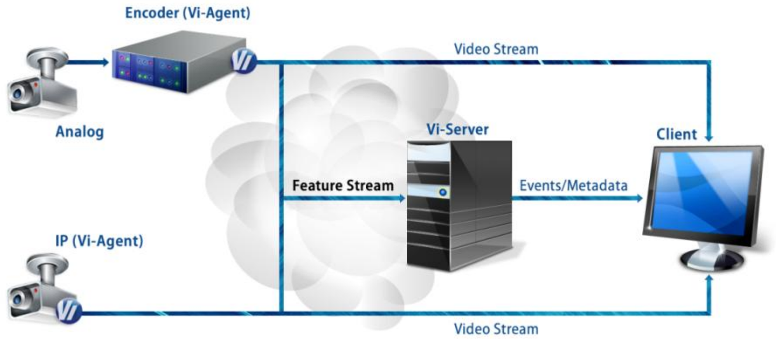
2. Edge Based Implementation

In this approach, the Video Analytics is implemented through an IP video camera or video encoder, which must have sufficient processing power to run the Video Analytics functionality. On the surface, this approach seems ideal, however it does not perform satisfactorily in many cases as it imposes limitations on the overall surveillance system design and performance. Most edge devices still lack sufficient processing power for high-end Video Analytics requirements, and therefore such implementation compromises on either the range of functions or performance quality of the Video Analytics, or both. In addition, most surveillance installations include different types of cameras, and not all cameras are suitable for "edge based implementation" nor do all cameras support it to the same quality.



3. Distributed Implementation

With architecture, the Video Analytics task is distributed between the edge device (which may be an IP camera or encoder) and a server. This approach optimizes the workload on the edge device and server and yields high quality analytics performance. A key benefit is that a single server can run comprehensive Video Analytics functions on up to 200 cameras simultaneously. This hardware efficient camera-to-server ratio is achieved without compromising on the range and performance of the analytics functionality, which makes it especially beneficial for large scale surveillance installations.



IV. CONCLUSION

This paper conveys that under neuroph project becomes efficient if the network architecture using a small number of hidden neurons training will become excessively and the network may over fit no matter what are the values of training parameters. Through the various tests we have demonstrated the sensitivity of neural networks to high and low values of learning parameters. We have shown that the best solution to the problem of face recognition. The combination of high integrity recording, monitoring and reporting tools provided in an easy to use and intuitive interface improves business efficiency, prevents criminality, reduces insurance claims and delivers accurate performance data to aid better decision making. Security management solutions (Video Management Systems, Command & Control Systems etc.)

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