Suggesting Advance Methods for Obtaining Instantly Recognizable and Accurate Images

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Abstract

Face recognition (image processing) is a process of identification of human face or faces similar to human face in a video or an image. Sometimes it is also referred as the process of identifying images which are similar to each other, for example there is a database of 100 images of 10 individuals, each person can look up, down, sideways, can smile, can frown etc. Thus the designed system should be able to recognize a particular person having all the different expressions and also should be proficient in differentiating other person's face. The face recognition technology has improved over the years but still there are some drawbacks. This paper studies the three main drawbacks in the present day image processing technology and suggests useful methods to surmount the drawbacks. First half of the paper talks in detail about the present day image processing technology and its drawbacks and the second half gives a experimental study and analysis of the techniques which can be used to improve the quality of image.

Keywords - False Acceptance Rate, False Rejection Rate

Introduction

Face recognition or detection is a widely used technology which is undergoing constant development to improve its results. It is used in different environments such as in forensic science, medicine and surveillance or security systems. It is also a widely developed mobile application. There are many different kinds of face detection devices and many different algorithms operating these devices. Many researchers and scholars have been trying to implement the ideal case of face detection algorithm. Many algorithms were used to achieve this goal but not all constraints have been taken into consideration while developing this software. Some of the known algorithms are: Principle Component Analysis using eigenfaces, Linear Discriminate Analysis, Elastic Bunch Graph Matching using Fisherface Algorithm, Content Based Image Retrieval (Jain, 2013), the Hidden Markov and Dynamic Link Matching. The constraints taken while developing the software to yield accurate results are: position of the face, low lighting, sufficient data in database and facial expressions. To produce the ideal algorithm that yields 90% accurate results 3 out of 4 constraints should be overcome.

Technology of Face Recognition

Face detection

- Face located in image.
- Skin-tone, texture and face pyramid used

Face recognition

- Appearance and geometry of face used
- Geometry- difficult but robustness against disguising
- Appearance- easy but vulnerable

- facial landmarks used
- A face image is represented as a vector of intensities and this vector is then approximated as a sum of basis vectors (Eigen faces) (Andrew and Ruud, 2002).

Matching

- Face templates used
- Similarity and dissimilarity decided based on threshold
- Altering threshold- FA and FR (Andrew and Ruud, 2002).

Areas of Application

Forensic Science

The face of the dead/criminal is checked against the database to identify the face. Some software can identify the face similar to a given face even if the input is distorted (Gomes, 2001).

Identification systems

This is an identification task, where any new applicant being enrolled must be compared against the entire database of previously enrolled claimants, to ensure that they are not claiming under more than one identity (Gomes, 2001)

Surveillance

The application domain where most interest in face recognition is being shown is probably surveillance. Video is the medium of choice for surveillance because of its richness and type of information that it contains and naturally, for applications that require identification, face recognition is the best biometric for video data (Menin, 2001).

Pervasive Computing: Another domain where face recognition is expected to become very important, although it is not yet commercially feasible, is in the area of pervasive or ubiquitous computing, etc.

Problem Statement

The inherent constraints of the image processing technology:

- Image haziness due to position of the image.
- Incoherence in image due to low lighting.
- Deficiency of image related data in the database.

Methodology

This paper suggests a proficient face recognition system using a modified algorithm which is free of present technology image processing constraints. Paper realizes the objective of instantly recognizable and accurate images by designing an efficient algorithm to perform the below mentioned tasks.

- Keeping the image database in consistent state but substantiating full information of one's face i.e. 360 degree view of the face, updated on a weekly basis.
- Image recorded from a particular angle will be passed through an image reconstruction procedure to match with image data.
- High resolution camera is used to zoom the face thus retaining the image in high resolution.
- Whereas in low light, brightness ratio is applied to the image to maintain its standard quality.

Section Drawbacks of Existing Image Processing Techniques highlights the drawbacks of the present day systems in detail with illustrations. Further the section Proposed Solution gives the proposed solution of the major problems faced by the face Recognition algorithms. The section Results & Discussion of the

paper shows how the solutions proposed to overcome the drawbacks are of significance to face recognition technology.

Design and Analysis

In the implementation, the camera of significantly good quality was connected to the computer. The images captured were send through the software for matching or if needed reconstruction first. The software is implemented on MATLAB 7.5 and all graphs are plotted by the same software. Data will be analyzed based on the FRR (False Rejection Rate) and FAR (False Acceptance Rate). FRR is the instance of a security system failing to identify or verify an authorized person and FAR is the instance of a security system incorrectly verifying or identifying an authorized person.

Technology Used

- Software- MATLAB 7.5
- Camera 8 Megapixel or Higher

Drawback of Existing Image Processing Techniques

There have been constant improvements in image processing and face recognition techniques over the past years but yet some constraints still exist in the present systems which refrain from getting efficient images recognitions. Some of the constraints are:

Low accuracy

Face recognition has low accuracy compared to the proven performance of finger print and iris recognition. Both these methods are way more precise than face recognition and are therefore given preference **(**Datta *et al.,* 2008).

Variety of images of single faces

There are many attributes leading to the variability of images of a single face that add to the complexity of the recognition problem if they cannot be avoided by careful design of the capture situation (Graf and Cosatto, 2001).

Personal changes

Change in facial expressions, aging and other personal factors also add to the difficulty in recognizing faces.

Camera variations

Different cameras carry different lenses which again has a great impact on the picture being captured as different lens have different power. So any change in the camera or the lenses adds to the difficulty.

False accept

Impersonating somebody else is not a difficult task anymore. It can be easily achieved in today's time. This imitation if perfectly done by the attacker can easily con the system. This is called “false accept" (Feraud, 2000).

False reject

A little expression or accessory can change the whole look of a person. This leads to unnecessary dismissal of the same face. This is called “False Reject”.

Security

Physical, procedural, electronic (Blackburn, 2000; Orubeondo, 2001).

Insufficient data

It is very important that all the angles and expressions of the face are well captured beforehand. No side or

angle of the face should be left in order to carryout proper process. But handling such huge amount of data is not feasible which makes face recognition even more tough.

Brightness paradigm

Lighting variations or the change in the lighting of the surroundings in which the picture is taken also plays a very important rule. If the lighting is dimmed then the probability of face not being recognized increases by many folds.

For example:

- Images are affected by the direction from where the light is coming and it may be affected by the source of light (Jafri, 2009).
- Color models greatly affect the image. Images taken in sunlight are different from the ones taken in a room with tube light.

Figure 1: Brightness variation.

Image position/face orientation

Obstructions on face: Presence of spectacles, moustaches, beard, surgery on face, ageing, pimples etc

Position of face: Looking up, down, sideways etc may cause hindrance (Jafri, 2009).

Expression on face: Smiling, frowning, crying, laughing etc may cause inconsistent results

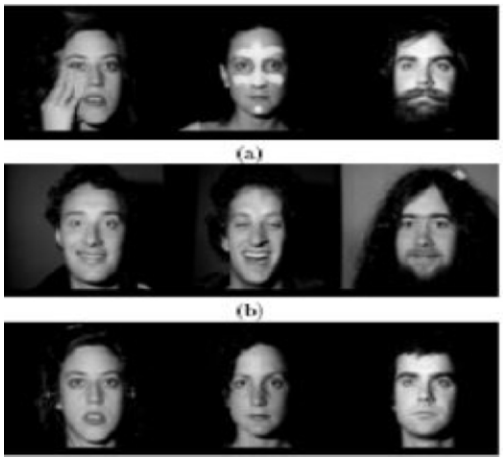

Figure 2: Image position/Orientation.

Proposed Solution

Big database

Use of Big Data

To make the process of face recognition easier and more effective the database should be as detailed as possible. Faces should be captured from every angle and every direction. This needs a huge database which is very difficult to handle. So the solution for this problem is BIG DATA. Big data is the term for a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. Big data is difficult to work with using most relational database management systems and desktop statistics and visualization packages, requiring instead "massively parallel software running on tens, hundreds, or even thousands of servers". Working with big data can be made easier if the following two methodologies are involved:

Incorporate massive data volumes in analysis

If the answers you're seeking will be better provided by analyzing all of your data, go for it. High-performance technologies that extract value from massive amounts of data are here today. One approach is to apply high-performance analytics to analyze the massive amounts of data using technologies such as grid computing, in-database processing and in-memory analytics, (Troeste, M.).

Determine upfront which data is relevant.

Traditionally, the trend has been to store everything (some call it data hoarding) and only when you query the data do you discover what is relevant. We now have the ability to apply analytics on the front end to determine relevance based on context. This type of analysis determines which data should be included in analytical processes and what can be placed in low-cost storage for later use if needed (Troeste, M.).

Brightness Ratio

The less bright images can be made clearer using reconstruction process and by adjusting image transformations like variation of contrast, brightness ratio matrix change, increase sharpness etc. Even the Eigen faces can help overcome the problem to some extent.

Below mentioned steps can be followed to enhance the image (Photoshop example)**.**

Step 1 Duplicate and blend

Open up an image taken in low light, and duplicate the Background layer. Change the blend mode of this duplicate layer to Screen. This will make the image look much brighter. If it's too bright in parts, lower the Opacity of the layer until details are brought back in the highlights.

Step 2 Add Levels

Add a Levels adjustment. Change the Luminosity of this layer before making any changes. This will now only affect the lighting and not warp the colors in the image.

Step 3 Adjust lighting

Inside the Levels adjustment, move the middle marker (mid tones) to the left slightly. Assess the shadow regions in your image and try and use Levels to reveal as much detail here as possible, without fading the overall image.

Step 4 Reduce Noise

Create a merged visible layer of your image. Rename this layer 'Reduced Noise' and then reduce noise (many tools are available).

Step 5 Advanced Noise

Because noise (digital distortion created by the lack of image information) appears more in certain parts of an image than others, we can control it selectively.

Step 6 Clearer image

Zoom to an area of your image where there is a shadow. Cycle through the Channels list and select one that shows the most noise in this case it's the Green and Red Channels. Increase Strength until you see an improvement, and then boost Preserve Details to bring back some definition.

Step 7 Color control

To finish with, add a Color Balance adjustment, CYM or RGB color pellets can be used to adjust the colors (Plataniotis and Venetsanopoulos, 2000).

Multi dimension and High definition viewing

The images can be captured using a camera which is decent in quality and the views can be generated using multi frames. These frames will help accomplish 360 degree view which will later be integrated and allows overcoming most of the drawbacks effectively (Chua, 2000; Cascia, 2000). This may require huge amounts of data collection which will be facilitated by big data.

Set up Cameras for X, Y and Z axis

Check the brightness I.e. Shooting in room or sunlight

Rotate each of the cameras clockwise by 25-degree increments, overlapping each photo. Overlap pictures, to avoid lines, distortion, or missing portions.

Check for the level equal after each rotation.

Generate View.

Others

Alongside of the above mentioned methods we can implement Neural network based face recognition which has been proven to be most effective till date.

Details of Experimental Implementation

We have implemented a basic code for the recognition of the face.

Results and Discussion

The current methodology used in face recognition is the main reason it could never evolve as the best recognition technique. Face recognition has some basic requirements such as huge database, proper lightening, proper angles of face etc. So many shortcomings have put face recognition on a back foot. Solutions such as big data, brightness ratio etc provided in this paper can easily overcome all the present shortcomings of face recognition. The solutions provided are capable enough to upgrade face recognition to the level of finger print and iris recognition.

Conclusion

Face recognition is a technology just reaching sufficient maturity for it to experience a rapid growth in its practical application. Much research effort around the world is being applied to expand the accuracy and capabilities of its biometric domain, with a consequent broadening of its application in the near future. Verification systems for physical and electronic access security are available today, but the future holds the promise and the threat of passive customization and automated surveillance system enabled by face recognition.

References

Andrew, W.S., Ruud M.B. 2002. Face recognition and its applications. In Biometric Solution for Authentication in e-world, Ed. Zhang, D.D., *Kluwer Academic Publisher.*

Blackburn, D.M., Bone, M., Phillips, P.J. 2000. Facial Recognition Vendor Test. Evaluation Report. *Department of Defense Counterdrug Technology Development Program*.

Cascia, M.L., Sclaroff, S., Athitsos, V. 2000. Fast, Reliable Head Tracking under Varying; Illumination: An Approach Based on Registration of Texture-mapped 3DModels. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(4), 322-336.

Chua, C.S., Han, F., Ho, Y.K. 2000. 3D Human Face Recognition using Point Signature. In the Proceedings of International Conference on Face and Gesture Recognition, *IEEE Xplore,* 233-238.

Datta, R., Joshi, D., Li, J., Wang, J.Z. 2008. Image retrieval: Ideas, influences, and trends of the new age. *ACM Computing Surveys,* 40, 2.

Defense Advanced Research Projects Agency 2000. Human Identification at a Distance. *BAA00-29 edition*.

Feraud, R., Bernier, O., Viallet, J.E., Collobert, M. 2000. A Fast and Accurate Face Detector for Indexation of Face Images. In the Proceedings of International Conference on Face and Gesture Recognition, *IEEE Xplore*, 77-82.

Gomes, L. 2001. Can facial recognition snag terrorists?. *The Wall Street Journal.*

Graf, H.P., Cosatto, E. 2001. Sample-based Synthesis of Talking Heads. In the Proceedings of *Recognition, Analysis, and Tracking of Faces and Gestures in Real-Time Systems*, 37.

Jafri, R., Arabnia, H.R. 2009. A survey of face recognition techniques. *Journal of Information Processing Systems*, 5, 41-68.

Jain, J. 2013. Improved the Existing Method for Sketch Based Image Retrieval System. *International Journal of Advance Research in Computer Science and Management Studies,* 1, 31-34.

Menin, G. 2001. Performance Tests: Fingerprint Biometrics. *PC Magazine*.

Orubeondo, A. 2001. A New Face for Security. *InfoWorld.com*.

Plataniotis, K.N., Venetsanopoulos, A.N. 2000. Color Image Processing and Applications.

Troeste, M. Big Data Meets Big Data Analytics, Three Key Technologies for Extracting Real-Time Business Value from the Big Data, That Threatens to Overwhelm Traditional Computing Architectures. *SAS White Paper.*

Biometrics in Human Services User Group. http://www.dss.state.ct.us/digital.html

Free Photoshop Tutorial: Correct colour and brighten low-light images; Tips & Tutorials, by Simon Skellon. http://blog.photoshopcreative.co.uk/tutorials/free-photoshop-tutorial-correct-colour-and-lighten-your-low-light-images/

Jain, V. Human Face Classification using Neural Networks. http://vis-www.cs.umass.edu/~vidit/AI/