# Elastic Bunch Graph Matching : A Review

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***Abstract*— This paper presents a review of different techniques for face verification. The face recognition and face verification technique is playing a very important role in research area under field of image processing and computer vision. There are many techniques or algorithm is discovered for the face recognition system but not all are applied on the surgically altered face image. This paper deal with the brief overview of the EBGM algorithm with the various method for the face verification. However the performance of all discovered algorithm are also depends on the various factors. The EBGM algorithm recognizes novel faces by first localizing a set of landmark features and then measuring similarity between these features. On the plastic surgery face images, the proposed algorithm give high verification accuracy as compared to other various algorithms and a commercial face verification system.**

***Index Terms*— EBGM; face verification; plastic surgery; viola jones; Bunch graph**

## I. INTRODUCTION

Human face recognition has been generally examined throughout the previous two decades; in this period numerous face recognition procedures have been proposed and a large portion of them can't leave separated from limiting the facial components and/or the comparing fiducial focuses, deciding the component confinement physically.

By improving in the method of making the feature point estimation more efficient, because here the method is applied for surgically altered face image. There are lot of changes occur after the plastic surgery process on the face image. There are several techniques of face recognition which are already discovered in past but some of the technique are not as much efficiently work on the face which are surgically altered. However Here Himanshu S Bhatt and others proposed an Multiobjective Evolutionary Algorithm to recognize surgically altered face. Which provide good matching throughout the database according to the result analysis.

Plastic surgery is a medical term worried with the correction or rebuilding of structure and function. In spite of the fact that cosmetic or aesthetic surgery is the best-known sort of plastic surgery, plastic surgery is not as a matter of course corrective and incorporates numerous sorts of reconstructive surgery, craniofacial surgery, hand surgery, microsurgery, and the treatment of burns. A procedure is used to give a smooth finish to face skin by correcting the skin damaged by scars or sunburns irregular patches that grow over the face skin, and also possible to remove mole.

Cosmetic or corrective plastic surgery incorporates surgical and nonsurgical strategies that reshape ordinary structures of the body with a specific end goal to enhance appearance and self-regard. Solid people with an uplifting standpoint and practical desires are suitable possibility for corrective systems.

Plastic and reconstructive surgery is not limited to a single anatomic or biologic system. It is based on understanding tissue transformation generally with same body. Operative techniques are complex to achieve the good results. The surgery also involves enlarging, removing, reducing, and Re-contouring, as well as camouflaging scars into respective skin lines. The tissues of the body which is known as flaps are transferred to the destination skin.

Here the Elastic Bunch Graph Matching is proposed for surgically altered face image from which we expecting good result. The Elastic Bunch Graph Matching abbreviated as EBGM is already applicable on normal face image which provides best results as much as possible when compared with database of that image. EBGM is an algorithm in image processing and computer vision for recognizing object classes or object in an image based on a graph representation extracted from other similar images. It has been frequently used in face verification, face recognition and analysis but also for gesture purpose and other object classes.

## II. THE EBGM SYSTEM

The EBGM system consist of the various technical terms after the detection to verification of image which are briefly described below

### 2.1 *Gabor Wavelets*

Gabor wavelet transform is used to represent the local features; Gabor wavelets are biologically related convolution kernels restricted by a Gaussian envelope function in the shape of plane waves. The jet is define as the set of convolution coefficients for kernels of different frequencies and orientation at one image pixel. In this major step we discover jets, different similarity functions between jets, and process for localization of jets in an image. The regularly utilized basic components as a part of EBGM depend on Gabor wavelets, having the state of a (co)sine wave duplicated with a Gaussian envelope capacity.

### 2.2 *Jets*

The Gabor wavelet change yields a quality for every wavelet at all areas of the picture. Subsequently, with the standard parameters and discredited pictures it yields 80 (40 real + 40 imaginary) values at any pixel position. This arrangement of values for a solitary pixel position is alluded to as a plane. Since a plane contains values from wavelets of distinctive recurrence and introduction, one can consider it a nearby Fourier change, and it is accordingly a representation of the nearby surface. It is also possible to

  

reconstruct the image having gray values from a jet in a small neighbour surrounding of its location, except for the mean value. The Gabor wavelets come in pairs of filters having cosine which is real part and sine which is imaginary part. Each filter is sensitive with respect to a small shift, either of the pixel position or of the image in a stationary image. However, adding and squaring the responses of these pairs reduces the number of values to 40 and create the local analogue to a power spectrum, which still resolves orientations and frequencies but is non sensitive to small shifts by the rule $\cos^2(x) + \sin^2(x) = 1$.

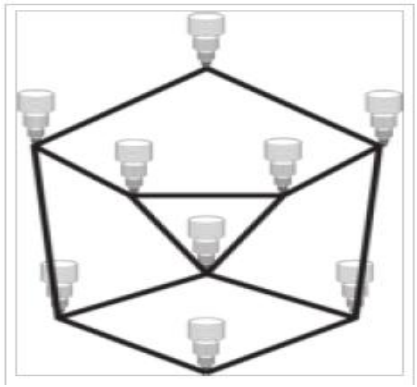

Fig.1 A model graph structure all nodes are represented with respect to jet.

2.3 *Graph*

A local texture is represented by jet j. It requires to combine many jets in a predefined specific arrangement to represent images of whole objects. One could utilize planes at all pixel positions inside of the range of the item, yet that would be repetitive by a variable of 80. In this way one subsamples the planes in the picture. In its least complex shape this can be a rectangular exhibit with altered dispersing from which jets are taken and put away to represent an object. In the more general case one can characterize a graph(with edge set E and vertex set V ) that is particular to the item and grants to find hubs at especially notable focuses on the point of object, which are then utilized as landmark, The full representation of a only object then is a labelled graph with vertices $i \in V$ named with jets $J$ and edges $(i,j) \in E$ marked with distance $\Delta(i,j)$ between the positions of pixel from which the planes have been taken in the unique picture. It is moderately simple to recreate the picture of an article from such a chart representation.

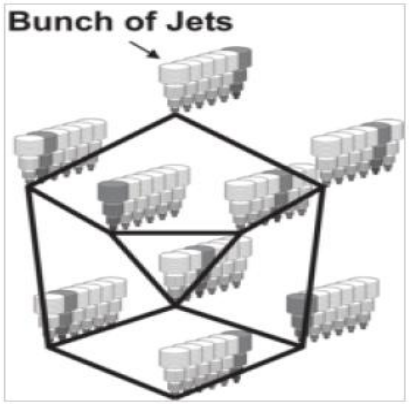


Fig 2 a bunch graph, the combination of jet of many model graph, gray shades are local expert.

2.4 *Bunch Graph*

Versatile chart coordinating takes care of the issue of matching so as to discover a known item in a picture a model diagram to the picture. Notwithstanding, it would be beneficial if one could likewise locate an obscure article in a picture and make a picture diagram for it in a reproducible way. This would have no less than two noteworthy points of interest: Firstly, demonstrate diagrams for new questions could be made without manual help. Also, there would be no compelling reason to coordinate each and every model in the exhibition to the picture.

A picture diagram could be created autonomously of a solid model and after that just the diagram correlation would be done for every model, which would spare a considerable measure of calculation. Such a non specific production of a picture chart is difficult for two reasons: Firstly, one needs to section the object from the background, and also, one needs to choose where to put the nodes on the object. Be that as it may, when handling an object class where all items have a typical structure, much is thought around another object of that class, regardless of the possibility that we have not seen it some time recently. Faces are the exact example. Regardless of the fact that we have not seen a specific face some time recently, we know its structure and can without much of a stretch discover the eyes, nose, and so forth, in light of the fact that we have seen numerous different faces some time recently.

The basic information of face and their variations can be represented by a graph called bunch graph. Accept model diagrams of indistinguishable structure are given for 100 frontal perspectives of different faces. Since the graph have indistinguishable structure, one can without much of a stretch ascertain the normal separation between two nodes over each of the 100 model graph.

The EBGM algorithm is one of the good algorithms for two reasons. To begin with, the algorithm is in a general sense unique in relation to others on the grounds that it perceives faces by contrasting their parts, rather than performing comprehensive picture coordinating. Second, the algorithm performed exceptionally well in the FERET study. Despite the fact that the subsequent EBGM execution does not recreate execution on the FERET database, the outcomes are good in connection to different algorithms assessed in the FERET test. The framework is a piece of an open source extend that incorporates four benchmark algorithms and an arrangement of devices and scripts that can be utilized to assess the execution of face acknowledgment algorithm.

## III. LITERATURE SURVEY

There are lot of work is done on the face recognition system many of them are providing the optimal result also but these all are on the normal face image which are likely to be same or which can be easily verified with some other easy techniques. However some of the listed research gave a remarkable result. All these are performed on normal face image not on the surgically altered face image or the destructed face image like the case of burn and plastic surgery. However the multi- objective evolutionary algorithms are proposed for surgically altered face image by Himanshu S Bhatt and group.

  

The subject of face recognition is primary method for the identification of person, both because of the theoretical interest from cognitive researcher and practical importance of the topic. In spite of the way that different routines for recognition, (for example, iris scans, or fingerprints) can be more exact, recognition of face has dependably remains a noteworthy center of research as a result of its non-invasive nature. Face recognition is always a challenging topic and research task in the field of computer vision and image processing. From two decades many researchers tried recognition of face methods based on inter-feature distances, edges and other neural net techniques. Some of them were successfully match on small databases of nearly same type of image, they were not up to the mark addressed the more realistic problem having large databases where the scale and location of the face is unknown.

## IV. PROBLEM DEFINITION

In the field of image processing and computer vision lot of research work are carried out some work are still on focus. One of them is applying the algorithm on surgically altered face image. The multi objective evolutionary algorithm is already applied on such face image. In this paper the Elastic Bunch Graph Matching algorithm are used for surgically altered face image and it is expected to give more optimal result.

The viola jones is the first ever real time face identification system. There are three factors working in show to empower a accurate and fast identification: the essential image for selection of feature, Adaboost for choice of feature and an attentional course for efficient computational asset allotment. It contains complete conceptual and algorithmic description, that can be applied to any colour image.. Since the Viola-Jones calculation normally gives various recognitions, a post-preparing step is additionally proposed to decrease recognition repetition using a strengths argument.

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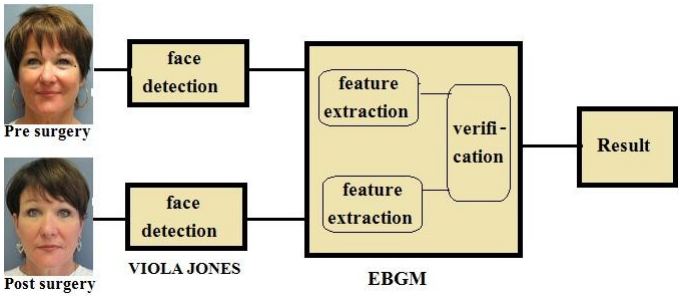


Fig.3 Block diagram illustrating different stage of proposed algorithm

EBGM is based on the concept that real face images have many nonlinear characteristics that are not addressed by the linear analysis methods like in PCA such as variations in expression illumination, pose and illumination. A Gabor wavelet transform are used to create a dynamic link design The Gabor jet is a node on the elastic grid. Gabor wavelet projects the face onto an elastic grid. That notated by circles on the below image, each point on face image describes the behavior of image around a given pixel. It is the result of a convolution of the image with a Gabor filter

A convolution expresses the amount of blending the functions overlap from functions together. Gabor filter is used to extract features and detection of object shapes by using image processing. Recognition is carried out by testing the similarity of the Gabor filter at each and every Gabor node. This biologically-based method using Gabor filters is a process executed already in the normal face image. Now it is implemented on the surgically altered face image for the verification of face. The accurate requirement of landmark localization may be difficult with this method.

## V. METHODOLOGY

Himanshu S Bhatt and others proposed a Multi objective Evolutionary Algorithm to recognize surgically altered face image [1] a multi objective evolutionary granular algorithm is proposed to match face pictures prior and then afterward plastic surgery. The algorithm initially creates non-disjoint face granules at different levels of granularity. The granular data is absorbed utilizing a multi objective information methodology that at the same time improves the determination of highlight extractor for every face granule along with the weights of individual granules. On the plastic surgery face database. The method used in this algorithm is that the process of granulation is performed on face image which consist of three levels of granularity after that feature extraction is carried out by two techniques namely Extended Uniform Circular Local Binary Patterns and Scale Invariant Feature Transform are used. After that Genetic optimization process are used for selecting feature extractor and weight for each face granule then it matched with pre and post surgical image and give expected result.

Daniel González-Jiménez and José Luis Alba-Castro [2] proposed a Shape-Driven Gabor Jets for Face Description and Authentication. A Shape driven Gabor planes, goes for selecting an own arrangement of focuses and elements for a given customer. In the wake of applying an edges and valleys indicator to a face image, characteristic lines are removed and an arrangement of focuses is consequently tested from these lines where Gabor elements (jets) are ascertained. So every face is portrayed by $R^2$ focuses and their individual planes. When two sets of focuses from face pictures have been separated, a shape-coordinating calculation is utilized to take care of the correspondence issue (i.e., map every point from the first picture to a point inside of the second picture) so that the framework can think about shape-coordinated jets. As a repercussion of the coordinating procedure, geometrical measures are processed also, incorporated into the final divergence function.

Takeshi Mita and others proposed Discriminative Feature Co-Occurrence Selection for Object Detection [3] feature co-events are naturally found by Sequential Forward Selection at every phase of the boosting procedure. They chose feature co-events are equipped for extricating basic similarity of target items prompting better execution. The proposed system is a speculation of the structure proposed by Viola and Jones, where every weak classifier depends just on a solitary highlight. Trial results acquired utilizing four article identifiers for discovering appearances and three changed hand postures, individually, appear that finders prepared with the proposed calculation yield reliably higher identification rates than those in view of their structure while utilizing the same number of features.

  

Narayanan Ramanathan and Rama Chellappa proposed Face Verification Across Age Progression [4] Human countenances experience significant measures of varieties with maturing. While face acknowledgment frameworks have been demonstrated to be touchy to components, for example, light and represent, their affectability to facial maturing impacts is yet to be concentrated. They add to a Bayesian age contrast classifier that arranges face pictures of people taking into account age contrasts and performs face check crosswise over age movement. Further, we concentrate on the likeness of countenances crosswise over age movement. Since age isolated face pictures constantly contrast in enlightenment and stance, we propose pre-processing strategies for minimizing such varieties.

## VI. CONCLUSION

In this Paper, We have discussed about the various face recognition techniques and their corresponding result with the face image. According to the survey first phase of algorithm is face detection and using multiple level of granularity may degrades the efficiency and increase the time complexity also so the Elastic Bunch Graph Matching algorithm are proposed to utilizes the output of real time face detection system i.e. Viola jones that are provides more accurate detection of face image. It is also expected to give more accurate results on surgically altered face image. Further, simultaneously optimizing the feature selection with Gabor wavelets and computing the matching of bunch graph of pre and post surgical image calculation takes into consideration tending to the nonlinear and unconstrained varieties presented by plastic surgery.

## REFERENCES

[1] Himanshu S. Bhatt, Samarth Bharadwaj, Richa Singh, and Mayank Vatsa, "Recognizing Surgically Altered Face Images Using Multi objective Evolutionary Algorithm" *IEEE Trans. Inf. Forensics Security*, vol. 8,no - 1, pp. 89–100, Jan. 2013.

[2] Daniel González-Jiménez and José Luis Alba-Castro, "Shape-Driven Gabor Jets for Face Description and Authentication" *IEEE Trans. Inf. Forensics Security*, vol. 2, no - 4, pp. 769–780, Dec. 2007.

[3] Takeshi Mita, Toshimitsu Kaneko, Bjo¨ rn Stenger, and Osamu Hori, "Discriminative Feature Co-Occurrence Selection for Object Detection" *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 30, no. 7, pp. 1257-1269. july 2008.

[4] Narayanan Ramanathan, and Rama Chellappa, *"*Face Verification Across Age Progression*" IEEE Trans. Image Processing*, vol. 15, no. 11, pp.3349-3361, Nov. 2006.

[5] Sonu Agrawal, Sushil Kumar, Sangeeta Agrawal, "A Survey on Face Recognition Techniques", in the proceedings of International Journal of Engineering Research and Applications (IJERA – 2012), Volume 2, Issue 4, July 2012.

[6] Aradhana Singh, Sonu Agrawal, Pooja Kamavisdar "A Study of Human ear detection for biometric identification" International journal of advanced research in Computer and Communication Engineering, Volume 2, Issue 1, January 2013

[7] Sonam Saluja, Aradhana Kumari Singh, Sonu Agrawal, "A Study of Edge-Detection Methods" International journal of advanced research in Computer and Communication Engineering, Volume 2, Issue 1, January 2013

[8] Pooja Kamavisdar, Sonam Saluja, Sonu Agrawal **"**A Survey on Image Classification Approaches and Techniques" International journal of advanced research in Computer and Communication Engineering, Volume 2, Issue 1, January 2013

[9] Xin Geng, Zhi-Hua Zhou and Kate Smith-Miles," Automatic Age Estimation Based on Facial Aging Patterns" *IEEE Trans. on pattern analysis and machine intelligence*, vol. 29, no. 12, pp. 2234-2240, Dec. 2007,

[10] H. S. Bhatt, S. Bharadwaj, R. Singh, and M. Vatsa, "On matching sketches with digital face images," in *Proc. Int. Conf. Biometrics: Theory Applications and Systems*, 2010, pp. 1–7.

[11] R. Singh, M. Vatsa, H. S. Bhatt, S. Bharadwaj, A. Noore, and S. S. Nooreyezdan, "Plastic surgery: A new dimension to face recognition," *IEEE Trans. Inf. Forensics Security*, vol. 5, no. 3, pp. 441–448, Sep. 2010.

[12] G. Aggarwal, S. Biswas, P. J. Flynn, and K. W. Bowyer, "A sparse representation approach to face matching across plastic surgery," in *Proc.Workshop on the Applications of Computer Vision*, 2012, pp. 1–7.

[13] L. Wiskott, J. M. Fellous, N. Kruger, and C. von der Malsburg, "Face recognition by elastic bunch graph matching," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 19, no. 7, pp. 775–779, Jul. 1997.

[14] B. Duc, S. Fischer, and J. Bigun, "Face authentication with Gabor information on deformable graphs," *IEEE Trans. Image Process.*, vol. 8, no. 4, pp. 504–516, Apr. 1999.

[15] F. Smeraldi and J. Bigun, "Retinal vision applied to facial features detection and face authentication," *Pattern Recognit. Lett.*, vol. 23, no. 4, pp. 463–475, 2002.

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