



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Special Issue 2, December 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569

Facial Recognition Algorithm with Graphical Isomorphism – A Survey

V.Sree Rama Krishnan^[1], A.Muruganandham^[2]

Assistant Professor, Department of Mathematics, Nallamuthu Gounder Mahalingam College, Pollachi, Tamilnadu, India

Assistant Professor, UG Department of Computer Applications, Nallamuthu Gounder Mahalingam College, Pollachi, Tamilnadu, India

ABSTRACT : The facial recognition (FR) system is increasingly trending across the world as an extremely safe and consistent security technology. It is fast significant importance and attention from thousands of corporate and government organizations because of its high level of security and reliability. In this paper, facial nodes are considered as a network and structural recognition is down with graphical isomorphism

KEYWORDS: Face recognition, Types of Detection Algorithms, Graphical Isomorphism and Applications

I. INTRODUCTION

The face is considered the most serious part of the human body. Research shows that even a face can speak, and it has dissimilar words for different emotions. It plays a crucial role in interact with people in society. It conveys people's self and thus can be used as a key for security solutions in many organizations. The facial recognition (FR) system is ever more trending across the world as an extremely safe and reliable security technology. It is gaining significant importance and attention from thousands of business and government organizations because of its high level of security and reliability.

Moreover, the FR system is providing vast profit compared to other biometric security solutions such as palmprints and fingerprints. The system captures biometric capability of a person from a specific distance without interacts with the person. In crime deterrent applications, this system can help many organizations identify a person who has any kind of criminal record or other official issues. Thus, this technology is suitable essential for numerous residential buildings and corporate organizations. This technique is based on the ability to recognize a human face and then compare the different features of the face with previously record faces.

A graph is a pictorial demonstration of a set of objects where some pairs of objects are connected by links. The consistent objects are represented by points termed as vertices and the links that connect the vertices are called edges. Formally, a graph is a pair of sets (V, E) , where V is the set of vertices and E is the set of edges, connecting the pairs of vertices. Take a look at the following graph. In this paper, the face structures are reconstructed in to a graphical networks and structural similarities is recognized using graphical isomorphism.

II. FACE RECOGNITION

In computer science, face recognition is mostly the task of recognizing a person based on its facial image. It has become very usual in the last two decades, mainly because of the new methods developed and the high quality of the current videos/cameras. Note that face recognition is dissimilar of face detection:

- **Face Detection:** it has the objective of result the faces (location and size) in an image and possibly extract them to be used by the face recognition algorithm.
- **Face Recognition:** with the facial images formerly extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image.

The face recognition systems can operate fundamentally in two modes:

Verification or authentication of a facial image: it mostly compares the input facial image with the facial image connected to the user which is requiring the verification. It is basically a 1x1 comparison.

Identification or facial recognition: it basically compares the input facial image with all facial images from a dataset with the aim to find the user that matches that face. It is basically a 1xN comparison.

Facial recognition is a group of biometric security. Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The knowledge is mostly used for security and law enforcement, though there is increasing interest in other areas of use.

III. TYPES OF DETECTION ALGORITHMS

Support Vector Machine (SVM): SVM is machine-learning algorithm, which is mostly used in classification problems. The algorithm solves the problem of data interfering by using an insulating surface called hyper plane to separate data. The Support Vector (SV) is the closest points to the hyper plane. There is a positive connection between support vector distance from the hyper plane and the accuracy of the classification. SVM has been future as the best and the most helpful algorithm for attendance systems.

Viola Jones (VJ) Algorithm: The algorithm developed by Paul Viola and Michael Jones. The algorithm is able to detect forward faces better than the faces looking sideways, upwards or downwards. Viola Jones has the ability to run in real time. It detects the face on the grayscale image and then finds the location on the colored image. They proposed simple rectangular features, which are just one part of an image subtracted with another part of an image. Their approaches are a machine learning- based approach; therefore select a set of simple features which they collective into an efficient scalable classifier. Their contribution was very quick way to calculate these features and use them to make a face classification. They faced a problem which is on an image calculating large group of pixels and summing them up is slow process therefore they came an effective idea called integral image.

Kanade Lucas Tomasi Algorithm: Kanade-Lucas-Tomasi (KLT) algorithm is a tracking algorithm that was create by Lucas and Kanade. KLT tracks interest points in the scene from one frame to the next frame. These points are stored and used to identify the face from the database. The KLT algorithm:

1. Detects the Harris corners in the first frame.
2. For each Harris corner compute motion between consecutive frames.
3. Link motion vectors in successive frames to get a track for each Harris points.
4. Introduce new Harris points by applying Harris detector at every m (10 or 15) frames.
5. Track old and new Harris points using steps 1-3.

AdaBoost Algorithm: The AdaBoost algorithm is a developed Boosting algorithm, which is a machine-learning algorithm for training cascade stronger classifiers based on Haar-like features. AdaBoost was invented by Freund and Schapire in 1997. This algorithm uses multiple weak classifiers each based on different features combines these different weak classifiers into a single strong classifier.

Hybrid Face Detection Algorithm: The first step is skin detection to the input image, the second step is applying face detection algorithm by using Viola method, the third step is applying eye detection to detect the images weren't detected by the previous step, the last step is nose detection to detect the images weren't detected by Viola method and eye detection [9].

IV. GRAPHICAL ISOMORPHISM

Graph isomorphism is a parallel relation on graphs and as such it partitions the class of all graphs into equivalence classes. A set of graphs isomorphic to each other is called an isomorphism class of graphs. The two graphs shown below are isomorphic, despite their different looking drawings. In this section facial points are considered as a graph. Here the facial points are considered as vertices and connection lines are considered as edges.

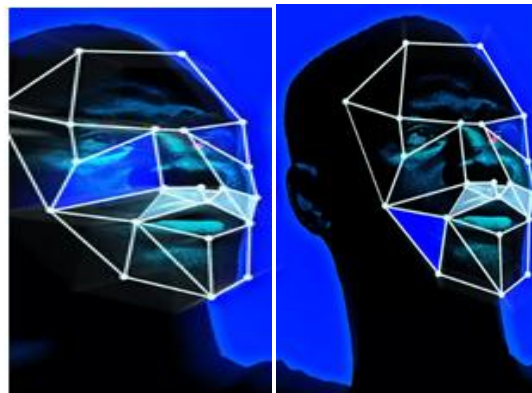


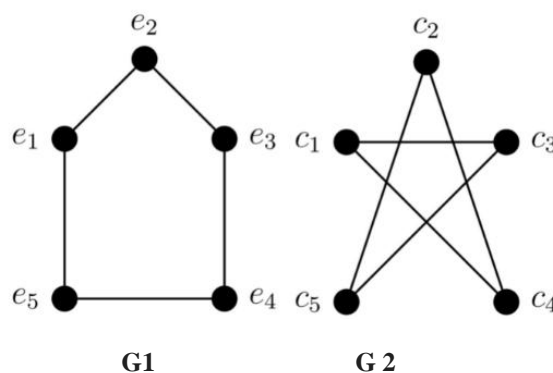
Fig.1.

Fig.2.

As of fig.1 two different graphs are considered from different facial structures. For any two graphs to be isomorphic, following 4 conditions must be satisfied.

Number of vertices in both the graphs must be same.

- Number of edges in both the graphs must be same.
- Degree sequence of both the graphs must be same.
- If a cycle of length k is formed by the vertices $\{v_1, v_2, \dots, v_k\}$ in one graph, then a cycle of same length k must be formed by the vertices $\{f(v_1), f(v_2), \dots, f(v_k)\}$ in the other graph as well.



The graph G_1 and G_2 are said to be isomorphic if two graphs G_1 and G_2 are said to be isomorphic if

- Their number of components (vertices and edges) is same.
- Their edge connectivity is retained.

15th & 16th September 2021

Organized by

Department of Computer Science, Parvathy's Arts and Science College, Dindigul, Tamilnadu, India

Here vertices $\{e_1, e_2, e_3, e_4, e_5\}$ in the graph 1 represents the facial nodes of Fig.1 and Vertices $\{c_1, c_2, c_3, c_4, c_5\}$ in the graph 2 represents the facial nodes of alternative pictures which is to be compare with fig. 2. If two graphs have the same number of vertices and edges after rearrangements and reconstructions, the graph is isomorphic and two facial nodes are similar and both are same persons.

V. APPLICATIONS

Face recognition is used for two primary tasks:

1. **Verification** (one-to-one matching): When presented with a face image of an unidentified entity along with a claim of identity, ascertain whether the individual is who he/she claims to be.

2. **Identification** (one-to-many matching): Given an image of an unknown individual, determining that person's identity by compare (possibly after encoding) that image with a database of (possibly encoded) images of known individuals.

There are frequent application areas in which face recognition can be exploited for these two purposes, a few of which are outlined below.

- Security (access control to building, airports/seaports, ATM machines and border checkpoints computer/ network security email authentication on multimedia workstations).
- Surveillance (a large number of CCTVs can be monitored to look for known criminals, drug offenders, etc. and authorities can be notified when one is located; for example, this procedure was used at the Super Bowl 2001 game at Tampa, Florida in another instance, according to a CNN report, two cameras linked to state and national databases of sex offenders, missing children and alleged abductors have been installed recently at Royal Palm Middle School in Phoenix, Arizona).
- General identity verification (electoral registration, banking, electronic commerce, identifying newborns, national IDs, passports, drivers' licenses, employee IDs).
- Criminal justice systems (mug-shot/booking systems, post-event analysis, forensics).
- Image database investigations (searching image databases of licensed drivers, benefit recipients, missing children, immigrants and police bookings).
- "Smart Card" applications (in lieu of maintaining a database of facial images, the face-print can be stored in a smart card, bar code or magnetic stripe, authentication of which is perform by matching the live image and the stored template).
- Multi-media environment with adaptive human computer interfaces (part of ubiquitous or context aware systems, behavior monitoring at childcare or old people's centers, recognizing a customer and assessing his needs)
- Video indexing (labeling faces in video)
- Witness faces reconstruction.

In addition to these applications, the underlying techniques in the current face recognition technology have also been modified and used for related applications such as gender classification, expression recognition and facial feature recognition and tracking each of these has its utility in various domains: for instance, expression recognition can be utilized in the field of medicine for intensive care monitoring while facial feature recognition and detection can be exploited for tracking a vehicle driver's eyes and thus monitoring his fatigue, as well as for stress detection. Face recognition is also being used in conjunction with other biometrics such as speech, iris, fingerprint, and ear and gait recognition in order to enhance the recognition performance of these methods.

VI. CONCLUSION

Face recognition is a challenging problem in the field of image analysis and computer idea that has received a great deal of awareness over the last few years because of its many applications in various domains. Research has been conducted vigorously in this area for the past four decades or so, and though huge development has been made,



15th & 16th September 2021

Organized by

Department of Computer Science, Parvathy's Arts and Science College, Dindigul, Tamilnadu, India

encouraging results have been obtain and current face recognition systems have reached a certain degree of maturity when operating under constrained conditions; however, they are far from achieving the ideal of being able to perform adequately in all the various situation that are commonly encountered by applications utilizing these techniques in practical life.

REFERENCES

- [1] K. Jain, R. Bolle, and S. Pankanti, "Biometrics: Personal Identification in Networked Security," A. K. Jain, R. Bolle, and S. Pankanti, Eds.: Kluwer Academic Publishers, 1999.
- [2] K. Kim, "Intelligent Immigration Control System by Using Passport Recognition and Face Verification," in International Symposium on Neural Networks. Chongqing, China, 2005, pp.147-156.
- [3] J. N. K. Liu, M. Wang, and B. Feng, "iBotGuard: an Internet-based intelligent robot security system using invariant face recognition against intruder," IEEE Transactions on Systems Man And Cybernetics Part C-Applications And Reviews, Vol.35, pp.97-105, 2005.
- [4] H. Moon, "Biometrics Person Authentication Using Projection-Based Face Recognition System in Verification Scenario," in International Conference on Bioinformatics and its Applications. Hong Kong, China, 2004, pp.207-213.
- [5] D. McCullagh, "Call It Super Bowl Face Scan 1," in Wired Magazine, 2001.
- CNN, "Education School face scanner to search for sex offenders." Phoenix, Arizona: The Associated Press, 2003.
- [5] P. J. Phillips, H. Moon, P. J. Rauss, and S. A. Rizvi, "The FERET Evaluation Methodology for Face Recognition Algorithms," IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.22, pp.1090-1104, 2000.
- [6] T. Choudhry, B. Clarkson, T. Jebara, and A. Pentland, "Multimodal person recognition using unconstrained audio and video," in Proceedings, International Conference on Audio and Video-Based Person Authentication, 1999, pp.176-181.
- [7] S. L. Wijaya, M. Savvides, and B. V. K. V. Kumar, "Illumination-tolerant face verification of low-bitrate JPEG2000 wavelet images with advanced correlation filters for handheld devices," Applied Optics, Vol.44, pp.655-665, 2005.
- [8] E. Acosta, L. Torres, A. Albiol, and E. J. Delp, "An automatic face detection and recognition system for video indexing applications," in Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing, Vol.4. Orlando, Florida, 2002, pp.3644-3647.
- [9] J.-H. Lee and W.-Y. Kim, "Video Summarization and Retrieval System Using Face Recognition and MPEG-7 Descriptors," in Image and Video Retrieval, Vol.3115, Lecture Notes in Computer Science: Springer Berlin / Heidelberg, 2004, pp.179-188.
- [10] C. G. Tredoux, Y. Rosenthal, L. d. Costa, and D. Nunez, "Face reconstruction using a configural, eigenface-based composite system," in 3rd Biennial Meeting of the Society for Applied Research in Memory and Cognition (SARMAC). Boulder, Colorado, USA, 1999.
- [11] K. Balci and V. Atalay, "PCA for Gender Estimation: Which Eigenvectors Contribute?" in Proceedings of Rabia Jafri and Hamid R. Arabnia 57 Sixteenth International Conference on Pattern Recognition, Vol.3. Quebec City, Canada, 2002, pp. 363-366.
- [12] B. Moghaddam and M. H. Yang, "Learning Gender with Support Faces," IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.24, pp.707- 711, 2002.
- [13] R. Brunelli and T. Poggio, "HyperBF Networks for Gender Classification," Proceedings of DARPA Image Understanding Workshop, pp.311-314, 1992



**Impact Factor:
7.569**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details