Robust Face Recognition System for E-Crime Alert

[1]Prof. Sumeet Pate, [2]Deepak G. Maurya, [3]Vinit J. Mhatre, [4]Parmesh K. Yadav
[1]Asst. Professor, [2,3,4]BE Student, [1,2,3,4]Comp. Engg. Dept, SSJCET, Asangaon, India.
[1]sumeetpate09@gmail.com, [2]mdeepak.maurya@gmail.com, [3]vinitmhatre95@gmail.com, [4]prem55726@gmail.com

Abstract - The main aim of this paper is to identify and locate missing persons, child's and most wanted criminals anywhere any time any place. This paper is to detect this person form any remote CCTV cameras and MOBILE camera as soon as our software detect this person. This application will automatically sends SMS alert to the nearby area police station of that area and also where the main details are registered by the police station. To perform face recognition in different light, and expression, this application extracts various patterns from image. Specifically, this System work on LEM algorithm in this we detect the point and calculate the line segment hausdorff (LSD) distance and then computes the feature. It is a novel face image descriptor inspired by the unique Edge structure of human faces. It is efficient and only doubles the cost of computing patterns, yet is extremely accurate to pose and expression variations. This new system will allow security to the data, by mean of authorizing users. Only those users who have a valid user-id and password can access the system.

Keywords — E-crime, biometric, face recognition system, alert system, online fir, line Edge mapping.

I. INTRODUCTION

E-crime alert concept is used to detect and live tag person in remote cameras footage recording on server monitor and get the exact location where this suspicious person is identified. The Report Main aim is to detect person form any cameras or mobile camera as soon as the software discover this person. Software will working by itself and sends alert message to the nearby area station and to the main concern person of that area and also where the main details are registered by the police station.

The main objective of this software is to recognize and locate missing persons, child's and most wanted criminals anywhere any time any place. Maintaining all records of criminals, missing persons and child's on centralized database will be easier with image. Updating or deleting of records can be done easily. Investigation can be done as per the requirements will be easier as centralized database will be located. Retrieval of data would be easier as the server maintains all the information needed. Less time would be required for to maintain, update and delete records. This software will help police to find and locate the missing persons, child's and most wanted criminals and terrorist remotely easily and quickly at anywhere at any time and at any place.

Ability to understand the problem in the live system & finding requested solution is having high rank activity while planning the project. Hence the developing a new system must find out problem associated with the current system. The police have to record missing person/child details as well as citizen details and most wanted criminal person's details. It is difficult to maintain such data manually as large amount crime happens daily and maintaining of daily data grows rapidly. It is difficult for police to remember the face of the suspicious person regularly in mind and to find them in common place where lots of rush are there. After filling the details user may have to be deleted or updated as per the requirements and changes was difficult. Police has to put

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their informers to get the unknown person details and to watch them closely which was hectic. Searching Problems: Searching is very difficult as the large amount of data is present. Finding and identifying the missing person or criminal person has to do it manually. The retrieval of records of crime from huge files is very time consuming, as the user has to search each and every record even for a single data from files. Citizen need to go to police station to register their complaint.

II. LITERATURE SURVEY

A. FACE RECOGNITION

A face detection system has been developed since in early 1970. Due to the limitation of computation, system can't be complete the requirement of client, which is identify passport photograph real time. At the beginning of 1990's algorithm are presented which focused on the face recognition on and increase the need of face detection. Face recognition has more popular and users give much attention and its development has rapidly expanded by not only engineers but also neuroscientists, since it has capacity to develop applications in computer vision communication and Security system

B. FACE RECOGNITION PROCESSING

Face recognition presents a challenging problem in the field of image analysis and computer vision, and as such has received a great deal of attraction over the last few years because of its many applications in various domains. Face recognition techniques can be broadly divided into three categories based on the face data acquisition methodology: [1]

- Methods that operate on intensity images
- Method those that deal with video sequences
- Method requires other sensory data such as 3D information or infra-red imagery.

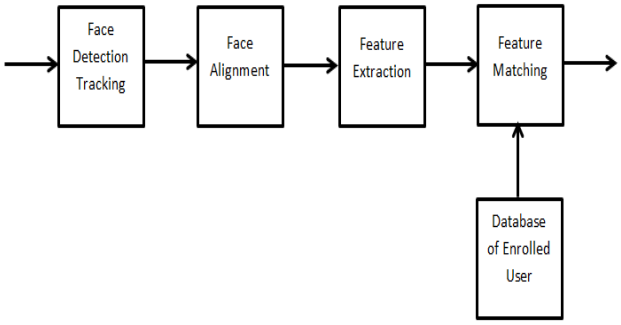

Figure 1. *Process of face recognition*

C. FACE RECOGNITION USING DIFFERENT METHOD

The key behind methods currently used for face recognition, which have a wide variety of uses from biometrics, surveillance, security system and forensics. After a description of how faces can be detected in images, describe 2D feature extraction methods that operate on all the image pixels in the face detected region [3]. Eigen faces and Fisher faces first proposed in the early 1990s. Although Eigen faces can be made to work reasonably well for faces captured in controlled conditions, such as frontal faces under the same condition, recognition rates are poor. How greater accuracy can be achieved by extracting features from the boundaries of the faces by using Active Shape Models and, the skin textures, using Active Appearance Models, originally proposed by Cootes and Talyor. The remainder of the chapter on face recognition is dedicated such shape models, their implementation and use and their extension to 3D. Show that if multiple cameras are used the 3D geometry of the captured faces can be recovered without the use of range scanning or structured light. 3D face models make recognition systems better at dealing with pose and lighting variation [2].

There is different method for face recognition:

- Face Recognition using Eigen faces.
- Face recognition using biometrics techniques.
- Template/statistical/neural technique.
- Face recognition using 2-d and 3-d techniques.

1) FACE RECOGNITION USING EIGEN FACES

This algorithm extracts the important information of an image and encrypts it as efficiently as possible. For this purpose, collection of images from the same person is

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evaluated in order to obtain the variation. Mathematically, the algorithm calculates the eigenvectors of the covariance matrix of the set of face images. Each image from the set contribute to an eigenvector, these vectors characterize the variations between the images. When represent these eigenvectors, call it Eigen faces. Every face can be represented as a linear combination of the Eigen faces. [4]

This is best approach that thoroughly investigated to face recognition. It is also known as Karhunen-Loève expansion, Eigen picture, eigenvector, and principal component [5] [6].in this, component analysis is easy to represent image of faces. They proposed that any face images can be reconstructed by a small collection of value for each face and a standard face picture (Eigen picture). The value describing each face is obtained by applying to the face image on the Eigen image. In mathematical terms, Eigen faces are the principal components of the distribution of faces. The eigenvectors are ordered to represent different amounts of the variation, respectively, among the faces. Each face can be denoted exactly by combination of the Eigen faces. It can also be approximated using Eigen vectors with the largest Eigen values. The best N Eigen faces construct an N dimensional space. This dimension called "face space". The authors [7] reported 96 percent, 85 percent, and 64 percent correct averaged over lighting, orientation, and size variations, respectively. Their database contained 2,500 images of 16 individuals. As the images include a large quantity of background area, the above results are influenced by background. The authors explained the robust performance of the system under different lighting conditions by significant correlation between images with changes in illumination.

2) BIOMETRICS TECHNIQUES OF FACE RECOGNITION

Biometrics is methods to identify a person based on a physiological or behavioural characteristic. The biometrics includes the identification of body features, scars or a grouping of other physiological criteria, such like height, eye colour and complexion. The present features are face recognition, fingerprints, handwriting, and retinal scan. Biometric technique is now becoming highly secure identification and personal verification. Recent world events had led to an increase interest in security that will impel biometrics into majority use [8].

3) TEMPLATE/STATISTICAL/NEURAL TECHNIQUE

The group face recognition methods into three main groups. The following approaches are proposed .Template matching. Patterns are represented by samples, models, pixels, textures. The recognition function is usually a correlation or distance measure.

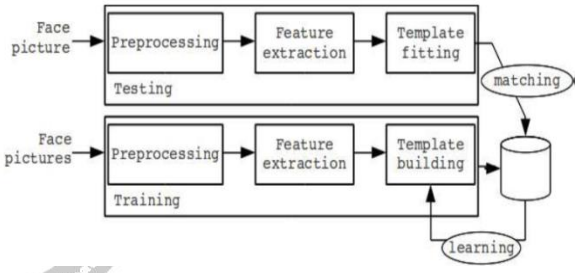

Figure 2. *Template mapping technique*

4) FACE RECOGNITION USING 2-D AND 3-D TECHNIQUES

3D face database providing 3D texture mapped face models, as well as 2D images captured at the same instant. This database facilitates a direct comparison of 3D and 2D techniques, which has not previously been possible. Various methods of system combination are tested, including combination by dimensional accumulation, elimination and genetic selection. This research leads to an innovative multi-subspace face recognition method capable of combining 2D and 3D data, producing state-of-there cognition method capable of combining 2D and 3D data, producing state-of-threat error rates, with a clear advantage over single subspace systems: The lowest EER achieved using 2D, 3D and 2D Projection methods are 9.55%, 10.41% and 7.86% respectively, yet multi-subspace combination reduces this error down to 4.50% on the same

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test data.[2]

III. LINE EDGE MAP (LEM)

Line edge map edge information is a useful to show an object that is not sensitive to light changes to certain extent .thus the edge is mostly used for various pattern recognition field. It has been removed in face recognition except in recent work reported in [10].edges of an image use for object recognition and to get same as accuracy as in grey level pictures. The above given report has use edge map to measure the similarity of the face image 92% accuracy was achieved .takas told that this process of face recognition might stat previously at earlier stage and edges image can easily use for recognition of face without any high level method function. LEM approach presented in extract line from a face edge map as features [11]. This is a combination of two template machines and geometrical matching LEM not only processes the advantages of feature based on approaches such as not similar to illumination and low memory environment but also has high recognition performance of template matching.

Figure 3. Line edge mapping

It integrates the structural information with spatial information of a face image by grouping pixels of face edge map of line segment. After thinning the edge map a polygonal line fitting is applied to generate the LEM of a face. It reduces the storage process as it records only the end points of line segment on curves. It expected to be less sensitive to illumination changes due to the fact that it is an intermediate level image representation which we set from low level edge map representation the basic stricture of LEM is the line segment which is grouped from pixels of edge map. A face pre-filtering algorithm is proposed which is useful in face identification application. The filtering operation can speed up the search by reducing the number of condition while is matching process and the actual face LEM matching is only carried out earlier the storage problem is taken place such as the size of each individual face template (16 kilobytes) bulky for obsolete computer System. The parallel processor work on the application also posed the threat to old machines.

IV. PROPOSED SYSTEM

E-Crime alert is a software in which we are going to detect the person with the help of face recognition software. In this software we can also find missing person, terrorist etc. These software have its own database to store the information of the missing person. As soon as person identified by software it will send the alert messing to nearest station.

This software work in three different steps

1. UPLOAD INFORMATION

Upload the photos of missing or suspicious person and there information to the application performs its algorithm to extract the feature of face and store in the database.

2. FACE RECOGNITION

In camera or CCTV face is detected it match with the database face feature. To face recognition we use the Line edge map algorithm. In these for face recognition we Use Face detection and recognition library that can be easily integrated into the application. It offers the API (Application Programming Interface) to detect and track faces. It is provided with Tracker API which allows tracking and recognizing faces in Real Time. The SDK provides the coordinates of 66 facial feature points (including eyes, eyebrows, mouth, and nose and face contours) [9]. It uses multiple processor cores to speed up recognition. The

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library supports DirectShow-compatible web cameras and IP cameras with an MJPEG interface.

3. SEND ALERT MESSAGE

If system identifies the person who is missing or suspicious it will send to the nearest department to further process.

A. SYSTEM ARCHITECTURE

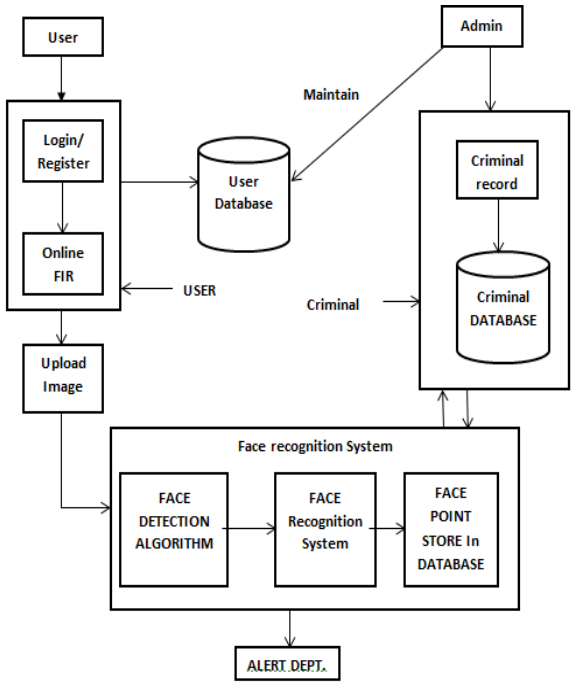

Figure 4. System Architecture

B. OVERVIEW OF SYSTEM

- Maintaining all records of criminals, missing persons and child's on centralized database will be easier with image.
- Updating or deleting of records can be done easily.
- Searching can be done as per the requirements will be easier as centralized database will be located.
- Retrieval of data would be easier as the server maintains all the information needed.
- Less time would be required for to maintain, update and delete records.
- Only authorized user of the system having valid user id and password can access the system and can manage the records.
- Anyone can ON their mobile camera and identify any suspicious person around them easily.
- This software will help police to find and locate the missing persons, child's and most wanted criminals and terrorist remotely easily and quickly at anywhere at any time and at any place

C. POINTS THAT ARE USED IN FACE RECOGNITION

Face detection and recognition library that can be easily integrated into the customer's application. It offers the API (Application Programming Interface) to detect and track faces. It is provided with Tracker API which allows tracking and recognizing faces in Real Time. The SDK provides the coordinates of 66 facial feature points .It uses multiple processor cores to speed up recognition. The library supports DirectShow-compatible web cameras and IP cameras with an MJPEG interface.

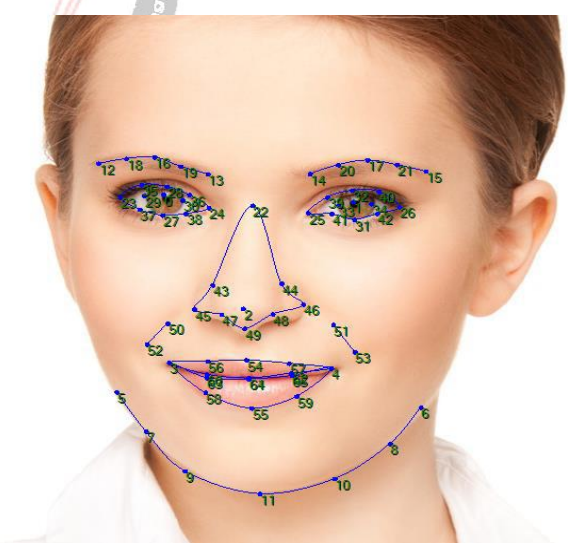

Figure 5. Significance of points that are used in face recognition [9]

- Tracker API is a set of functions that allows for recognizing subjects in live video streams. The API receives the video frame by frame, and assigns a unique identifier (ID) to each subject detected in the video.
- For each frame, the function FSDK_FeedFrame returns the list of $\overline{d_\theta}(a_i^l, b_j^l) == f(\theta(a_i^l, b_j^l))$

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identifiers (integer numbers) of faces recognized in this frame.

- The API allows limiting the memory used by a tracker. The memory size is measured in the total number of facial appearances stored (about 14Kbytes per appearance).
- The photometric stereo technique consists of obtaining several pictures of the same subject in different illumination conditions and extracting the 3D geometry by assuming a Lambertian reflection model. Assume that the facial surface, the object is illuminated by a source of parallel rays directed along line.

D. SYSTEM DESIGN AND DEVELOPMENT

The facial recognition approach used in developing this application is based on Line Edge Mapping method.

1. LINE EDGE MAPPING

Line edge mapping works with the outline of the facial features, maps out the important points as a vector line, and saves the template. Line edge map has advantage over all other methods of face recognition, because it identifies the most facial features, it has a higher accuracy than others due to this effect as in [11]. LEM (Line Edge Mapping) consists of a series of line segments, it records only the endpoints of lines which further reduces it storage requirements. LEM matches two different images using LHD (Line Segment Hausdorff Distance). This is used in calculating the distance between lines using angular projection, parallelism, and perpendicularity of the two different lines to be matched and check if they meet the threshold for similarity.

Line-Segment Hausdorff Distance

Given two LEMs $S=(S_1,S_2,\ldots S_P)$ And $T=(T_1,T_2,\ldots T_Q)$

The LHD is built on the vector $d(S_p, Tq)$

d() represents the distance between two lines segments

$$\vec{d}(m_i^l, t_j^l) = \begin{pmatrix} d_\theta(m_i^l, t_j^l) \\ d_\parallel(m_i^l, t_j^l) \\ d_\perp(m_i^l, t_j^l) \end{pmatrix}$$

Angular line matching with tolerance: This matches different lines between two images if images are at a slight angle with each other with a tolerance marking the threshold of the similarity. $\Theta(a_i^L, b_j^L)$ represents smallest intersection angle between lines a_i^L and b_j^L. Function 'f' is the penalty factor that ignores the smaller angles and penalizes the greater ones.

$$f(\theta) = \theta^2 / W$$

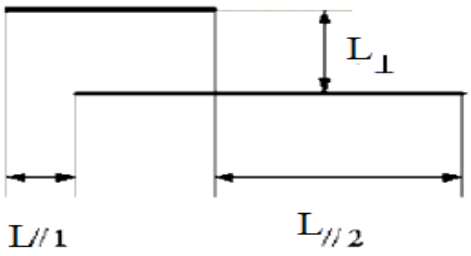
θ = angle, W is determined during training.

$$d_\parallel(m_i^l, t_j^l) = \min(l_{\parallel 1}, l_{\parallel 2})$$

Parallel line matching**:** This matches the parallelism of different lines and compares it in two images. $L_{\parallel 1}$, $L_{\parallel 2}$ are the two parallel lines, the' min' function is the minimum distance between the edges of the lines.

$$d_\perp(m_i^l, t_j^l) = l_\perp$$

Perpendicular line matching: This matches the perpendicularity of different lines and compares them between two images. L_ist the distance between perpendicular points. The representations of the above are represented in the figure below:



The distance between the two segments A,B can be calculated as follows:

$$d_\theta^2(a_i^l, b_j^l) + d_\parallel^2(a_i^l, b_j^l) + d_\perp^2(a_i^l, b_j^l)$$

$$d(a_i^l, b_j^l) = \sqrt{d_\theta^2(a_i^l, b_j^l) + d_\parallel^2(a_i^l, b_j^l) + d_\perp^2(a_i^l, b_j^l)}$$

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V. PERFORMANCE EVALUATION

The performance evaluation of the system is carried out with a few variables and constants. The constant parameters in this context are: Illumination and Face Posture. While the varying parameters are: Internal Resize Width of the Image processing engine and False Acceptable Rate (maximum error rate) in face template matching.

A. FACE IDENTIFICATION PROBABILITY

While testing for optimum face identification probability by varying the internal resize with, higher internal resize width gives a higher identification probability. These values are exponential proportion until resize width reaches about 300 pixels. This can be seen to produce optimum result for the face identification parameter. Although increasing the resize width increases the probability of identification, it also has an adverse effect on the performance of the system, creating unnecessary time lags in image processing. Figure 5 shows the relationship between Face Identification Probability and internal resize width.

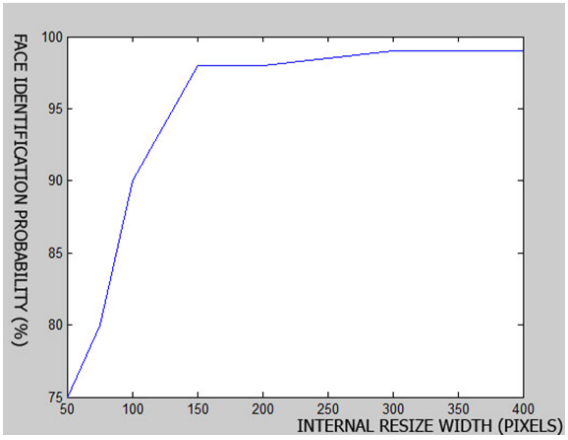

Figure 6. Relationship between Face Identification Probability and Internal Resize width.

B. FALSE ACCEPTABLE RATE (FAR)

The False Acceptable Rate (FAR) is the error value (in %) to which two different face templates can be said to match. FAR and FRR are inversely proportional to each other and are used interchangeably in the design of the system. In-order words, when working with FAR, a low value will improve the matching accuracy, while a high FRR will improve the matching accuracy. In this scenario, FAR is to be used to derive the corresponding matching accuracy by varying the FAR value as a percentage. Figure 6 shows the graph of the relationship between the FAR and the matching accuracy.

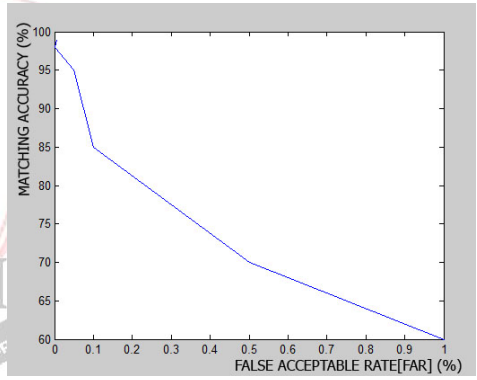

Figure 7. Graph of the relationship of FAR to the matching accuracy

Also by reducing the FAR to get a better matching accuracy, the system performance, with respect to the speed/rate of face recognition is reduced, and this creates a time lag in image processing. Optimum values of both FAR and internal resize width can be chosen based on the specification of the system that the application runs.

VI. RESULT

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Figure 8. *Home Page*

Figure 9.*welcome page*

Figure 10. *Face detection system*

VII. CONCLUSION

The major aim of this work is to design and construct a face recognition system which can be used for the detection of any criminals and missing person with a much faster, easiest and efficient detection technique. With these additional improvements, the standardization should be done for future face recognition system. The efficiency of this system is approximately 85% which can be improved by applying a more complex algorithm. It can also be integrated with any cameras. Robust face recognition system for e-crime alert is a best way to find missing and criminal person .it can also register FIR directly for all cases easily. Line edge mapping algorithm is used for face recognition which clearly identify the any issues.it is easy to handle and can access by any person.

REFERENCES

[1] A Survey of Face Recognition Techniques Rabia Jafri and Hamid R. Arabnia Face Recognition Based on Fitting a 3D Morphable Model Volker Blanz and Thomas Vetter, Member, IEEE.

[2] ACTIVE APPEARANCE MODEL AND PCA BASED FACE RECOGNITION SYSTEM Mrs. J.Savitha M.Sc., M.Phil, Dr. A.V.Senthil Kumar

[3] Facial Recognition using Eigen faces by PCA,Prof. Y. Vijaya Lata1, Chandra Kiran Bharadwaj Tungathurthi2, H. Ram Mohan Rao3, Dr. A. Govardhan4, Dr. L. P. Reddy

[4] L.Sirovich and M. Kirby, "Low-Dimensional procedure for the characterization of human faces"*Journal of Optical Soc. of Am*., vol. 4, pp. 519-524, 1987

[5] M. Kirby and L. Sirovich, "Application of the Karhunen-Loeve procedure for the characterisation of human faces" *IEEE Trans. Pattern Analysis*

[6] Review of Face Recognition Techniques Asavari G. Joshi, A. S. Deshpande

[7] DIGITAL RECOGNITION Jill Kothari1, Yash Mehta2, Asst.Prof. Vatsal Shah3

[8] LuxandFaceSDK "*Face Detection and Recognition Library*" Developer's Guide 2011

[9] B. Taka's, "Comparing face images using the modified hausdorff distance," *Pattern Recognition*, vol. 31, pp. 1873-1881, 1998.

[10] Y. Gao and K.H. Leung, "Face recognition using line edge map," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 24, no. 6, June 2002.

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