A Survey on: Automatic Facial Image Expression Retrieval using Machine Learning Techniques

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Abstract-From the last decade, the analysis of the facial expression automatically is now considered to be the most active area of research which has the potential applications in areas as-engaging human-interfaces, retrieval of images as well as emotions of human. So, accordingly human expressions are very important in reflecting the emotions but also the mental activities of the human being, social interactions as well as some physiological signals. This survey introduces the most prominent automatic facial expression analysis methods as well as systems are presented in the literature itself. In this proposed approach, we achieve immediate retrieval in a large-scale dataset by improving the face retrieval in the offline and online stages. The survey paper also focuses onto explaining previous techniques along with their working, and how the proposed work is relevant to the futuristic purpose.

Index Terms—Face Image Retrieval, Human Attributes, Content Based Image Retrieval.

I. INTRODUCTION

FACE location is a basic operation in PC vision, with wide applications in face prediction, human PC collaboration, social examination, and PC illustrations, to give some examples. As a result of its numerous utilizations, face discovery has gotten significant consideration, particularly in the previous quite a long while. By face recognition, we seems to imply that a jumping box (or an ellipsoid) encasing the face (or faces) in a picture at around the right scale should be indicated. These days, computerized gadgets assume a basic job in the climb of casual network goals and photo sharing organizations. It lead to the improvement of purchaser photos available in our life. The noteworthiness and the inside and out proportion of human face photos make controls of colossal scale human face pictures a very noteworthy research issue and engage various genuine applications [1], [2]. Late examples tell that the notoriety of touch contraptions conveys new shots and troubles to picture affiliation. It is an engaging advancement for certain, applications including customized face remark, bad behavior examination, etc. In this work, we give another quality interest by including unusual state human attributes into face picture depiction. By solidifying low-level features with anomalous state human characteristics, we find better component depictions and achieve favored recuperation results over the present system. A comparative idea is proposed in using fisher vectors with properties for immense scale picture recuperation. Human characteristics (e.g., sexual direction, race, haircut, and concealing) are irregular state semantic delineations about a person. Using these human characteristics, various researchers have achieved skilled results in different applications, for instance, face affirmation, ID, catchphrase based face picture recuperation, and same quality.

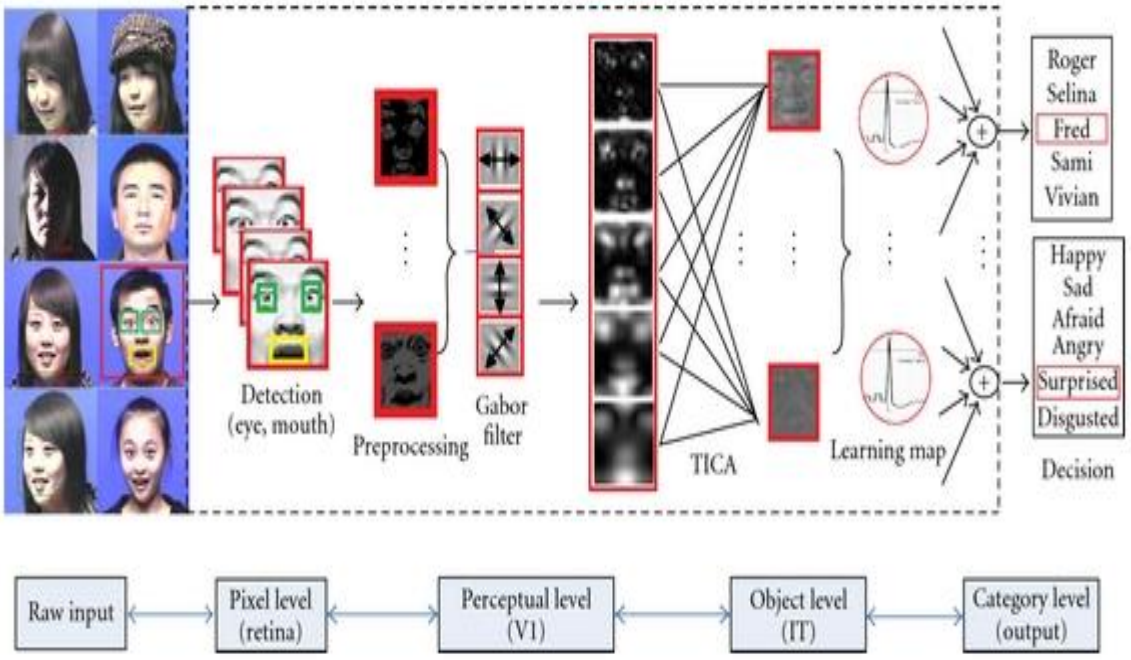

Figure 1: Raw inputs conversion into final output.

Machine learning is an advantage solution using which the extraction of features from different segment and its analysis can get perform. It is also having various classification solution, which find its usability to identify predictions by processing data through its mechanism. Many algorithm for such system which are rule based, tree based and other network layer based approaches are proposed for the data prediction solution purpose. Thus the same concept is very useful while working with the facial expression, their extraction and analysis purpose for the real time analysis.

At present, a few calculations exist which can give dependable location of appearances in pictures. Besides, late outcomes show how face indicators can be made to work quicker and all the more precisely under changing conditions.

Common types of Facial Expressions:

1. Confusion: A declaration of disarray is regularly dictated by the nose and brow scrunched up, now and then with one eyebrow raised higher than the other. Lips are commonly pressed together too, in spite of the fact that the declaration of perplexity will in general be most emphasizd around the eyes and nose.

2. Shame: A look of disgrace is an effectively and all around perceived articulation. It commonly incorporates eyes deflected descending with a disheartened or stressed appearance. The head is additionally regularly situated to face down with a scowling or unbiased mouth. Whenever improved, disgrace is firmly identified with accommodation. In primates, after the prevailing individual has prevailing with regards to driving the other into accommodation, the losing side will keep his or her eyes pointed descending to recognize misfortune and end the contention.

3. Surprise: A look of shock is effectively recognized by its extended eyes and expanding mouth. The feeling of astonishment or stun is a nearby relative of dread. The astonished face is one of the most

instinctual faces we make. More often than not we don't deliberately make the face—it is an immediate response to something. All primates, and numerous different creatures so far as that is concerned, extend their eyes in dread or when they are scared.

4. Focus: An engaged or focused outward appearance can differ dependent on the circumstance. On the off chance that the individual is centered around a specific assignment, their eyes will be fixed on it. In the event that one is centered around an idea or thought then again, they might look upward or with eyes deflected to the side. There is likewise commonly less flickering.

5. Exhaustion: A conspicuous factor showing that somebody is depleted are half-open eyelids. Eyebrows are likewise habitually brought up in an endeavor to remain wakeful. Exhaustion is an exhaustion brought about by a ton of effort without adequate rest. In primates, particularly the more wise extraordinary gorillas, their exhausted articulation is similarly as unmistakable. When planning for or taking part in a contention, chimps can scrutinize each other.

6. Anger: Anger, more so than different feelings, is believed to be all inclusive crosswise over societies. The look and aura is obvious: Eyebrows are crushed together to frame a wrinkle, and eyelids are tight and straight. The head is regularly somewhat brought down as the eyes glance through a brought down temples.

7. Fear: The outward appearance of dread is described by augmented eyes and eyebrows inclined upward. The mouth is generally open somewhat too. Dread, similar to shock, is intently attached to nature and demonstrates a longing to keep away from or circumvent something.

COMPARISON IN EXPRESSION AND EMOTIONS

’Expression’ and ’Emotion’ are not same. Emotion is relative in nature, for example expression laugh or smile to the emotion happiness. Expressions on face are not essentially be the outcome of human emotion. Hence we can say that the facial expression (if deliberately manipulated) is just a physiological movement of different face parts, and these parts can be mouth, nose, eyes, eyebrows etc. To map Emotions to Expressions is a difficult area till date hence for now we can concentrate on Expressions only. For interactive human and computer interface (HCI) it is important that the computer understand facial expressions only as it is difficult to capture emotions. Human Face Detection and Facial Expression Identification can make this interaction with more efficiency [12-16]. This type of system can also be used in research in behavioral science and medicine. This study focuses on a Zernike moments based feature extraction method with support vector machine to get better results of human facial expression identification.

Figure 2: Facial expressions challenges to detect.

Challenges in face recognition:

- Image procurement and imaging conditions: Generally, in shopper advanced imaging, face acknowledgment must battle with uncontrolled lighting conditions, huge posture varieties, outward appearances, cosmetics, changes in facial hair, maturing and fractional impediments without overlooking that the human face is anything but a one of a kind inflexible item. Additionally, in situations, for example, visual reconnaissance, recordings are frequently procured in uncontrolled circumstances or from moving cameras.

- Illumination varieties: When the picture is framed, factors, for example, lighting (spectra, source circulation and power) and camera attributes (sensor reaction and focal points) influence somewhat the presence of the human face. Light varieties can likewise do this due to skin reflectance properties and on account of the inner camera control. In structure a hearty and proficient face acknowledgment framework, the issue of lighting/enlightenment variety is viewed as one of the fundamental specialized difficulties confronting framework creators, where the essence of an individual can show up significantly extraordinary.

- Pose/perspective: The pictures of a face change on account of the relative camera face present (frontal, 45°, profile, topsy turvy), and some facial highlights, for example, the eyes or nose may turn out to be incompletely or completely impeded. Truth be told, present changes influence the acknowledgment procedure as a result of presenting projective disfigurements and self-impediment.

- Ageing and wrinkles: Aging can be normal (due to age movement) and fake (utilizing cosmetics apparatuses). In the two cases, maturing and wrinkles can seriously influence the exhibition of face

acknowledgment techniques. By and large, the impact of age variety or age factor isn't normally considered in face acknowledgment examine.

- Facial demeanor/facial style: The presence of countenances is legitimately influenced by an individual's outward appearance. Facial hair, for example, whiskers and mustache can adjust facial appearance and highlights in the lower half of the face, explicitly close to the mouth and jaw areas.

- Occlusion: Faces might be mostly impeded by different items. In a picture with a gathering of individuals, a few countenances or different articles may halfway impede different faces, which thus brings about just a little piece of the face is accessible as a rule.

II. LITERATURE SURVEY

This section discuss about the previous literature study which is performed by standard authors in latest papers.

In this paper [1] Author discuss an algorithm which is programmed identification of transient wrinkles with direct, fixed and disorderly shapes is proposed, that to a great extent comprises of edge pair coordinating, dynamic appearance model (AAM)- based wrinkle structure area and bolster vector machine (SVM)- based wrinkle order. The proposed wrinkle indicator is connected for articulation blend and an improved Poisson wrinkle mapping approach is proposed. Their methodology talked about their approach in three portion: First, the Canny edge identifier is connected to the information face, and combines of persistent wrinkle edges are recognized. Second, a functioning appearance model (AAM) is utilized to discover the majority of the applicant wrinkle lines, in which wrinkle structure around each wrinkle is built and balanced. At long last, quantitative measurements are characterized and utilized for SVM characterization to separate wrinkle areas from non-wrinkle districts. They have computed the comparison analysis using the different approach such as SIFT, LBP and HOG. Further the comparison analysis using the detection analysis parameter as wrinkle and non-wrinkle detection over image facial expression. The effect of facial alignment is left for the future remark.

In this paper [2] Author discussed about system for demeanor acknowledgment by utilizing appearance highlights of chosen facial patches. A couple of unmistakable facial patches, contingent upon the situation of facial tourist spots, are extricated which are dynamic during feeling elicitation. These dynamic patches are additionally handled to acquire the notable patches which contain discriminative highlights for characterization of each pair of articulations, consequently choosing diverse facial fixes as notable for various pair of appearance classes. One-against-one characterization strategy is embraced utilizing these highlights. Furthermore, a computerized adapting free facial milestone identification method has been proposed. The work they performed is confining the face parameter and afterward pursued by location of the milestones. An adapting free methodology is proposed in which the eyes and nose are identified in the face picture and a coarse locale of intrigue (ROI) is set apart around each. The lip and eyebrow corners are recognized from particular ROIs. Areas of dynamic patches are characterized as for the area of milestones.

Lip corner detection and finding active patches for the expression involve in computed to find exact expression detection solution.

In paper [3] author discussed the work which works with the available landmark detection and alignment errors over the facial expression detection. They have given established the fact that, appearance based models work robustly even with small alignment errors, and perform the same as that of a close to perfect alignment. Therefore, slight error in landmark detection will not hamper the purpose. Thus the accuracy with the minor error in landmark should not be affected over actual answer.

In this paper [4] they have proposed an novel approach which is Zernike moments based feature extraction method with support vector machine to identify 8 expressions (including Disgust, and Contempt) on JAFFE and Radboud faces database with discriminative multimanifold analysis technique with Single Sample Per person (SSPP) and finally compared results of Zernike with Hu moments is shown in the comparison analysis. For the image matching, they have used KNN algorithm. There are basically four steps are given in their paper which is first taking the input database image, working with face detection which detect complete face which get performed using localization, DMMA feature extraction where dividing the face into many non-overlapping section, further KNN algorithm is applied, Zernike algorithm using Zernike movement [6] is further applied on the result obtained from KNN, Finally SVM is applied for detection. Hence the multiple step find a 96.7% region accuracy. They have also discussed a neural network technique presented by another paper [5] which gives better accuracy while classifying the different nature of facial expression. While the same ANN model is also presented as Viola-Jones object detection framework and ANN by author [7].

In the paper [8] they have given two algorithm which is calculations to consequently partition the preparation tests of every facial element into a lot of subclasses, each speaking to a particular development of a similar facial segment (e.g., shut versus open eyes) or its unique situation (e.g., various hairdos). The main calculation depends on a discriminant examination definition. The subsequent calculation is an augmentation of the AdaBoost approach. They have give broad trial results utilizing still pictures and video arrangements for a sum of 3,930 pictures. They have shown the efficiency of their proposed algorithm in manual images. They have worked with the facial expression detection using Facial Feature Detection Using SubAdaBoost. Finally the proposed algorithm by the author gave an high accuracy using their combine approach.

Saman cooray, Noel O' Connor [9], has talked about to recognize frontal faces; the creator had utilized a system that joins highlight extraction and measurable face grouping. The utilization of eye facial component focuses empowers to infer a standardized pursuit space by dispensing with the prerequisite of breaking down the picture at numerous scales for identifying diverse measured countenances. Since the inquiry space is standardized, the requirement for investigating the picture at each picture pixel area is wiped out. This thusly gives a promising way to deal with facial order.

Bo WU, Haizhou AI and Chang HUANG [10], portrayed a LUT frail classifier based boosting strategy for face recovery by statistic characterization. A Haar highlight based 2D LUT-type frail classifier was produced for multi-class issues and had utilized a variety of boosting calculation for multi-class multilabel issues, Adaboost.MH to become familiar with the measurement classifiers. A model of modified measurement face recuperation system is displayed and the preliminary outcomes exhibit its conceivable outcomes in the organization of a huge facial picture database for online recuperation applications.

Ahmed Abdu Alattab, Sameem Abdul Kareem [11]: has analyzed about the blend of verbal portrayal of human face and eigen face feature achieved astonishing results in the recuperation of face picture when appeared differently in relation to recuperation by picture content that lessens the semantic opening between abnormal state question prerequisite spoken to by client verbal portrayal and low level facial highlights spoken to by picture substance highlights. Joining the two techniques for inquiry by portrayal and question by picture model, the precision of the recovery procedure is improved naturally and the required time to locate the ideal countenances is likewise limited. The thought depended on coordinating the client verbal portrayal of the question face with the explained depiction of the appearances in the database. The framework at that point utilizes eigen faces highlights for further pursuits on limited hunt space of the pruned set facial pictures, achieving more accurate results.

Table 1: Comparison analysis.

Authors	Techniques	Working	Key Features/Effects
Weicheng Xie, Linlin Shen [1]	Support vector machine (SVM)-based wrinkle classification.	Wrinkle detector is applied for expression synthesis and an improved Poisson wrinkle	The effect of facial alignment is left for the future remark.
S L Happy [2]	An automated learning-free facial landmark detection technique.	The lip and eyebrow corners are detected from respective ROIs.	Lip corner detection and finding active patches for the expression involve in computed to find exact expression detection solution.
S. W. Chew, P. Lucey [3]	Landmark detection and alignment errors over the facial expression detection.	The accuracy with the minor error in landmark should not be affected over actual answer.	Models work robustly even with small alignment errors.

Sadaf A. H. Shaikh [4]	Zernike moments based feature extraction method with support vector machine.	KNN algorithm is applied, Zernike algorithm using Zernike movement [6] is further applied on the result obtained from KNN.	Finds accuracy upto 96.7%.
Liya Ding, Aleix M. Martinez [8]	AdaBoost approach	They have worked with the facial expression detection using Facial Feature Detection Using SubAdaBoost.	Gave high accuracy using their combine approach.

In the above table 1 the comparison of the techniques along with their working is given.

III. EXPECTED OUTCOMES

Facial expression Image processing and finding the knowledge from facial multimedia is helpful in many scenario where the human skill effort can minimize at primary level while working with devices monitoring. The prediction of appropriate region, finding its suitability for detection and report analysis can be done using the image processing approach.

There are many advantage of proposed flow which help in persisting the high computation in performance parameters. The following are the core expected outcome of proposed approach:

1. Accuracy over face selection help in minimizing the time, as it need the selected area and working with the provided area features. Thus the better face detection algorithm is expected with high accuracy.
2. The proposed algorithm utilize different part segment of image and its analysis. Thus the observation of output of each stage to obtain by us. The algorithm will be working with high accuracy of expression detection with different 6 features.
3. A feature extraction data processing help in finding the desired feature by providing the input on demand.
4. A proper binaries approach and thresholding step minimize the pre-processing effort and thus saves time of usage.
5. Finally the algorithm help in overall computation and possess low computation time with high accuracy.

Thus the system presented is eligible and more enhance while comparing with traditional feature expression analysis for image classification and its registration eligibility.

IV. CONCLUSION

The main focus of this survey is to recognize the proper face images retrieval techniques where several techniques have been using several feature extraction methods as well in order to generate proper results. In this paper different face indexing techniques proposed that will effectively retrieve the face images correspondingly. Some merits as well as demerits have been proposed which helps in predicting better results and exploring new face images retrieval techniques.

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