Analysis of Lip Biometry on Handheld Operating Systems

Pavitra Kadiyala[1], Atharva Khaire[2], K.V. Shanmukhasai[3], Yuvraj Singh[4]

[1,2,3,4]*SCOPE, Vellore Institute of Technology*

---***---

Abstract - *One of the most emerging techniques of human identification is human lips recognition. The fact that lip features are unique for every individual has been confirmed by Yasuo Tsuchihasi and Kazuo Suzuki in their studies at Tokio University(1968-1971). Lip biometrics is passive biometrics i.e. no contact between the user and subject is needed. Image is acquired from a distance. Moreover, lip biometrics is anatomical. They are usually visible and are not hidden/overcast by anything. In this research, we analyze various techniques of lip biometric algorithms and their compatibility with operating systems.*

Key Words: Biometry, Operating Systems, Handheld, Lips, Clustering

1.INTRODUCTION

Biometric identification methods first started appearing in the 1800s. Alphonse Bertillon, a Perisian anthropologist, and police desk clerk developed a method for the identification of criminals, and it came to be known as Bertillonage.[16] It was a system that considered measurements of the body for classification and comparison purposes. Bertillon's system was not without fault. It relied intensely upon exact estimations yet the two individuals working on estimations for a similar individual would record different readings.

The discovery of fingerprinting proved to be flawless. It was discovered and accepted that every human being possessed a unique and unchanging fingerprint. Fingerprinting first emerged back as a form of criminal identification method in the 14th century in China but by Dr. Henry Faulds in 1880. The Henry Classification system discovered by Edward Henry was the first method of classification for fingerprint identification based on physiological characteristics. The system allows each finger a numerical value and divides the fingerprint readings into groups based on different pattern types.

A few of the biometric technologies frequently used include:

1) Fingerprint Biometrics: Fingerprint Biometric systems are known for their precise identification, thereby lowering the risks of unwanted breaches. As biometric data is different for everyone, it is near impossible to imitate or copy or duplicate another individual's data. It provides near 100 percent accuracy for authentication purposes. The biggest demerit of a fingerprint biometric system is that if somebody manages to steal your fingerprints, your prints as a form of identification will turn obsolete. There's no way of obtaining new fingerprints.

2) Retina Biometrics: A retina scan is a biometric technique that uses non-indistinguishable patterns on an individual's retina blood vessels. This method has surprisingly low(near 0) false-negative rates. No two people have the same retinal pattern. Verification of a person's identity is relatively very quick as compared to other biometric identification techniques. Demerits: The accuracy of measurements is affected by cataracts and severe astigmatism. The individual has to be very close to camera optics and thus can lead to various eye-related problems. Moreover, any cheap equipment used can lead to fatal eye damage. Hence due to the above disadvantages of different biometric methods, there is a need for a new biometric.

2. SURVEY OF LIP BIOMETRIC TECHNIQUES

We surveyed several different papers for various lip biometric and recognition techniques. They are Automatic lip contour extraction using pixel-based segmentation and piece-wise polynomial fitting, K-means clustering and Ellipse Fitting, Lip contour extraction from color images using a deformable model, Accurate and Quasi-Automatic Lip Tracking, An algorithm for the automatic extraction of thespeaker's lips in a video sequence, Algorithm for finding lip area in color face images.

2.1 Pixel Based Segmentation and Piece-Wise Fitting

Algorithm: Firstly, Region of Interest (ROI) is extracted, i.e., the mouth region, based on color ratio thresholding

followed by centrally located large, connected region detection. K-Means clustering is applied to the green plane to get the upper lip area, while the lower lip is extracted through binary K-Means clustering on a weighted plane. The combined big area is then further processed to detect centrally located big, connected regions. Robert filtering followed by similar neighbor transversing is employed to estimate the lip contour. A smooth upper and lower contour are obtained by varying piecewise polynomial fitting.[1]

Advantages: can classify lip and non-lip regions effectively using color discrimination information.

Limitations: However, due to variations like noise, teeth, facial hair, tongue, etc., not easy to detect lip information accurately. This is because of the difficulty in finding the Region of Interest.

2.2 K-Means and Ellipse Fitting

Advantages: The earlier K-Means have been tried out and results were not satisfactory as the number of clusters had to be determined manually, which were affected by many factors, such as -visibility of teeth, facial hair, etc. This approach[2] is different as it uses K-Means with an automatic adaptive number of clusters, whose performance and accuracy are improved by the use of nearest neighbor segmentation. Moreover, for mouth corners (where the color is darker), a corner detector is used for fine-tuning.

Challenges in this algorithm: large variations are caused by a high level of deformable lips, different lip color tones, different light conditions, the appearance of teeth and tongue, presence/absence of facial hair.

2.3 A Deformable Model

They used visual information of the lips along with audio, which helped increase the accuracy of speech recognition systems. This paper[3] proposes a region-based lip contour extraction algorithm based on a deformable model-based approach to lip contour extraction. It employs a stochastic cost function to partition a color lip image into the lip and non-lip regions such that the joint probability of the two regions is maximized. The paper shows the optimization of the cost function can be done in a continuous setting, given a discrete probability map generated by spatial fuzzy clustering.

Advantages: The advantage of region-based clustering is that it makes the algorithm more adaptive to noise in the image. It also allows larger regions of attraction, hence making the algorithm less sensitive to initial and parameter settings.

2.4 Quasi-Automatic Technique

Algorithm: Initially, the upper mouth boundary and several characteristic points are detected in the initial frame by using an active contour: the "jumping snake." Unlike other snakes, this can be initialized far from the final edge and the adjustment of its parameters is easy and intuitive. This paper[4] Proposes a parametric model composed of several cubic curves.

Advantages: It is highly flexible which enables accurate lip contour extraction even in the challenging case of a very asymmetric mouth. Compared to existing models, it brings a significant improvement in accuracy and realism.

2.5 Automatic Extraction in a Video Sequence

The method[5] uses spatial (region and contour) and temporal (similarity function) information from Luminance and Huc components. It is kind of the inverse of the active contour's stiffness matrix is introduced.

Advantages: This ensures a faster and accurate convergence of active contours towards lips boundaries. The use of the Kanade-Lucas tracking algorithm with the point extraction method leads to an automatic, fast, and robust initialization of snakes. The significant robustness enhancement and decrease in related computational cost allow a better real-time approach for processing.

2.6 In Colour Images

Algorithm: Crop the lower part of the face area from the input image. Highlight the lip area using by proposing a modified Lip-Map algorithm. After noise reduction from the wavelet transform. Then, not all skin pixels are removed. Only the skin pixels away from the lip areas are removed. Top Hat transform and region growing algorithm is then used to separate the lip pixels from skin pixels. The algorithm uses YCbCr color space.

Uniqueness: The algorithm[6] selects the proper saturation component and color space for better separation between skin pixels and lip pixels. Experimental results showed that the algorithm has high performance as compared to other works on the same databases and has higher accuracy.

3. HANDHELD OPERATING SYSTEMS

Handheld operating systems are planned and customized to run on machines having low-speed processors and very low memory. They are extraordinarily improved to run utilizing less memory and utilize fewer assets. Besides, they additionally intended to work in relationships with various types of equipment than standard operating systems. This was done to meet the force prerequisites of standard CPUs and memory as they significantly surpass the force necessities of handheld gadgets. Handheld gadgets can't disperse substantial amounts of warmth produced by CPUs all things considered. To manage this, organizations like Motorola, Intel, and so forth have created more modest CPUs with far fewer force needs and low warmth dispersal.

Since the innovative work of handheld systems during the 1990s, the prerequisite for programming to work and their execution on these gadgets has significantly expanded. Three significant organizations have arisen in the handheld PC world with three novels OS for these handheld PCs. One of the main organizations was the Palm Corporation who approached PalmOS. Microsoft likewise delivered what initially was alluded to as Windows CE. Microsoft's as of late delivered operating systems for handheld PCs are currently known under the name of PocketPC. As of late, a couple of organizations creating handheld PCs have now begun delivering a handheld adaptation of the Linux OS on their gadgets.

Types of Handheld OS

3.1 Palm OS
Since the dispatch of the first-historically speaking Palm Pilot in 1996, the Palm OS stage has provided cell phones with helpful business instruments, just as the capacity to get to a focal information base or the Internet through a remote association. Palm gadgets have consistently focused on giving essential individual data to the board applications. The most recent items created by Palm, in any case, have dominated far past that, giving more stockpiling, extension abilities,

remote Internet association, and surprisingly computerized cameras.

3.2 Symbian OS

The Symbian OS was expanding until it got enormous thumps from Sony Ericsson and Nokia. Presently it's one of the surprisingly strong contenders in this confounded handheld OS race. Symbian OS has become an essential OS for cell phones and has been authorized by 85% of the world's handset makers. The Symbian OS is made to meet the necessities of 2.5G and 3G cell phones.[19]

3.3 Pocket PC
Microsoft's advantage is its dominance among desktop operating systems. Pocket PC handhelds have leverage over Microsoft by designing familiar applications such as Pocket Excel, Pocket Word, and over Pocket Internet Explorer.

3.4 Linux OS
The primary organization to dispatch telephones with Linux as its OS was Motorola in 2003. Linux is viewed as a reasonable choice for better quality telephones with ground-breaking processors and bigger measures of memory. The working framework (OS) transfers directions from an application to, for example, the PC's processor. The processor plays out the trained undertaking, at that point sends the outcomes back to the application through the working framework.

3.5 Android
Android is the world's most famous working framework for cell phones and tablets. It is an open-source working framework, made by Google, and accessible to a wide range of designers with different aptitude levels, running from newbie to proficient. From a designer's point of view, Android is a Linux-based working framework for cell phones and tablets. It incorporates a touch screen UI, gadgets, camera, arranges information checking, and the various highlights that empower wireless to be known as a cell phone.

Android is a stage that supports different applications, accessible through the Android Play Store. The Android stage additionally permits end clients to create, introduce and utilize their applications over the Android system. The Android system is authorized under the Apache License. Designers of the Android

application hold the privilege to disseminate their applications under their permit.

4. BIOMETRICS IN OPERATING SYSTEMS

4.1 Windows

With Windows Hello, there are two kinds of biometric acknowledgment through cameras: iris and facial. The facial acknowledgment side of Windows Hello works by skirting infrared (IR) light off your face and lifting it with a camera. A picture of your face is then thought about against the one that is put away on your PC. If they match, you're signed in. The iris filtering side — broadly found in the Lumia 950, 950 XL, and HP Elite x3 — rather snaps a photo of your iris and thinks about it to one put away in your gadget.

Windows Hello facial affirmation ends some mimicking appreciation to the IR camera. Printed and computerized pictures don't show up in the IR camera, so it would take more to move beyond the innovation. Keep in mind any door is penetrable to somebody with the means and time to break it.

4.2 IOS

Apple's framework is designated "TrueDepth," and it is like what Intel has made with RealSense. TrueDepth shoots out around 30,000 IR lights (microscopic spots that are concealed by the natural eye) onto your face that is then gotten by the IR camera. The lights (or dabs) are handled by Apple's A11 Bionic Neural Engine, which is a framework separate from the primary processor.[18] A matrix dependent all over's 3D shape is framed, and just somebody with a similar network can sign into the iPhone. This TrueDepth framework is required to kill a portion of the issues we've found previously, where you can overcome facial acknowledgment shields. Apple expects Face ID will even venture to such an extreme as keeping away from the route from reproduced 3D models of countenances. Phil Schiller, senior VP of overall showcasing at Apple, said in the feature discourse that Hollywood cosmetics specialists were gotten to test whether proficient 3D entertainments of appearances would trick FaceID. (It's intriguing to take note that Schiller didn't say whether Face ID was tricked by these fake countenances).

5. LIP BIOMETRIC ON OPERATING SYSTEMS

Specialists at Florida State University have built up a path for cell phones to peruse client's lip signals with sonar, empowering the motions to be utilized as an aliveness location framework to defeat replay assaults.

The framework, which the specialists call VoiceGesture, utilizes the telephone's speaker to transmit a high-recurrence sound, which is reflected by the receiver as the client says their secret word. It doesn't require and extra equipment and can be coordinated into existing cell phone working frameworks and portable applications to verify logins.

Utilizing articulatory signals to verify alongside their voice maintains a strategic distance from the danger of mocking assaults completed utilizing tests sound and video from promptly accessible sources like web-based life. The exploration was done utilizing the Samsung Note 5, Note 3, and Galaxy S5 cell phones. "Our exploratory assessment with 21 members and various kinds of telephones shows that it accomplishes over 99 location exactness at around 1 percent Equal Error Rate (EER)," study writers Linghan Zhang, Sheng Tan, and Jie Yang compose. "Results additionally show that it is vigorous to various telephone positions and can work with various testing frequencies."

Yang revealed to Digital Trends that Google is presently looking into the strategy, and the analysts intend to take it to other cell phone makers, including Samsung and Huawei. As recently revealed, University of Michigan scientists as of late declared the advancement of a method to utilize wearables to alleviate voice confirmation vulnerabilities.

ClassifEye and Omran created face acknowledgment innovation in camera-empowered cell phones. The benefit of this system is that it doesn't require introducing any extra equipment or programming since cameras as of now exist in many telephones today. The base camera goals ought to be 100,000 Pixels.

Lip Passwords offer various focal points over progressively ordinary biometric security strategies. Top of the rundown is the alternative to change the secret word the same number of times as you wish. Since confirmation is done against lip development, it's conceivable to over and over record new lip developments and reset the Lip Password. They are

likewise autonomous of language, which means they will work worldwide and can even be arranged to utilize lip developments that don't bode well as words.

Another advantage is the capacity to consolidate a Lip Password with another strategy for biometric verification. The Lip Password requires a camera, so it is anything but difficult to consolidate the framework with facial acknowledgment. Access would then possibly be conceded if the face was perceived, and the lip design coordinated.

Indeed, even alone, Lip Passwords are extraordinarily hard to bypass. Everybody's lip designs are interesting for each expressed word which someone else can't copy. Regardless of whether somebody observes you talking your Lip Password, they would not have the option to state it themselves and access your record/framework. Add to that the capacity to change your Lip Password whenever and the security focal points of this biometric validation arrangement are clear.

Since it doesn't generally make a difference on the off chance that somebody hears your Lip Password, it very well may be utilized anyplace. Just as allowing access to any camera-prepared workstation, cell phone, or tablet, there's nothing to stop mix with ATMs or in any event, utilizing them as installment confirmation in retail locations.

Hong Kong Baptist University (HKBU) specialists had built up a lip movement secret word for biometric use. The innovation watches an individual's lips to pick up security approval, since a client may have explicit movements attached to a specific expression.

6. LIPS AS A BIOMETRIC: AN OVERVIEW

As indicated by HKBU, this framework can verify a client's personality by coordinating the secret key substance with "the fundamental conduct qualities of lip development." Matching the speaker is done through preparing a man-made brainpower calculation. Lip shape, surface, and movement are altogether utilized as information in the preparation procedure.

Scientists figure this technique for confirmation may have a major bit of leeway over exemplary biometric sensors. If a biometric sensor-created secret expression is sabotaged, the mysterious key age system

itself is never again as secure since something like fingerprints can't be revived or changed.

Nonetheless, with the lip movement secret word, another practical secret word can be created essentially by saying an alternate expression. Extra security advantages to executing this sort of biometric security incorporate voice-based confirmation without foundation clamor impedance, the low pace of mimicry or secret phrase falsification, and a nonexistent language hindrance for worldwide use.

Educator Cheung Yiu-ming, who drove the exploration, clarified that "a similar secret phrase spoken by two people is extraordinary, and a learning framework can recognize them." How a considerable amount of differentiation was truly found by the learning system was not communicated, yet it is enough to get around a fundamental mimicry attack.

7. IMPROVING LIP BIOMETRIC AUTHENTICATION

Bleeping Computer noticed that utilization of lip passwords can be practically difficult to break. Since the lip movement in the entirety of the verification endeavors would need to originate from a similar face to be validated, it would more likely than not crush any noxious assault.

Different sorts of assaults were not tended to by HKBU. Recording a client while setting a lip secret word would give the assailant the two pieces of the information expected to trick a verification guard, for instance. Additionally, a man-in-the-center assault could hang tight for a creating event to remotely occur, at that point record the sound and video yield for later use.

HBKU said that the strategy, that got a U.S. patent in 2015, will discover utilizes in electronic installment circumstances utilizing cell phones, ATM exchanges, and as an additional layer to Mastercard passwords.[17]

8. CONCLUSIONS

Lip biometrics is still an upcoming form of biometric. It is a good form of biometric as no touch is needed and the biometric is scanned from a distance. It could be slowly integrated with all devices in the coming future. We can use various Artificial Intelligence Techniques for extracting and detecting lips.

REFERENCES

[1]   Sukesh Kumar Das, Salam Nandakishor and Debadatta Pati; Automatic lip contour extraction using pixel-based segmentation and piece-wise polynomial fitting; 2017 14th IEEE India Council International Conference (INDICON)

[2]   Bhuvan Singh, Swodeep Sahoo, Vikul Kumar, Ashish Issac, Malay Kishore Dutta; Improved Lip Contour Extraction using K-Means Clustering and Ellipse Fitting; 2016 2nd International Conference on Communication Control and Intelligent Systems (CCIS)

[3]   Alan Wee-Chung Liew, Shu Hung Leung, Wing Hong Lau; Lip contour extraction from color images using a deformable model; Proceedings 2000 International Conference on Image Processing (Cat. No.00CH37101)

[4]   Nicolas Eveno, Alice Caplier, and Pierre-Yves Coulon; Accurate and Quasi-Automatic Lip Tracking; IEEE Transactions on Circuits and Systems for Video Technology (Volume: 14 , Issue: 5 , May 2004)

[5]   Michał Choras; The lip as a biometric; Pattern Analysis and ApplicationsFebruary 2010, Volume 13, Issue 1, pp 105–112

[6]   Evangelos Skodras and Nikolaos Fakotakis; AN UNCONSTRAINED METHOD FOR LIP DETECTION IN COLOR IMAGES; 2011 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)

[7]   Behrooz Zali-Vargahan, Hashem Kalbkhani, and Mahrokh G. Shayesteh; An Efficient Algorithm for Lip Detection in Color Face Images; 2013 21st Iranian Conference on Electrical Engineering (ICEE)

[8]   Sambit Bakshi∗, Rahul Raman† and Pankaj K Sa†; Lip Pattern Recognition based on Local Feature Extraction; 2011 Annual IEEE India Conference

[9]   Yiu-ming Cheung, Senior Member, IEEE, Meng Li, Xiaochun Cao, and Xinge You; Lip Segmentation under MAP-MRF Framework with Automatic Selection of Local Observation Scale and Number of Segments; IEEE Transactions on Image Processing (Volume: 23 , Issue: 8 , Aug. 2014)

[10] A.W.-C. Liew, S.H. Leung and W.H. Lau; Region-based approach to robust lip contour Extraction; Electronics Letters (Volume: 36 , Issue: 15 , 20 Jul 2000)

[11] Binh T. H. Nguyen, Tran Vu Hieu, Bui Ngoc Dung; Robust Lip Feature Detection in Facial Images; 2017 13th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery (ICNC-FSKD)

[12] Jongju Shin, Bongjin Jun, Daijin Kim; Robust Two-Stage Lip Tracker; 2009 IEEE International Symposium on Signal Processing and Information Technology (ISSPIT)

[13] Alan Wee-Chung Liew, Member, IEEE, Shu Hung Leung, Member, IEEE, and Wing Hong Lau, Member, IEEE; Segmentation of Color Lip Images by Spatial Fuzzy Clustering; IEEE Transactions on Fuzzy Systems (Volume: 11 , Issue: 4 , Aug. 2003)

[14] M. Ulises Ramos Sa'nchez, JiFi Matas, Josef Kittler; STATISTICAL CHROMATICITY-BASED LIP TRACKING WITH B-SPLINES; 1997 IEEE International Conference on Acoustics, Speech, and Signal Processing.

[15] Patrice Delmas, Nicolas Eveno, Marc Lievin; Towards Robust Lip Tracking; Object recognition supported by user interaction for service robots.

[16] Biometrics - History (globalsecurity.org)

[17] Pucker Up: Lips Can Now Provide Biometric Authentication (securityintelligence.com)

[18] How Apple's new Face ID compares to Microsoft's Windows Hello | Windows Central

[19] Different types of Operating systems in Mobiles (geekyard.com)