Face Smile Detection and Cavernous Biometric Prediction using Perceptual User Interfaces (PUIs)

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Abstract: Face identification and biometric analytics is a modern domain of study and enormous algorithms in this aspect. Perceptual interface can be described as: highly immersive, multi - modal interfaces focused on normal human-to - human interactions, with the purpose of allowing users to communicate with software in a similar way to how they communicate with one another and the physical environment. It is nowadays quite effectual in face smile detection. Smile detection is a two-stage process. First you feel a face and then wait for a grin and in thousands of zones a motion detector splits the clip, Analyzing criteria like auto focus and facial flash level. When a human smile, the camera identifies a facial defect by identifying various parameters, It involves shutting your eyes, making your teeth transparent, folding your mouth, and lifting your lips. You should adjust the camera parameters to increase the sensitivity of the Smile automatic feature. When participants (with bangs, etc.) do not cover their faces, especially their eyes, authentic smile recognition is more successful. Helmets, masks or sunglasses can also be obstructed. For your subjects, you should have a wide and open-mouthed smile. When the teeth are open and clear, the camera can even detect a smile better. The presented work focuses on analytics of face smile through Perceptual User Interfaces in biometric analytics for cumulative results.

1 INTRODUCTION

Graphical user interfaces have long been the dominant medium for human-computer interaction (GUIs). The GUI style has refined the usage of devices and promoted the use of computers, particularly for business software purposes which machines have been used to perform tasks. Therefore, the approach we use machines changes but more widespread computing, in GUIs, the graphical interfaces needed to fulfil our users' needs are not directly given.

It seems that identifying real and false emotion on the human face is one of the toughest activities for the brain once. The vision system of humans has a remarkable capacity to distinguish a person's genuine and false smile. Nevertheless, our brain is still not talented enough to discern it clearly countless times. But how does a computer vision system distinguish between real and false feelings? For such questions, there is no suitable reply to date. Nevertheless, in order to find solutions to such difficult problems to some degree, quite a few computer techniques have been shown. In order to make these things understandable, a well-known French physician called Guillaume Duchenne from the 19th century reserved the primary challenge to differentiate genuine and false smile based on the muscles involved in producing facial expressions (BRASOV, 2018). In this research we are using focuses on the face smiles analysis of biometric analytics with the PUIs for cumulative results.

2 PROPOSED SYSTEM

2.1 Perceptual User Interface (PUI) and Biometric Traits

A perceptual design enables a user to communicate with the device without utilizing the usual desktop

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computer. This interface was realized by allowing the device to recognize user gestures or voice control.

Table 1: The PUI is having enormous components and module in which a number of segments are analyzed.

Conceptual User Interface	Perceptual User Interface
System Key Functions for the Interaction and Response. Manipulation by the User.	Response of System similar to Human. Human to Human like Intelligent Interface.

2.2 Head Orientation

For certain visually impaired individuals, machines are an important tool for connectivity, environmental protection, schooling, and entertainment. Even so, a person's impairment can make getting to the machine harder. We aim to establish full advantage by monitoring three noncolinear facial characteristics, e.g., eyes and nose. Since we know the relative positions of the features when the consumer stares straight only at screen, we will estimate shifts in head orientation if we know immediate locations of the features. This differential direction may be used to guide the cursor.

2.3 Gesture Input

In this section, we examined ways of manipulating the cursor direction through head motions, primarily through monitoring the nose: as you look upwards, the nose travels upwards and the cursor follows.

To do this, we must find the nostrils. This is rendered possible by first finding the mask, then two nearby dark areas. Locating facial colored pixels will find the facial.

Face color is determined by environmental illuminating and skin pigmentation. Fortunately, the change of skin color attributable to discrepancies of pigmentation is reasonably minimal, but if we can accommodate changes induced by discrepancies in light, we should be able to distinguish potential skin pixels.

Several color normalization approaches were proposed. The easiest is to have the red, green, and blue components identical. A much more complicated approach, but one that may provide better outcomes, is to use log-opponent representation, as Fleck and Forsyth say. We preferred uniform red and green as this is computationally cheaper.

The following photos display intermediate outcomes while analyzing details.

Figure 1: Analytics of Face Smile for Evaluations.

A bounding box on the input image will be displayed in the final picture. There are also two crosses that indicate where the nostrils are situated. The average position for cursor driving is tracked.
With modest hardware, we were able to achieve acceptable frame rates. This tracker will be integrated into a regular function system in the next stages of this research.

2.4 Gesture Analytics

We want a number of gestures to replace the mouse. In order to work on applications without the mouse to specifically, we would like to reduce the points as well as click and point that drag operations. They want a picture series to find and map the fingertip. We'd like to infer what the consumer means. Magi display intermediate effects while analyzing details. This role requires evaluating the text the consumer performs.

2.5 Analysis Patterns for Face Smile and Biometric using PUI

We must switch to normal, automatic, responsive and unobtrusive interfaces to respond to a wider range of situations, positions, users and tastes. A latest MCI concentrate, (Perceptual User Interfaces PUIs), aims to make interactions among people and devices more like interactions through people and the environment. (El Haddad, 2016).

This chapter talks about the changing PUI domain and concentrates on the segments of PUI Computer-based vision policies that view applicable user information visually (Vyshagh and Vishnu).

Figure 2: Key Segments in PUIs.

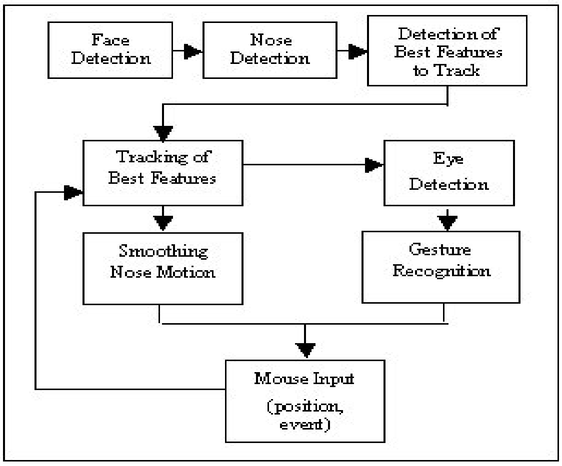


Figure 3: Integration of Face Detection with Assorted Segments.

Graphical user interfaces have been the main tool for human-computer interaction (GUIs). Computers were streamlined and simplified by the GUI-based interaction style, especially for business software requirements where computers have been used for particular tasks (Phung, 2017). However, as computation advances and computing become more ubiquitous, (GUIs) can't comfortably meet the diversity of experiences expected to meet the needs of your users. We need to switch to standard, automated, versatile and discreet interfaces to accommodate a greater range of situations, responsibilities, users and interests (Au, 2020). HCI's target is to make human-computer experiences more analogous to the way humans communicate for one another and with the world, called perceptual user interfaces (PUIs). This article describes the emerging PUI field and focused on three main (PUI) tasks: computer- based vision strategies to demonstrate consumer awareness (Song, 2018).

There is no Moore law for user interfaces. Communication between humans and robots has not dramatically changed for nearly two decades. Most users may connect by sort, point, and click their computers. Most HCI work in previous decades has been built to make interactive user interface users to track and detect directly (Rizzo, 2016). These properties will provide consumer with a basic model about what commands and actions are possibly and what their effects may be; they enable users would be conscious of total and taking charge of interaction with software solutions.

Although these attempts were common, their WIMP (Windows, buttons, menu, pointer) paradigm was a reliable global system face, Obviously, this paradigm would not work into different machine shapes and uses in the future. Computers are becoming smaller and more common, and their encounters with our daily life is becoming much significant. Large displays are becoming more popular simultaneously, and we are beginning to see a convergence of computers and television. (El Haddad). It is very important to connect with technology in a more public and conjectural way in all situations. Shortly, the way most people interact with many computing facilities will not be as they display, select and type, though still beneficial for many computers' solutions (Najm, 2019).

What we need are networking approaches that are well matched to how humans use computers. It does not match anything from lightweight, portable appliances to powerful machines installed into homes, factories and automobiles. Will the nature of such complex future HCI specifications exist? We assume that it exists and that it is based on the connection between the people and the natural universe. PUIs are defined by interaction techniques incorporating an awareness of human natural abilities (necessary to conduct a range, motor, mental and perceptual ability). Using the contexts in which individuals communicate verbally with each other and the environment, the consumer interface is more normal and compulsive. Sensors must be clear and passive with the software, and computers have to interpret appropriate human communication networks and produce a naturally known output. This will include technological integration at various levels, including speech and acoustic synthesis and generation, computer vision, graphic design, simulation, language interpretation, sensing and suggestions dependent on touch (haptics), device modelling, conversation and listening (De Oliveira, 2018; Oday A., 2017).

The figure below illustrates how research in various fields requires PUI. Since the figure shows the transfer of information within a traditional machine form factor, PUI is also meant for new form factors.

A perceptive user interface applies human sensing skills to the device, such as reminding the computer of the user's vocabulary or the user's face, body, hands... Some interfaces use the input PC while communicating between people, and engines are used. (Taskirar, 2019).

Multimodal UI has strong links that underline human communication skills. We use different modalities that result in better contact as we engage in face-to-face interaction. Much of the MUI function concentrated on device inputs (for instance, by speaking with pen-based gestures). The multimodal performance uses multiple ways to interpret what is viewed by individuals using auditory, cognitive, and communication abilities, including visual presentation, audio, and tactile feelings. In multimodal user interfaces, various modalities are sometimes used separately or even concurrently or closely related. (Oday A., 2017; Ryu, 2017).

Multimedia UI, that has undergone tremendous study throughout the past two decades, utilizes perceptual abilities to understand the user's details. Normal media is text, graphics, audio or video. Multimedia study focuses on media, multimodal study on human sensory sources. Multimedia review is a multimodal branch of output testing from that angle.

PUI incorporates perceptive, multi - modal, with multimedia interfaces to bear on developing more natural, responsive interfaces. PUIs can improve the usage of machines as instruments or equipment, improving GUI-based software explicitly, for example, through taking into account motions, voice, and eye gaze ('No, that'). Maybe more significantly, these emerging developments would allow computers to be widely used as assistants or agents who communicate in more humane ways. Perceptual interfaces would enable various input modes, including such speech alone, speech and motion, text and contact, vision and synthetic voice, any of which could be suitable in different situations, be it web applications, hands-free phones or embedded household structures (Ugail, 2019; Ansaf, 2019; Azez, 2018).

Pentland advocates sensory intelligence as essential to interfacing with potential generations of machines; it identifies two classes of responsive sensor-based environments and technology expected to help them. latest investigation about computer-based sensing and interpretation of human behavior in particular vision areas. They offer a wide view of the field and explain two initiatives that, using visual experiences, improve graphical interfaces. Reeves and Nass discuss the criteria for a deeper understanding of human cognition and psychological in conjunction with technology interaction, and their studies concentrate on human beings. Additional knowledge on unique Perceptual User Interface domains, that is haptic and computational effects (Hassena, 2019).

Figure 4: Channel based Face Analytics.

A device able to recognize or verify an individual from a digital picture or video source is a technology. Many processes function, however overall, by comparing a specified image's chosen facial features with faces in a database. Different facial recognition technologies exist. The program, which can recognize an individual by analyzing patterns based on facial structure and form, is also identified as biometric artificial intelligence.

In the past, it has seen broader applications of mobile platforms and other aspects of technology including robots, though initially a computer program. Currently used in access management authentication schemes, it can be contrasted with some other biometrics such as facial patterns system (Ugail, 2019; Hassen, 2017).

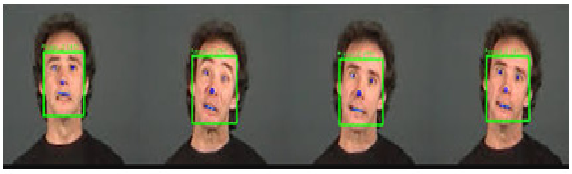
3 RESULT AND DISCUSSION

Expression monitors are used in several industries, like newspapers, one is the advertising business, where it is essential for businesses to evaluate the market response to their goods. Here we create an OpenCV smile detector that receives web cam feed. There are several simpler approaches to incorporate our ideal smile / happiness detector.

Phase # 1: First, we must import OpenCV library.
Importing cv2
Move # 2: Include hair-cascades.
Hair-cascades are classifiers that used detect features (in this case face-to - face) through superimposing measures or procedures over facial segments and utilizing them as XML data. In our template, we can use haar-cascades profile, eye and smile to be inserted in the working directory after installing.
The requisite hair-cascades were found here.
Face Cascade=.CascadeClassifier('haarcascade default.xml)
CascadeClassifier('haarcascade eye.xml)
= .CascadeClassifier('haarcascade smile.xml)
Phase 3: Step 3
At this point, to detect the grin, we will enhance the main function.
Frame by frame from the webcam/vid unit for the live stream is analyzed. Where hair-cascades work more effectively on it, we consider the grey image.

We make use of the following to detect the face:

```
Faces = Face MultiScale(gray, 1.3, 5)
Detection(gray, frame):
Face = MultiScale Face(gray, 1.3, 5)
For face(x, y, w, h):
Rectangle(frame,(x, y),(x+w),(y+h)),(255,0,0),(2)
Roi gray = gray[y+h, x: x+w]
Roi color = frame[y+h, x: x+w]
Smile cascade.detectMultiScale(1.8, 20)
Smiles (sx, sy, sw, sh):
Computervision2.rectangle(roi color,(sx + sw),(sy + sh),(0, 0, 255), 2)
Return photo
Vid capture = PC2.VidCapture(0)
Whereas True:
# Captures frame vid capture
, vid capture.read)
# Capture monochrome image
Gray = computerview2.computerviewtColor(frame, computerview2.COLOR BGR2GRAY)
# Calls feature detect)
Canvas = detect(gray)
# Shows camera feed data
Computerview2.imshow('Vid, 'canvas)
# Regulation breaks when q is pushed
Where computervision2.waitKey(1) & 0xff==ord('q'):
Breakdown
# Unlock capture during all testing.
Vid capture.release) (Release)
Computerview2.destroyAllWindows)
```



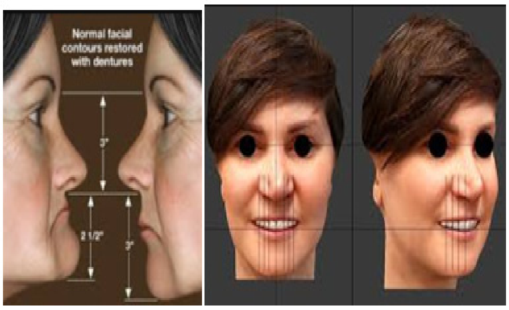


Figure 5: PUI with Face Smile Predictions.

Table 2: Evaluation Analytics.

Category (Class) Label	Accuracy (%)	Specificity (%)	Precision (%)	Sensitivity (%)
0	95	69	77	84
1	93	66	79	85
2	95	65	81	87
3	93	69	81	81
4	97	64	94	79

The figure 6 shows the different categories specificity, sensitivity, precision and accuracy.

PP = Truly Identified Positive data points

NF = Falsely Identified Negative data points

PF = Falsely Identified positive data points

NP = Truly Identified negative data points

$$Sensitivity = PP / PP+PF \quad (1)$$

$$Specificity = NP / NP+NF \quad (2)$$

$$Precision = PP / PP+NF \quad (3)$$

$$Accuracy = PP+NP / PP+NP+NF +PF \quad (4)$$

The new MCI focus, recognized as PUIs, aims to make the interaction between individuals more like people's contact with the environment. In either case, we concentrate on PUI and PUI motivated projects emerging field: computer-based graphics techniques for the visual thoughts of individual user awareness.

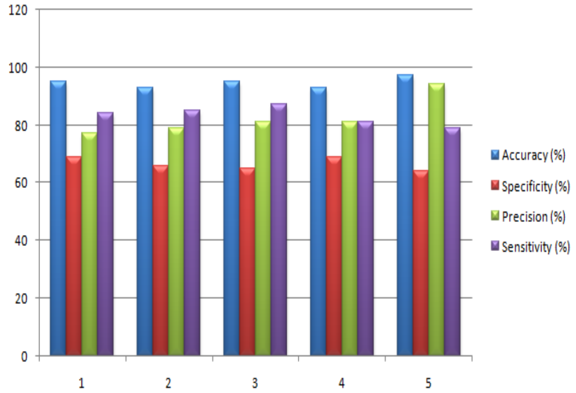


Figure 6: Assorted Patterns on Specificity, Sensitivity, Precision and Accuracy.

4 CONCLUSION AND FUTURE DIRECTION

While the precision of the face recognition method as a biometric system is below iris recognition and fingerprint recognition, it is commonly believed due to non-invasive, contactless operation. Also, famous recently as a method for commercial recognition and promotion.

Integrating Perceptual User Interfaces and associated dimensions with meta-heuristics will give biometric analytics a higher degree of precision and efficiency on several aspects. Our experiment has provided the best results so far and still we can improve accuracy if we can train networks with real and fake databases and also in future work, we are planning to present an effective approach for detecting smiles in the wild with deep learning. Deep learning can effectively integrate feature learning and classification into a single model, unlike previous work that extracted hand-crafted features from face images and trained a classifier to perform smile recognition in a two-step approach.

REFERENCES

El Haddad, K., Cakmak, H., Dupont, S., & Dutoit, T. (2016). Laughter and smile processing for human-computer interactions. Just talking-casual talk among humans and machines, Portoroz, Slovenia, 23-28.

Vyshagh, A., & Vishnu, K. S. Study on Different Approaches for Head Movement Deduction.

Phung, H., Hoang, P. T., Nguyen, C. T., Nguyen, T. D., Jung, H., Kim, U., & Choi, H. R. (2017, September). Interactive haptic display based on soft actuator and soft sensor. In 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 886-891). IEEE.

Au, P. K. (2020). An application of FEATS scoring system in Draw-A Person-in-the-Rain (DAPR): Distinguishing depression, anxiety, and stress by projective drawing (Doctoral dissertation, Hong Kong: Hong Kong Shue Yan University).

Song, B., & Zhang, L. (2018, July). Research on Interactive Perceptual Wearable Equipment Based on Conditional Random Field Mining Algorithm. In 2018 International Conference on Information Systems and Computer Aided Education (ICISCAE) (pp. 164-168). IEEE.

Rizzo, Albert, et al. "Detection and computational analysis of psychological signals using a virtual human interviewing agent." *Journal of Pain Management* 9.3 (2016): 311-321.

Najm, Hayder, Hayder Ansaf, and Oday A. Hassen. "An Effective Implementation of Face Recognition Using Deep Convolutional Network." Journal of Southwest Jiaotong University 54.5 (2019).

El Haddad, K., Cakmak, H., Doumit, M., Pironkov, G., & Ayvaz, U. Social Communicative Events in Human Computer Interactions.

De Oliveira, C. C. (2018). Experience Programming: an exploration of hybrid tangible-virtual block based programming interaction.

Oday A. Hassen, "Face smile and related dimension analysis using deep learning", International Journal of Enterprise Computing and Business Systems(IJECBS), vol. 7, issue, 2, pp:1-13, 2017.

Taskirar, M., Killioglu, M., Kahraman, N., & Erdem, C. E. (2019, July). Face Recognition Using Dynamic Features Extracted from Smile Videos. In 2019 IEEE International Symposium on INnovations in Intelligent SysTems and Applications (INISTA) (pp. 1-6). IEEE.

Ryu, H. J., Mitchell, M., & Adam, H. (2017). Improving smiling detection with race and gender diversity. arXiv preprint arXiv:1712.00193, 1(2), 7.

Ugail, H., & Aldahoud, A. A. A. (2019). The Biometric Characteriztics of a Smile. In Computational Techniques for Human Smile Analysis (pp. 47-56). Springer, Cham.

Ansaf, H., Najm, H., Atiyah, J. M., & Hassen, O. A. Improved Approach for Identification of Real and Fake Smile using Chaos Theory and Principal Component Analysis. Journal of Southwest Jiaotong University, 54,5,(2019).

Hassena, Oday A., Nur Azman Abub, and Z. Zainal Abidinc. "Human Identification System: A Review." International Journal of Computing and Business Research (IJCBR), Vol. 9. Issue 3, pp. 1-26, September 2019.

Hassen, Oday A., and Nur Azman Abo. "HAAR: An Effectual Approach for Evaluation and Predictions of Face Smile Detection." International Journal of Computing and Business Research (IJCBR) 7.2 (2017): 1-8.

Hayder Najm, Haider K. Hoomod, Rehab Hassan, "Intelligent Internet of Everything (IOE) Data Collection for Health Care Monitor System ",

International Journal of Advanced Science and Technology, Vol. 29, No. 4, 2020.
Hayder Najm, Haider K. Hoomod, Rehab Hassan, "A proposed hybrid cryptography algorithm based on GOST and salsa20", Periodicals of Engineering and Natural Sciences,Vol 8, No 3, 2020.
Mahdi, Mohammed Salih, and Nidaa Falih Hassan. "A Proposed Lossy Image Compression based on Multiplication Table." Kurdistan Journal of Applied Research 2.3 (2017): 98-102.
Azez, H. H., Ansaf, H. S. H., & Abdul-Hassan, H. A. (2018). Secured Energy Aware Projected 5G Network Architecture for Cumulative Performance in Advance Wireless Technologies. *International Journal of Engineering & Technology*, *7*(4.17), 53-56.
Brasov, O. F. Proceeding of the IVth Balkan Congress of History of Medicine. *Bulletin of the Transilvania University of Brasov• Vol*, 2009, 6.
Khalaf, Mahdi, et al. "Schema Matching Using Word-level Clustering for Integrating Universities' Courses." 2020 2nd Al-Noor International Conference for Science and Technology (NICST). IEEE, 2020.
Najm, Hayder, Haider Hoomod, and Rehab Hassan. "A New WoT Cryptography Algorithm Based on GOST and Novel 5d Chaotic System." (2021): 184-199.