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Design and Experimentation of Face liveliness Detection using Temperature Gradient and Image Quality Assessment

Betty P, Mohana Geetha D

Abstract: ***Face recognition system has gained its importance as the digital imaging has received its growth. Since most of the handheld devices like mobile phone, tablet, laptop etc. have preinstalled digital cameras, it has become the easiest way of authentication. Due to the extensive usage of biometric as a measure of authentication, the proper feature transformation with improved security is to be established. For any biometric system to be robust, the genuineness of the input and the proper storage of the same . Liveliness detection using temperature gradient of the input samples with DNA codec based transformation is proposed in this paper. This methodology proven to be computationally worth when compared with the state of art techniques***

Keywords **: *Biometrics, Data Security, Face Liveliness***

I. INTRODUCTION

The feature transformation methods of biometric template protection is majorly classified as salting based techniques and and Non- Invertible transform based methods[1]. There are many methods adopted in the previous studies to experiment feature transformation. The biometric templates are represented as real or binary vector in case of vector based techniques[2][3]. the other techniques based on steganography [4].The liveliness detection in face recognition were researched over many years in two major categories. Intrusive system and Non Intrusive system. In the Intrusive system the user has to perform a particular activity in order to verify his identity. Where in the non intrusive system, there is no user intervention. Intrusive system may sound effective, but its is practically impossible to deal with it . the intrusive system normally works by making the user rotate the head in one particular direction, or to tell the number in convenience to record the lip movement of the user[5]. The synchronization between the audio and video is also studied by and experimented[6] in the non intrusive system, the major focus is towards the facial properties such as eye blinking[7] , the texture of the users skin etc[8]. this methodology is quite convenient for the user since they are not physically intervened . but these methodologies are prone to noise

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* Correspondence Author
Betty P*, Research Scholar, Anna University. Chennai. Email: berylbetty@gmail.com
Dr Mohana Geetha D, Professor, Dept. of Electronics and Communication Engineering, SNS College of Technology, Coimbatore. Email: mohanageetham1@rediffmail.com

II. PROPOSED METHOD

The feature transformation is achieved by DNA codec technique. It comprises of the Z-Pattern formation where the biometric template, $f(m,n)$ will be in the matrix form of 0s and 1s. The Z-pattern is formed from this matrix form. The Z-pattern is formed by getting the two adjacent bits of the first row and the bits of same columns in the next adjacent row. The next is the 4 –bit bin formation where the The mXn matrix will be converted to $(\frac{m}{2}\ X4k)$ matrix. The simultaneous four bits of the 4-bit bin are formed together to a quad, $g(i,j)$. This step is called Quad-bin Formation. The quad bin is converted to its decimal equivalent. The decimal equivalent formed is called as dec-code. Thus it is ensured that the feature is transformed and securely stored. Followed by which , in the verification stage, the liveliness detection paves the key role. the proposed method will have a hardware having both CMOS camera and thermograph camera. CMOS camera will capture the photography of the face. At the same time, the thermograph camera will capture the thermograph of the face. Thermograph will illustrate both the temperature and its gradient across the face. The photography image will be compared with the specimen image and subsequently the conventional image analysis will be made to ensure the face detection. At the same time, the thermograph image will be analyzed for the temperature and the temperature gradient across the image. Face detection will be approved once both the photography and thermograph are qualified. Therefore, the proposed system is expected to be robust and it will eliminate all disadvantages of the conventional system. The basic illustration of the following subsections are illustrated in Fig. 1.

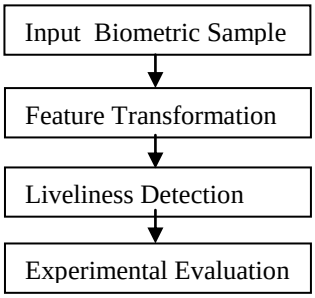

Fig 1: Methodology

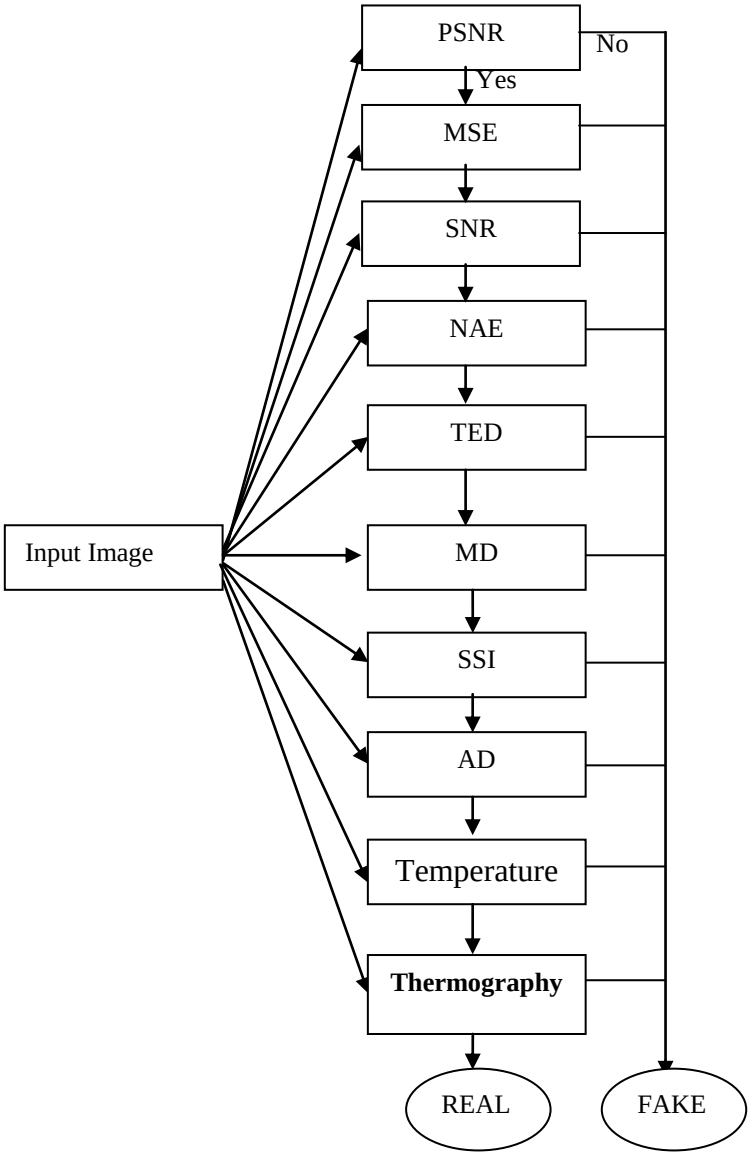

Fig 2: Proposed Liveliness Detection

The pictorial representation of the proposed Liveliness detection in Face Biometrics is presented in Fig. 2. The experiments were carried out with a set of 100 images from the dataset. The below figures explains the precision , recall and the accuracy information of the samples.

Precision, Recall and Accuracy

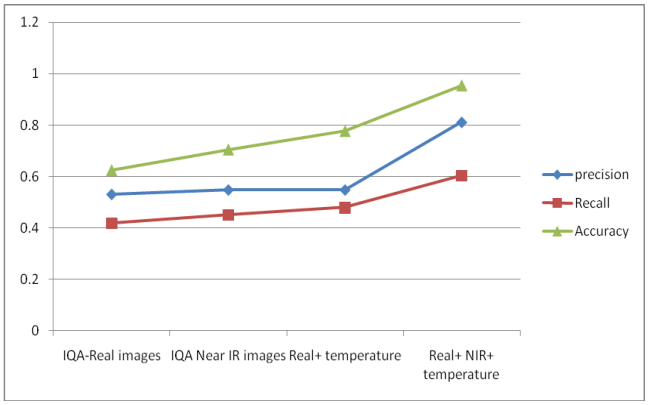

Fig 3: Precision of various methods

The Fig. 3 depicts the precision of various methods. The precision of the proposed methods with the other existing methods is carried out for the experiment. The precision is improved in the proposed method which stands as a measure in the improvement of the overall accuracy of the system.

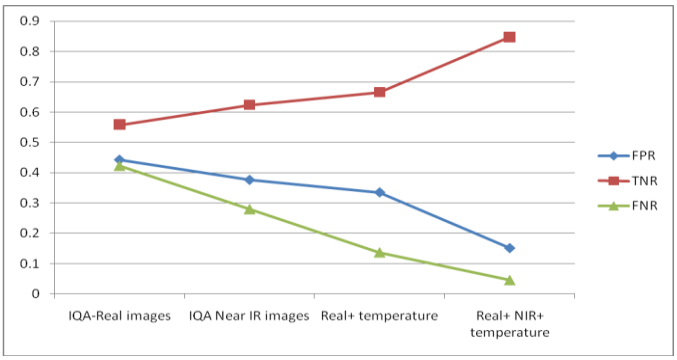

Fig 4: Recall of various methods

The Fig. 4 depicts the recall of various methods. The recall of the proposed methods with the other existing methods is carried out for the experiment. The recall is considerably depreciated in the proposed method which stands as a measure in the improvement of the overall accuracy of the system.

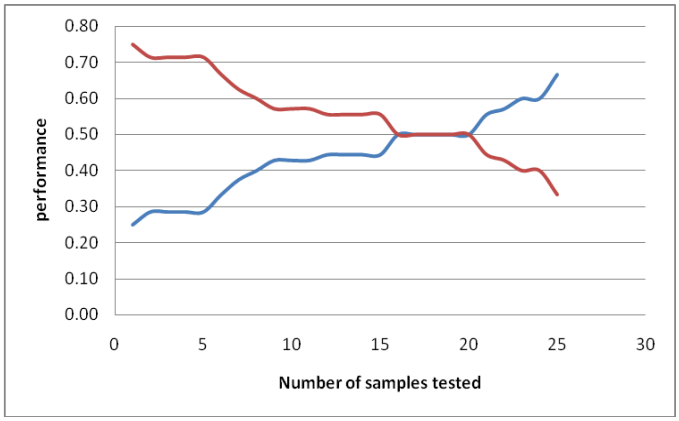

Fig 5: Authentication using IQA-Real images

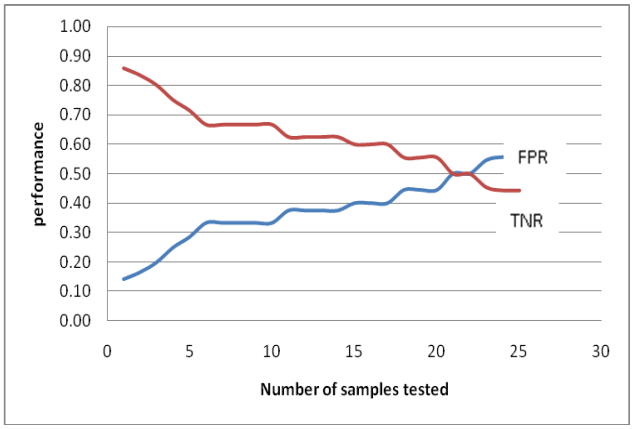

Fig 6: Authentication using IQA Near IR images

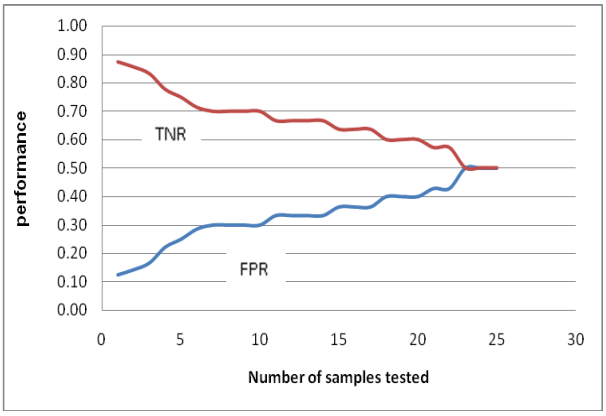

Fig 7: Secured authentication using Real and temperature

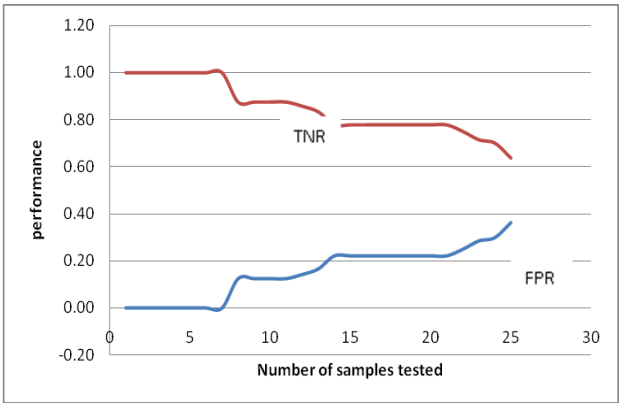

Fig 8: Secured authentication using Real+ NIR+ temperature

The Fig. 5 to 8 depicts the improvements of the proposed method for the better authentication.

When the photograph of the genuine is presented in front of both IQA and proposed system, almost two third of the cases were failed in IQA system. However, all were detected by proposed system. Therefore, it is proven that the proposed system will detect all fraudulent related to presenting the photograph of the genuine in verification stage.

III. CONCLUSION

The face recognition system is improved in the feature transformation at the enrolment stage and liveliness detection in the verification stage. The proposed thermograph based system has identified exactly the presented objects. Therefore, the proposed system is capable of detecting the livelihood and non- livelihood up to 100% accuracy. Thermograph image technique can be implemented to any circumstances since it is one of the non-intrusive method of liveliness detection.

REFERENCES

1. A. K. Jain and U. Uludag, "Hiding biometric data," *IEEE Trans. Pattern Anal. Mach. Intelligence*, vol. 25, no. 11, 2003, pp. 1493–1498.
2. H. Lee, C. Lee, J. y. Choi, J. Kim, and J. Kim, "Changeable face representations suitable for human recognition," *Lecture Notes Comput.Sci.*, vol. 4642 ,2007, pp. 557–565.
3. N. Ratha, S. Chikkerur, J. H. Connell, and R. M. Bolle, "Generating cancelable fingerprint templates," *IEEE Trans. Pattern Anal. Mach.Intell.*, vol. 29, no. 4, 2007, pp. 561–572.
4. F.Quan, S. Fei, C.Anni, andZ.Feifei, "Cracking cancelable fingerprint template of ratha," in *Proc. Int. Symp. Computer Science and ComputationalTechnology*, 2008, pp. 572–575.
5. Kollreider, K., Fronthaler, H., Faraj, M. and Bigun, J.,Real time face detection and motion analysis with application in liveness assessment, Trans. Infor. Forensics and Security, IEEE, 2007, pp. 548–558.
6. Choudhury, T., Clarkson, B., Jebara, T. and Pentland, A., Multimodal person recognition using unconstrained audio and video,International Conference on Audio- and Video-based Biometric Person Authentication (AVBPA'99), Washington DC, 1999, pp. 176–181.
7. Lin Sun, Gang Pan, Zhaohui Wu and Shihong Lao, Blinking-Based Live Face Detection Using Conditional Random Fields, ICB 2007, Seoul, Korea, International Conference,2007, pp. 252-260.

AUTHORS PROFILE

Betty P has completed the Post Graduation – Master of Engineering in the field of Computer Science. Currently Pursuing Ph.D. at Anna University, Chennai. Has also gained the work experience as Assistant Professor in the Institution Kumaraguru College of Technology., Coimbatore. Her area of interest includes Image Processing, Data Security.

Dr Mohana Geetha D has completed the Ph.D. in the field of Optical Networks in Anna University- Chennai in the year 2011. Currently working as Professor at SNS College of Technology, Coimbatore. Has published more than 35 research articles in Refereed Journals. Has coordinated various National and International Conferences. Her area of interest includes Optical Networks, VLSI, Data Security