A Novel Analysis Of The Application Of Foot-Print Recognition

Varnikhaa.P , Dr. V.D.Ambeth Kumar.

Abstract: Foot print based recognition system is the most evolving technology in today's world. Still this has been not mostly welcomed by the industries to use it in day-to-day basis. This is only because of the lack of efficiency in the application in which it is used. To bring out an efficient system design, first the technologies and the recognition rate are compared and analyzed till date. A survey to analyze the gap in the use of this technology in the real world is made up-to-date. There are previous survey works done up to the year 2011 and focuses mainly on the recognition rate of the technology used. In this, it mainly focuses on the papers mostly after 2011 and various application of it by analyzing every possible parameter and their drawbacks and benefits.

Index Terms: Biometric, Efficiency, Foot-print, Neural Network, Personal Identification, Stature, Scalability.

1. INTRODUCTION

Footprint identification is projected to become a new emerging alternative to access control in wellness domains such as spas and thermal baths. Though there are many approaches available. Always new features and new technique would improve the system. The technique of using neural network has been implemented in which the network is being enhanced and new geometric features are introduced in a way that it fits with the evolving generation and technologies. The performance parameters computed for scanning techniques show a better agreement with experimental results and could be used for biometric authentication the footprints can provide a reliable estimate of stature in forensic investigations. Sex specific regression models give a more accurate estimate of stature than the pooled sample. Footprint recognition is projected to become a new emerging alternative to access control in wellness domains.. Though there are many existing approaches available for foot print recognition but still providing a high accuracy for the improvement of the system is always being questioned. Not only maintaining the accuracy alone provides a better system of technology but still scalability is the main factor that affects the performance of the system. Where the existing systems have a problem of providing high accuracy along with scalability improvement is at risk. Biometrics is the automated recognition of individuals based on their behavioral and biological characteristics. Efforts to determine best practices for testing and evaluating existing and new biometric systems should be sustained and expanded. Footprint identification is projected to become a new emerging alternative to access control in wellness domains such as spas and thermal baths. Though there are many approaches available.

- *Varnikhaa.P is currently pursuing masters degree program in computer science and engineering in Panimalar Engineering College, India, PH-7200191195. E-mail: varnikhaacpsamy97@gmail.com.*
- *Dr.V.D.Ambeth Kumar, Professor, computer science and engineering, Panimalar Engineering College, India. PH-7200191195. E-mail: vdambethkumar@gmail.com.*

2 RELATED WORK

Robert B Kennedy in his paper [1] has shown that a foot impression has a uniqueness comparing to other biometrics such as finger and eye. It has been concluded that the foot features can be very useful and productive in the biometric domain.

Even though the database created by them shows good results it requires more man power which is shown in [2] that it can be automated. In [2] Jung, J. W., Sato, T., & Bien, Z. , addressing the drawback in [1], an automated foot-print recognition system has been designed using Centre-Of-

Pressure (COP) Trajectory and Hidden Markov Model(HMM). It proposes a new person recognition method based on COP trajectory in the dynamic footprint and suggests the extraction procedure of the aligned COP trajectory for MAT sensor and a quantization method for HMM. Though [2] introduces an automated system for foot-print recognition the spatial resolution of sensors and variation of parameters gives no good information and the recognition rate of 80% only is obtained which is further improved in the following years. Nakajima, Kazuki, et al in [3] proposes a personnel recognition with foot-print using normalization is introduced assuming a static position using Euclidian Distance algorithm. With the help of the foot print a personal recognition method based on the pressure of foot is designed. The recognition rate of this biometric system is 85% while for finger is 100%. And there is a reduce when there is a movement in the position. Biometric User Identification with Dynamic Footprint [4] by Yun, J., Abowd, G., Woo, W., & Ryu, J. overcomes the limitation in [3] by using Principal Component Analysis (PCA) And Neural network to create a biometric user identification system. With a well-trained neural network, the system is used to obtain high recognition rate. In spite of having a good recognition rate it uses or traces only the foot gaits during walking and stepping patter that is only dynamically which becomes a drawback of the system. The above only dynamic system is upgraded by including a static position along with it in [5] which is proposed by Al-Dulaimi, K. A. Using three stages of feature matching a complete and fully automatic approach for Human footprint recognition images is proposed. Thresholding matching Least Square criterion is used for this purpose. Regardless of using three stages of feature matching [5], When position or the direction of the foot changes it does not result positively. This is being rectified in the Person recognition method using

Sequential Walking Foot-prints via an overlapped foot shape and COP trajectory [6] which is devised by Jung, J. W., Bien, Z., & Sato, T. Recognition Rate of 98.6% achieved in recognizing the overlapped foot shape and one step walking. But still only 11 volunteers are used for testing that is a minimal database set used for testing. Khokher, Rohit, and Ram Chandra Singh [7] in their work have addressed the problem of Static foot-prints of individuals are obtained by scanning technique and then feature extraction is done for computational purpose. Using scanning technique, foot-prints of 94 individuals are stores using scanning technique and then feature extraction is done for the further process which was a drawback in [6]. This is an uni-modal system which is less strong and safe for biometric authentication process. This is an unimodal system which is less strong and safe for the biometric authentication process. In [8], Kumar, VD Ambeth, and M. Ramakrishnan have made an attempt to resolve the issue of Using a database set of 100 people with different angles of footprint. By the use of Modified Haar Energy transform, the heel portion of the leg is cropped as it is having more intensity at this portion. This cropping is done using built-in function. Though many limitations in [7] has been rectified still only the left leg alone is considered for training and testing and accuracy drops to 92%.King, Raji Rafiu, and Wang Xiaopeng [9] proposed Gradient Vector Flow （GVF） snake Technology to Include two parameters namely foot shape and minutiae foot friction ridge to study footprint. This presents a novel personal identification method using the static footprint features viz. friction ridge and foot shape / silhouette. Verification accuracy is in the range of 98 – 99% which was a major drawback in [8]. Kumar, Sanjay et al [10] addressed the concept of biometric-based multi-modal authentication system with four levels of securities using the technology of Hashed MAC (HMAC). Multi-modal biometric authentication system, used the hashing of password and also used biometric traits like thumb print, face and iris. Thus, overcoming the using static features [9]. But still It lacks insecurity in a way of the used encryption algorithm which can be changed. Barde, Snehlata, A. S. Zadgaonkar, and G. R. Sinha [11], made Implementation of person identification fusing face and ear biometric modalities using the technology of PCA based neural network. Good combination of multiple biometric traits and various fusion methods is achieved to get the optimal identification results. The limitation of this is self-created database with same old geometric features and a single neural network increases the false acceptance rate of the system. Yun, Xiaoping, et al [12] uses the technology of Foot motion algorithm to device An algorithm to filter the foot motion by sensing the foot using a sensor and kinetic parameters are obtained. Foot acceleration is directly measured by the accelerometers of the IMMU. Foot velocity is obtained by numerically integrating corrected foot acceleration measurements obtained during the swing phase. But the calibration technique is limited to laboratory work. In Stature estimation from foot dimension [13] by Kanchan, Tanuj, et al to do an Individual identification in forensic investigation uses Forensic anthropology technology. Partial identification of unidentified bodies and dismembered remains can be easily done by stature identification. The limitation is that Using linear regression reduces the efficiency instead of which multiple regression can be used. Costilla-Reyes, O., Scully, P., &Ozanyan, K. B. [14] using the technology of Floor Sensor system, the Gait analysis from time domain sensor data by pattern recognition techniques is been addressed. The ability of a one of a kind impression imaging sensor frameworks utilizing floor sensor which is utilized for acquiring better outcome is tested and displayed. Drawback of this is that the time domain data from the footprint imaging sensor system allows reliable classification of human gait and that the selection of model-feature pairs is essential to obtain high classification scores. Deutschmann, I., Nordström, P., & Nilsson, L.[15] in the Comparative Analysis and Fusion of Spatiotemporal Information for Footstep Recognition using Assessment protocol does a comparative assessment of the spatiotemporal information contained in the footstep signals for person recognition. Satiate moral data in stride signals is engaged utilizing evaluation convention which expanding security concerns. And this lacks in Simulation conditions of different potential applications such as smart homes or security access scenarios. Yuan, Yuan, Yanwei Pang, and Xuelong Li [16] in their research designed a Gender recognition system using the technology of Non-linear SVM classifier. The system Proposed gender orientation acknowledgment from footwear appearance, and furthermore has assembled a first footwear database. From the preparatory trial comes about, it can be reasoned that the HOG in addition to nonlinear SVM classifier gives agreeable outcomes. Still a knowledge of the numbers of male customers and female customers is not very helpful for a shopping manager. In [17], Hiew, Bee Yan, Andrew BJ Teoh, and Ying-Han Pang proposes the existing sensors for this technique belong to one of these three families: ultrasound, optical and solid-sate using a Sensor procedure. Existing sensor procedure issues are overcome by utilizing touch less unique finger impression acknowledgment which turns out to be a proficient strategy. Images captured with touch-less devices are distortion free and present no deformation because these images are free from the pressure of contact. The problems in terms of hygienic, maintenance, latent fingerprint problems and so forth yet to be considered effectively. Lu, Liang, and Steve Renals [18] using Highway deep neural network (HDNN) technology designs a Deep neural network (DNN) based acoustic models often have many more model parameters. Profound neural system gives a reduced DNNS that is utilized for acoustic modeling, which gives general DNNs as an acknowledgment medium. HDNNs are more compact than regular DNNs for acoustic modeling. Kapil Kumar Nagwanshi , Sipi Dubey and Toran Verma[19] focuses on the gap concerned with access control and biometric technique. In this a system that provides less error and fast recognition rate is designed using Foot-print matcher, Fuzzy logic. This does not produce a fully developed biometric system using foot-print. In Detailed Analysis of Footprint Geometry for Person Identification[20],Kushwaha, R., Nain, N., & Signal have proposed a unique method for user identification using foot print. It provides various analysis of foot features to be used as a biometric parameter using Dynamic time warp, Principal Component Analysis method. The drawback of this is only that the parameters used are not so unique. Parameter like minutiae can be used for more accuracy.

3 CONCLUSION

Various applications employed with the use of foot as a parameter is analyzed and documented. With this analysis it can be said that the recognition rate is inversely proportional

to the database size. When the database size increases the recognition rate decreases and whenever the database size is small the system gives a high recognition rate. With the help of these observations more accurate and efficient system can be designed for foot-print identification.

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REFERENCES

[1] R. B. Kennedy, “Uniqueness of bare feet and its use as a possible means of identification,” Forensic science international, vol. 82, no. 1, pp. 81– 87, 1996.
[2] J.-W. Jung, T. Sato, and Z. Bien, “Dynamic footprint-based person recognition method using a hidden markov model and a neural network,” International journal of intelligent systems, vol. 19, no. 11, pp. 1127– 1141, 2004.
[3] K. Nakajima, Y. Mizukami, K. Tanaka, and T. Tamura, “Footprint-based personal recognition,” IEEE Transactions on Biomedical Engineering, vol. 47, no. 11, pp. 1534–1537, 2000.
[4] J. Yun, G. Abowd, W. Woo, and J. Ryu, “Biometric user identification with dynamic footprint,” in 2007 Second International Conference on Bio-Inspired Computing: Theories and Applications. IEEE, 2007, pp. 225–230.
[5] K. A. Al-Dulaimi, “Using feature extraction for human footprints recognition,” International Journal of Computer Applications, vol. 64, no. 3, 2013.
[6] J.-W. Jung, Z. Bien, and T. Sato, “Person recognition method using sequential walking footprints via overlapped foot shape and center-of-pressure trajectory,” IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, vol. 87, no. 6, pp. 1393– 1400, 2004.
[7] R. Khokher and R. C. Singh, “Footprint-based personal recognition using scanning technique,” Indian Journal of Science and Technology, vol. 9, no. 44, 2016.
[8] V. A. Kumar and M. Ramakrishnan, “Footprint recognition using modified sequential haar energy transform (mshet),” IJCSI International Journal of Computer Science Issues, vol. 7, no. 3, 2010.
[9] R. R. King and W. Xiaopeng, “Study of biometric identification method based on naked footprint,” International Journal of Science and Engineering, vol. 5, no. 2, pp. 29–35, 2013.
[10] S. Kumar, S. Paul, and D. K. Shaw, “Real-time multimodal biometric user authentication for web application access in wireless lan.” JCS, vol. 13, no. 12, pp. 680–693, 2017.
[11] S. Barde, A. Zadgaonkar, and G. Sinha, “Pca based multimodal biometrics using ear and face modalities,” International Journal of Information Technology and Computer Science, vol. 6, no. 5, pp. 43–49, 2014.
[12] X. Yun, J. Calusdian, E. R. Bachmann, and R. B. McGhee, “Estimation of human foot motion during normal walking using inertial and magnetic sensor measurements,” IEEE transactions on Instrumentation and Measurement, vol. 61, no. 7, pp. 2059–2072, 2012.
[13] T. Kanchan, R. G. Menezes, R. Moudgil, R. Kaur, M. Kotian, and R. K. Garg, “Stature estimation from foot dimensions,” Forensic Science International, vol. 179, no. 2-3, pp. 241–e1, 2008.
[14] O. Costilla-Reyes, P. Scully, and K. B. Ozanyan, “Temporal pattern recognition in gait activities recorded with a footprint imaging sensor system,” IEEE Sensors Journal, vol. 16, no. 24, pp. 8815–8822, 2016.
[15] I. Deutschmann, P. Nordstrom,¨ and L. Nilsson, “Continuous authentication using behavioral biometrics,” IT Professional, vol. 15, no. 4, pp. 12–15, 2013.
[16] R. Vera-Rodriguez, J. S. Mason, J. Fierrez, and J. Ortega-Garcia, “Comparative analysis and fusion of spatiotemporal information for foot-step recognition,” IEEE transactions on pattern analysis and machine intelligence, vol. 35, no. 4, pp. 823–834, 2012.
[17] Y. Yuan, Y. Pang, and X. Li, “Footwear for gender recognition,” IEEE transactions on circuits and systems for video technology, vol. 20, no. 1, pp. 131–135, 2009.
[18] B. Y. Hiew, A. B. Teoh, and Y.-H. Pang, “Touch-less fingerprint recognition system,” in 2007 IEEE Workshop on Automatic Identification Advanced Technologies. IEEE, 2007, pp. 24–29.
[19] L. Lu and S. Renals, “Small-footprint highway deep neural networks for speech recognition,” IEEE/ACM Transactions on Audio, Speech, and Language Processing, vol. 25, no. 7, pp. 1502–1511, 2017.
[20] R. Kushwaha, N. Nain, and G. Singal, “Detailed analysis of footprint geometry for person identification,” in 2017 13th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS). IEEE, 2017, pp. 229–236.