Finding a Rational Set of Features for Handwritten Signature Recognition

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Abstract

© 2020 IEEE. In this paper we proposed the approach for dynamic handwritten signatures recognition. We proposed a formal model of the handwritten signature, containing fuzzy features of curvature of discrete handwritten signature functions. We proposed handwritten signature reference template creation algorithm, characterized by the use of the potential method for constructing membership functions of fuzzy features. The choice of a rational set of features has been implemented, which allows to minimize the false accept rate (up to 0.05%), as well as a rational set that minimizes the equal error rate (up to 0.36%), which significantly exceeds the efficiency of existing handwritten signature recognition algorithms.

Keywords

biometric authentication, formal model, fuzzy logic, handwritten signature, reference template

References

[1] M. Freire, J. Fierrez, M. Martinez-Diaz, and J. Ortega-Garcia, "On the applicability of off-line signatures to the fuzzy vault construction", in International Conference document analysis and recognition, pp. 1173-1177, 2007.

[2] M. Hanmandlu, M.Y. Hafizuddin, and V.K. Madasu, "Off-line signature verification and forgery detection using fuzzy modeling", Pattern Recognition, vol. 38, pp. 341-356, 2005.

[3] V. Iranmanesh, S.M.S.Ahmad, and W.A.W. Adnan, "Online Handwritten Signature Verification Using Neural Network Classifier Based on Principal Component Analysis", The Scientific World Journal, pp. 1-8, 2014.

[4] A.Q. Ansari, M. Hanmandlu, J. Kour, and A. K. Singh, "Online signature verification using segment-level fuzzy modelling", IET Biometrics, vol. 3, pp. 1-15, 2013.

[5] I.V Anikin, and E.S. Anisimova, "Handwritten signature recognition method based on fuzzy logic", in 2016 Dynamics of Systems, Mechanisms and Machines, Dynamics, 2016. [Online]. Available: Http://apps.webofknowledge.com/full_record.doproduct=WOS&search_mode=GeneralSearch&qid=1&SID=F2YWzOWhBTJ3DZYKjJt&page=1&doc=2

[6] V. Malekian, A. Aghaei, M. Rezaeian, and M. Alian, "Rapid Off-Line Signature Verification Based On Signature Envelope and Adaptive Density Partitioning", Pattern Recognition and Image Analysis (PRIA), 2013. [Online]. Available: Https://doi.org/10.1109/PRIA.2013.6528428

[7] N.Y. Choudhary, R. Patil, U. Bhadade, and B.M. Chaudhary, "Signature Recognition & Verification System Using Back Propagation Neural Network", International Journal of IT, Engineering and Applied Sciences Research (JJIEASR), vol. 2, no. 1, pp. 1-8, 2013.

[8] J.R. Rico-Juan, and J.M. Inesta, "Confidence Voting Method Ensemble Applied to Off-Line Signature Verification", Pattern Analysis and Application, vol. 15, pp. 113-120, 2012.

[9] P.S. Lozhnikov, and A.E. Sulavko, "Generation of a biometrically activated digital signature based on hybrid neural network algorithms", Journal of Physics: Conference Series, vol. 1050, no.1, 2018. DOI: 10.1088/1742-6596/1050/1/012047.

[10] D.S. Guru, and H.N. Prakash, "Online Signature Verification and Recognition: An Approach Based on Symbolic Representation", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 31, no. 6, pp. 1059-1073, 2009.

[11] B. Yanikoglu, and A. Kholmatov, "Online Signature Verification Using Fourier Descriptors", EURASIP Journal on Advances in Signal Processing, 2009. [Online]. Available: Https://doi.org/10.1155/2009/260516

[12] A. Kholmatov, and B. Yanikoglu, "Identity Authentification Using Improved Online Signature Verification Method", Pattern Recognition Letters, vol. 26, pp. 2400-2408, 2005.

[13] N. Sae-Bae, and N. Memon, "A Simple and Effective Method for Online Signature Verification", in BIOSIG 2013-Proceedings of the 12th International Conference of the Biometrics Special Interest Group, pp. 147-158, 2013.

[14] E. Maiorana, M. Martinez-Diaz, P. Campisi, J. Ortega-Garcia, and A. Neri, "Template Protection for HMM-based On-Line Signature Authentification", CVPR Workshop, pp. 1-6, 2008.

[15] J. Galbally, M. Diaz-Cabrera, and M.A. Ferrer, "On-line signature recognition through the combination of real dynamic data and synthetically generated static data", Pattern Recognition, vol. 48, pp. 2921-2934, 2015.

[16] K. Cpalka, M. Zalasinski, and L. Rutkowski, "New method for the on-line signature verification based on horizontal partitioning", Pattern Recognition, vol. 47, pp. 2652-2661, 2014.

[17] E.S. Anisimova, and I.V. Anikin, "Biometricheskaya sistema raspoznavaniya rukopisnykh podpisey cheloveka na baze metodov teorii nechetkikh mnozhestv", Problemy informatsionnoy bezopasnosti. Kompyuternyye sistemy, no. 4, pp. 44-54, 2018.

[18] J. Ortega-Garcia, J. Fierrez-Aguilar, D. Simon, J. Gonzalez, M. Faundez-Zanuy, V. Espinosa, A. Satue, I. Hernaez, J.-J. Igarza, C. Vivaracho, D. Escudero, and Q.-I. Moro, "MCYT Baseline Corpus: A Bimodal Biometric Database", Vision, Image and Signal Processing, IEEE Proceedings, vol. 150, no. 6, pp. 395-401, 2003.

[19] E. Maiorana, P. Campisi, J. Fierrez, J. Ortega-Garcia, and A.Neri, "Cancelable templates for sequence-based biometrics with application to on-line signature Recognition", IEEE Transaction on system, man and cybernetics-part A: System and human, vol. 40, no. 3, pp. 525-538, 2010.