EER of Fixed and Trainable Fusion Classifiers: A Theoretical Study with Application to Biometric Authentication Tasks

Norman Poh and Samy Bengio

IDIAP Research Institute, Rue du Simplon 4, CH-1920 Martigny, Switzerland
norman@idiap.ch, bengio@idiap.ch

Abstract. Biometric authentication is a process of verifying an identity claim using a person's behavioural and physiological characteristics. Due to the vulnerability of the system to environmental noise and variation caused by the user, fusion of several biometric-enabled systems is identified as a promising solution. In the literature, various fixed rules (e.g. $\min$, $\max$, median, mean) and trainable classifiers (e.g. linear combination of scores or weighted sum) are used to combine the scores of several base-systems. How *exactly* do correlation and imbalance nature of base-system performance affect the fixed rules and trainable classifiers? We study these *joint* aspects using the commonly used error measurement in biometric authentication, namely Equal Error Rate (EER). Similar to several previous studies in the literature, the central assumption used here is that the class-dependent scores of a biometric system are approximately normally distributed. However, different from them, the novelty of this study is to make a *direct link* between the EER measure and the fusion schemes mentioned. Both synthetic and real experiments (with as many as 256 fusion experiments carried out on the XM2VTS benchmark score-level fusion data sets) verify our *proposed theoretical modeling of EER* of the two families of combination scheme. In particular, it is found that weighted sum can provide the best generalisation performance when its weights are estimated correctly. It also has the additional advantage that score normalisation prior to fusion is not needed, contrary to the rest of fixed fusion rules.

Acknowledgment

This work was supported in part by the IST Program of the European Community, under the PASCAL Network of Excellence, IST-2002-506778, funded in part by the Swiss Federal Office for Education and Science (OFES) and the Swiss NSF through the NCCR on IM2. This publication only reflects the authors' view.