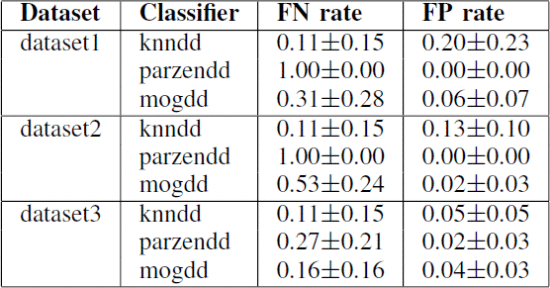
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TouchAnalytics [58]** | | | | | | |
| **5-Fold CV** | | | | | | |
| **Studio** | **Classificatore** | **Performance EER (%)** | | | | |
| [Frank et al. [58]](https://arxiv.org/pdf/1207.6231.pdf) | Intra-session kNN SVM | 2.0 - 3.0 % | | | | |
|  | Inter-session kNN SVM | 1. - 4.0 % | | | | |
| [Šeděnka et al. [67]](https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6971118) | / | No PCA | | PCA | | |
| Scaled Manhattan | 21.3 % | | 18.3 % | | |
| Scaled Euclidean | 21.0 % | | 18.3 % | | |
| 1-Prob | 16.7 % | | 24.1 % | | |
|  |  |  | | | | |
|  |  | Up | Down | Left | Right | All |
| [Fierrez et al. [51]](http://atvs.ii.uam.es/atvs/files/2018_TIFS_TouchBio_Fierrez.pdf) | Intra-session (GMM+SVM) | 3.5 (4.9) | 4.3 (3.5) | 3.3 (3.2) | 3.1 (3.0) | / |
| Inter-session (GMM+SVM) | 8.1 (7.2) | 8.4 (7.6) | 10.2 (7.96) | 12.8 (15.6) | / |
| Combined sessions (GMM+SVM) | 5.9 (5.9) | 5.2 (4.3) | 3.1 (2.9) | 3.8 (3.4) | / |
| Proposed Method | Random Forest | 0.82 | 0.67 | 0.83 | 0.54 | 0.63 |
| kNN | 24.71 | 20.45 | 21.3 | 19.66 | 19.57 |
| SVM | 13.24 | 23.35 | 18.24 | 21.6 | 45.01 |
| Neural Network | 9.26  (90.3 AUC) |  |  |  |  |

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| [BioIdent [X]](https://ms.sapientia.ro/~manyi/bioident.html) | | | | | |
| Studio | Classificatore | Up | Down | Left | Right |
| [Margit et al.](https://www.sciencedirect.com/science/article/pii/S0167865515000355) |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| [Fierrez et al. [51]](http://atvs.ii.uam.es/atvs/files/2018_TIFS_TouchBio_Fierrez.pdf) | Inter-session (GMM+SVM) | - | 2.6 | 5.3 | 8.2 |
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| **The MobiKey [31]** | | | | | |
| **[Classe in esame] vs [KfoldCV su esempi random da tutti gli altri utenti]** | | | | | |
| **Studio** | **Classificatore** | **Performance EER (%)** | | | |
| [Antal et al. [31]](https://link.springer.com/chapter/10.1007/978-3-319-33622-0_4) |  | **Features** | **Easy** | **Logical strong** | **Strong** |
| Bayes net | Secondorder | 7.4 | 5.8 | 6.7 |
| kNN (k = 1) | Secondorder | 5.6 | 4.8 | 5.4 |
| **Random forests (T = 100)** | **Secondorder** | **5.2** | **4.5** | **5.1** |
| Bayes net | All | 5.3 | 4.6 | 4.9 |
| kNN (k = 1) | All | 7.3 | 6.8 | 7.1 |
| **Random forests (T = 100)** | **All** | **3.2** | **3.3** | **3.3** |
| Euclidean | Secondorder | 20.8 | 14.9 | 18.1 |
| Manhattan | Secondorder | 20.2 | 14.4 | 16.9 |
| Mahalanobis | Secondorder | 19.1 | 15.4 | 15.9 |
| Outlier count (th = 1.96) | Secondorder | 20.8 | 16.4 | 17.8 |
| Kmeans (k = 3) | Secondorder | 17.7 | 13.6 | 14.3 |
| Euclidean | All | 23.8 | 18.3 | 19.5 |
| Manhattan | All | 20.3 | 15.4 | 16.7 |
| Mahalanobis | All | 25.6 | 19.3 | 21.0 |
| Outlier count (th = 1.96) | All | 16.0 | 12.9 | 14.3 |
| Kmeans (k = 3) | All | 17.3 | 12.8 | 13.1 |
| [Kalita et al. [21]](https://ieeexplore.ieee.org/abstract/document/9163524) | GMM | All | / | 2.34 | / |
| **Metodo Proposto**  Oversampling  Downsampling | Random Forest |  |  |  |  |
| KNN |  |  |  |  |
| SVM |  |  |  |  |
| Neural Network |  |  |  |  |

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| **Weka Arff** | | | | | |
| **[Classe in esame] vs [10-foldCV su esempi random da tutti gli altri utenti] 90% Train e 10% Test**  **Dataset 3 = these three features are password independent (meanholdtime, meanpressure and meanfingerarea) and reflect the users' individual characteristics** | | | | | |
| **Studio** | **Classificatore** | **Performance EER (%)** | | | |
|  | **/** | 71 Features | 17 Features | | 3 Features |
| [Szabo et al [68]](https://ieeexplore.ieee.org/document/7168452?arnumber=7168452&punumber%3D7158222%26filter%3DAND(p_IS_Number:7168393)%26pageNumber%3D3=)  2 Class classification | Bayesan Network (Default) | 4.3% | 6.6-10.9% | | 7.1-9.8% |
| kNN (k=3) | 8.3% | 6.6-10.9% | | 7.1-9.8% |
| Random Forest (T = 100) | 3.1% | 6.6-10.9% | | 7.1-9.8% |
| Metodo Proposto  Oversampling  Downsampling | Random Forest (T=100, BootStrap=0.5, Rand=”sqrt”) | 0.08%  4.38% | 0.32%  7.76% | | 0.60%  7.09% |
| KNN (K=3) | 0.72%  8.61% | 1.04%  10.47% | | 0.91%  7.52% |
| SVM (Linear) | 2.84%  8.04% | 8.07%  11.17% | | 12.05%  14.00% |
| Neural Network |  |  | |  |
| [Szabo et al [68]](https://ieeexplore.ieee.org/document/7168452?arnumber=7168452&punumber%3D7158222%26filter%3DAND(p_IS_Number:7168393)%26pageNumber%3D3=)  **1 Class classification**  The fraction of rejected objects on the positive class was set to 0.1. | default optimization for the width parameter of the parzendd | 18-19% | / | | 7% with 1% confidence bound |
| k≃3 for the knndd |
| 2 mixtures for the mogdd |
|  |  |  |  | |  |
| [Laszlo et al [69]](https://ms.sapientia.ro/~manyi/research/KeyStrokeDynamicsPaperFinal.pdf) | / | 41 Features | | 71 Features | |
| Naive Bayes | 50.15 % | | 78.93 % | |
| Bayesan Network | 75.95 % | | 91.94 % | |
| C4.5 (J48) (confidence 0.2, minimum 4 istances for leaf) | 54.79 % | | 69.02 % | |
| kNN (K=1) | 41.07 % | | 72.98 % | |
| SVM 41F (C=10.55, gamma=1.86)  71F (C=7.46, gamma=0.25) | 61.71 % | | 88.33 % | |
| Random Forest (T=100) | 82.53 % | | 93.04 % | |
| MLP [hidden layer = (# attributes +classi) /2] | 53.01 % | | 86.26 % | |
| Metodo Proposto  Oversampling  Downsampling | Random Forest  (T=100, BootStrap=0.5, Rand=”sqrt”) | 0.07%  4.42% | | 0.18%  6.93% | |
| KNN (K=3) | 1.57%  23.14% | | 1.57%  22.24% | |
| SVM 41F (C=10.55, gamma=1.86)  71F (C=7.46, gamma=0.25) | 1.09%  19.6% | | 1.01%  19.55% | |
| Neural Network |  | |  | |

One-class classification. Mean values of fn and fp rates sd. ±