

Supplementary File on A Structural Vibration-based Dataset for Human Gait Recognition: Results and Discussion

Mainak Chakraborty¹, Chandan², Sahil Anchal³, Bodhibrata Mukhopadhyay^{4*}, and Subrat Kar²

¹Centre for Sensors, Instrumentation, Cyber Physical System Engineering (SeNSE), IIT Delhi, New Delhi, India

²Department of Electrical Engineering, IIT Delhi, New Delhi, India

³School of Engineering and Architecture, University College Cork, Tyndall National Institute, County Cork, Ireland

⁴Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee, India

*corresponding author(s): Bodhibrata Mukhopadhyay (bodhibrata@ece.iitr.ac.in)

We use the toolkits provided by ¹, to analyse the interim dataset, which utilize 134 pre-defined features, to classify the gait patterns within the data. These features are extracted from the raw vibration signals. We then create labeled datasets from the features and perform five-fold cross-validation for robust evaluation. We investigate the performance of Random Forest(RF). In RF, we used entropy as the splitting criteria, and depth is set at 30.

A comparative analysis of machine learning methodologies on the datasets (Table 1) revealed superior performance in indoor environments. This suggests that the hand-crafted features used by the toolkits are better optimized for indoor footstep characteristics. Using multiple footstep inputs we improved recognition results by $\sim 5 - 10\%$, this is most likely due to the ability of multiple footsteps to capture a more comprehensive representation of the underlying walking patterns.

Table 1. Accuracy (%) of datasets evaluated using machine learning methods. Accuracy is in “mean (std.)” format.

Dataset / Footstep Events	2	5	7	10
A1	81.50(4.49)	88.10(4.56)	90.54(4.33)	92.67(3.91)
A2.1	51.19(1.54)	61.89(2.77)	65.60(2.69)	69.37(2.19)
A2.2	59.69(3.65)	68.15(4.00)	69.32(4.67)	72.35(6.49)
A2.3	59.93(2.33)	71.87(2.30)	74.87(3.14)	76.31(2.90)
A3.1	81.67(3.79)	88.71(3.28)	91.10(3.33)	93.60(2.69)
A3.2	85.21(2.92)	92.29(2.46)	94.36(2.78)	95.87(1.97)
A3.3	81.01(3.81)	88.99(3.55)	91.58(3.46)	93.67(2.89)
A4.1	76.57(3.89)	79.47(2.72)	82.87(2.77)	81.04(5.43)
A5.1	93.59 (1.67)	96.68 (2.51)	97.75 (1.11)	97.49(2.05)
A5.2	92.74 (0.98)	96.35 (0.96)	97.38 (1.13)	99.01 (0.33)
A5.3	91.38 (1.87)	94.45 (2.19)	96.33 (1.88)	97.55 (1.63)

References

1. Sahil Anchal, Bodhibrata Mukhopadhyay, and Subrat Kar. Person identification and imposter detection using footstep generated seismic signals. *IEEE Transactions on Instrumentation and Measurement*, 70:1–11, 2020. doi: [10.1109/TIM.2020.3022486](https://doi.org/10.1109/TIM.2020.3022486).