



HMOG (Hand Movement Orientation and Grasp) For Continuous Authentication of Smartphones



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Motivation

- Entry-point smartphone security schemes such as PINs and passwords are unable to protect users post-login [1]
- Sitova *et. al* [2] showed that data from a smartphone's sensors (accelerometer, gyroscope) was able to continuously authenticate users during typing
- Can similar authentication performance be observed using data collected as a user scrolls?

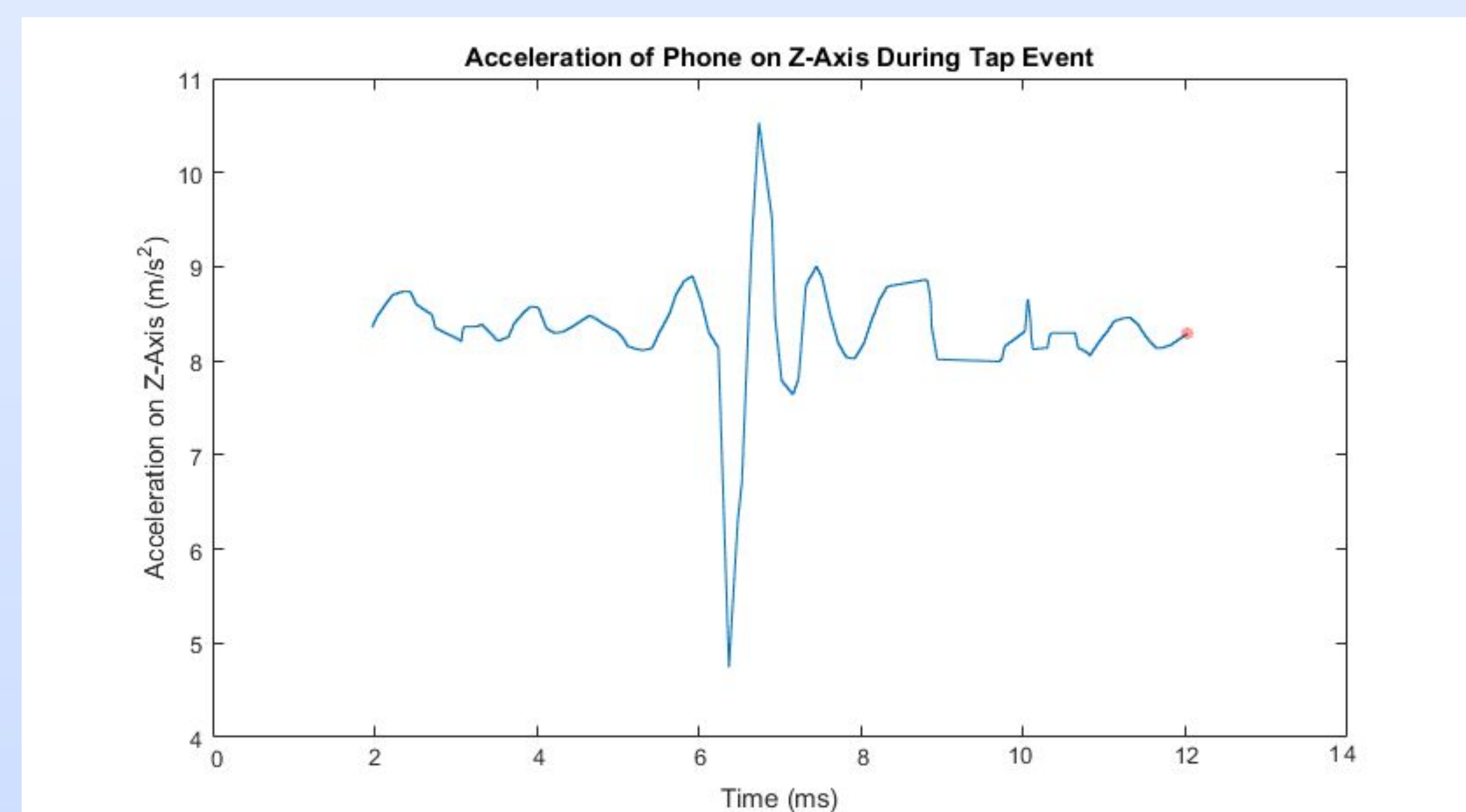


Fig. 1. Plot of accelerometer data around a tap

Features

- 18 HMOG features extracted from each scroll
- Our features use the offsets shown in Figure 2 to capture information unique to a scroll

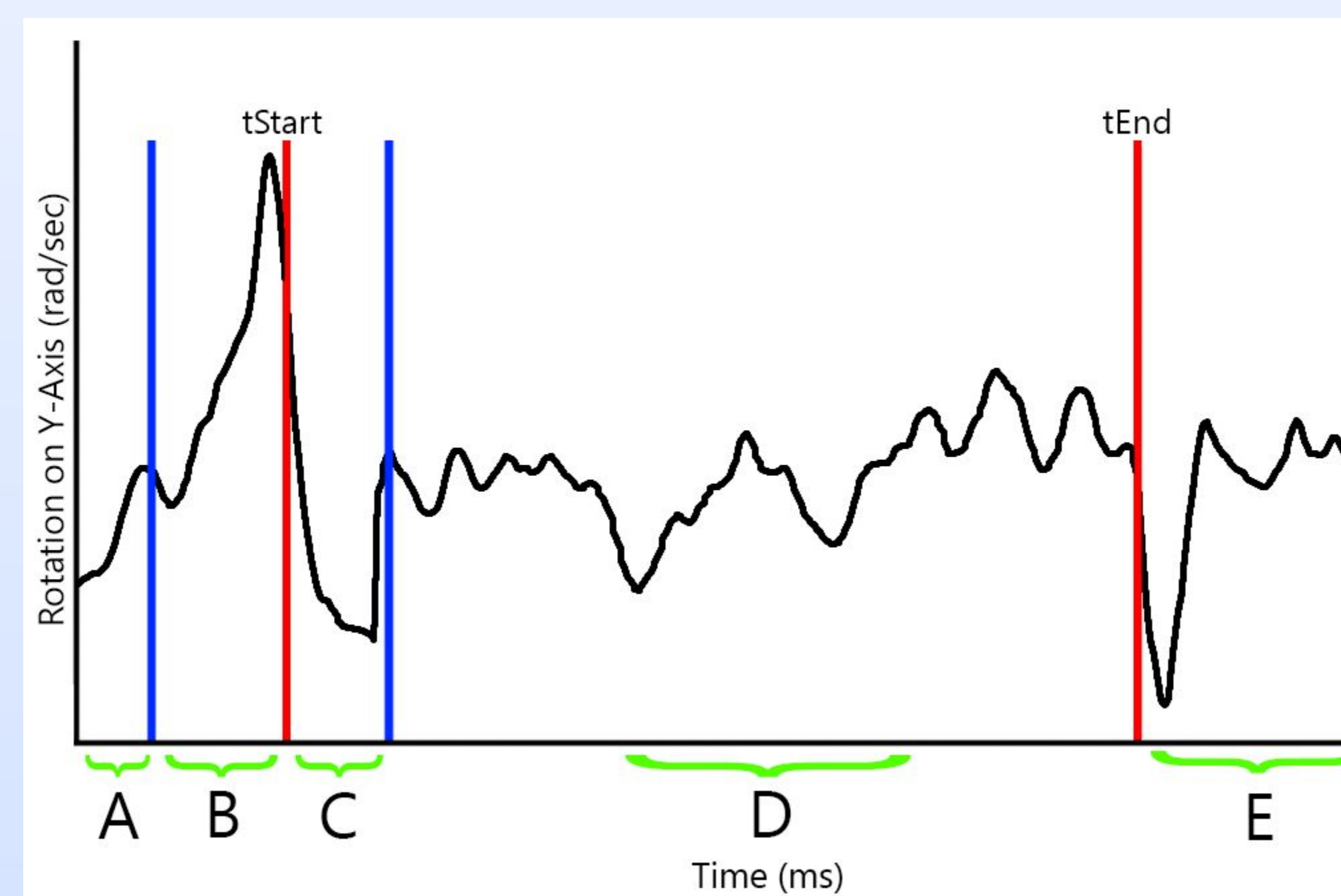


Fig. 2. The 5 sections of a scroll we used to create our features. A represents baseline activity before a scroll, B represents anticipatory hand movement, C captures reactionary hand movements, D captures the remainder of the scroll, and E represents baseline activity following a scroll.

Conclusions

- Scaled Manhattan produced EERs of 37% during sitting and 21% during walking
- EERs decreased during walking, showing HMOG captures gait information
- HMOG features are less discriminative for scroll-based usage scenarios like reading than they are for tap-based scenarios like typing [2]

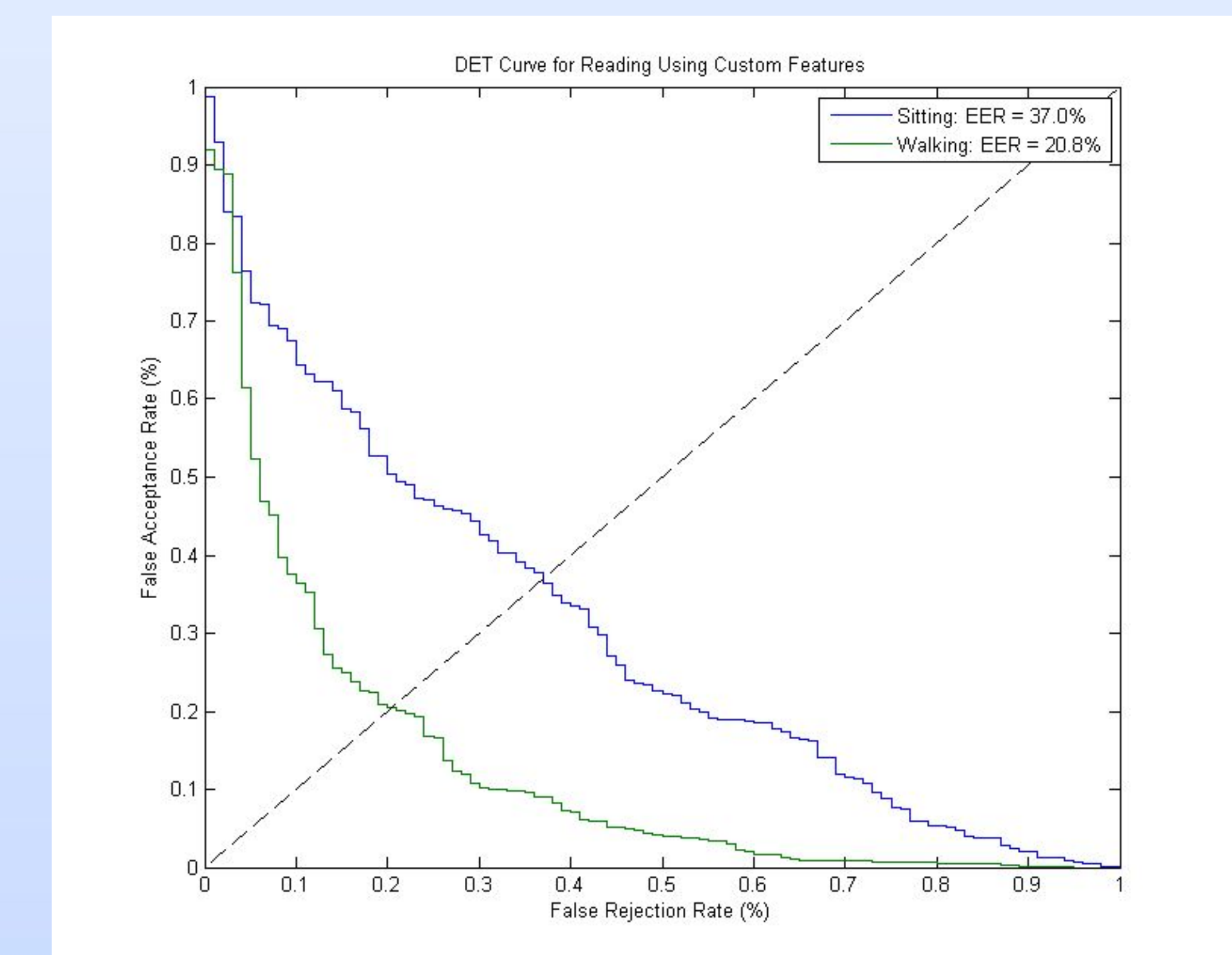


Fig. 3. DET curves of our HMOG scroll features

Dataset

- We used smartphone usage data from 100 users collected by Sitova *et al.* in 2013 [2]
- Recorded user touchscreen inputs and movement/orientation patterns via accelerometer and gyroscope

Methodology

- Used a Scaled Manhattan verifier to compare extracted features to the template
- Analyzed data taken while users read text on the screen
 - 8 session per user (4 walking, 4 sitting)
- Analyzed graphs of scrolls to identify features within a single scroll (see Figure 2)

Future Work

- Performance of HMOG when fused with other behavioral biometrics should be explored for the reading usage scenario
- Test accuracy for different authentication times

References:

- [1] A. K. Jain, A. Ross and S. Prabhakar, "An introduction to biometric recognition," in *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 14, no. 1, pp. 4-20, Jan. 2004.
- [2] Z. Sitova, J. Sedenka, Q. Yang, G. Peng, G. Zhou, P. Gasti, and K. S. Balagani, "HMOG: A new biometric modality for continuous authentication of smartphone users," *CoRR*, vol. abs/1501.01199, 2015.

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