Universität Bielefeld

Center of Excellence
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Continuous online user authentication based on keystroke dynamics

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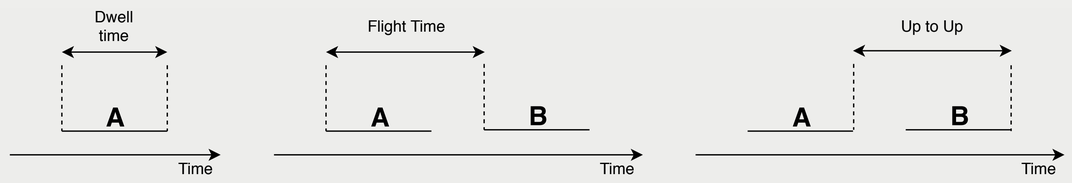
Introduction

- Continuous authentication is required in many use cases (e.g. online examination).
- Biometric authentication models are considered to be more secure [1].

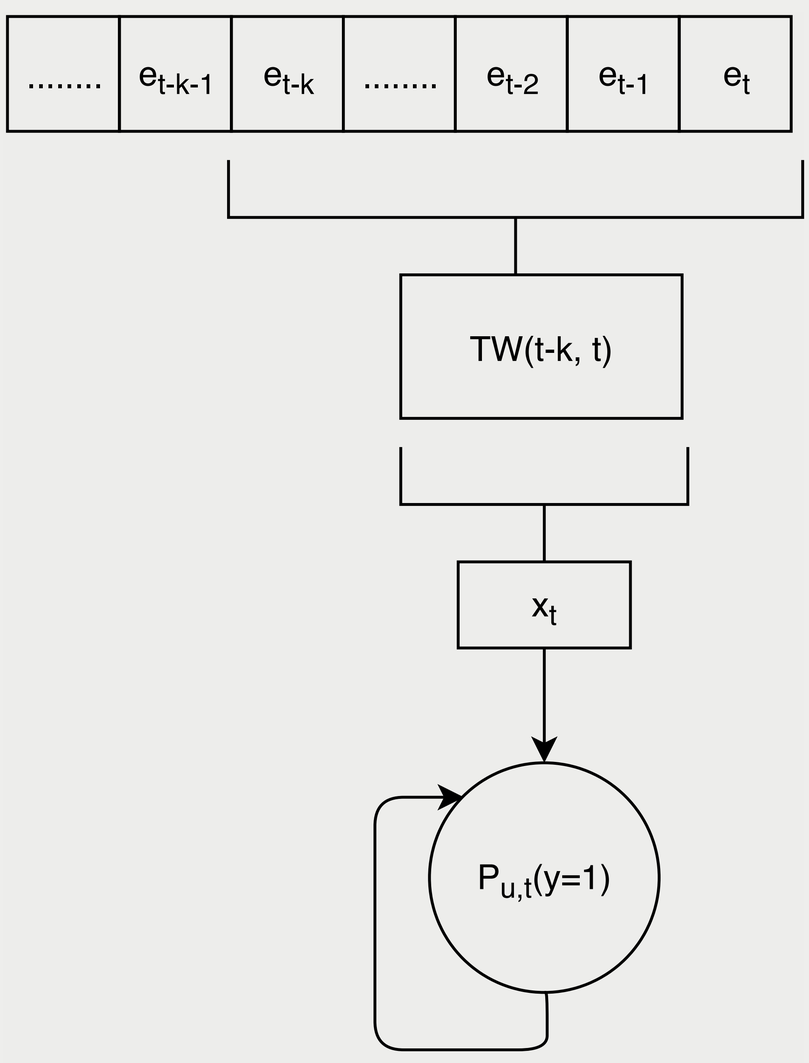
Feature Extraction

- Based on the logged key up and down events the following features were computed:
  - *dwell time* [2] for all letters of the alphabet, digits 0-9, shift and tab keys,
  - *flight time* and *Up to Up time* [2] of the 50 most frequent German bi-grams, all numbers from 10 to 99, and all letters in combination with the shift key,
  - *flight time* and *Up to Up time* [2] of the 100 most frequent German tri-grams and the 26 number triplets that were part of the survey.



Model

- **Approach:** Split the data stream of events into small chunks (time windows) and *classify each time window separately*.
- **Time integration:** Integrate the classifications over time by using a *sequential Bayesian hypothesis testing* framework.
- **Efficiency:** We only have to store and process a small chunk of data at every point in time and can discard it afterwards.



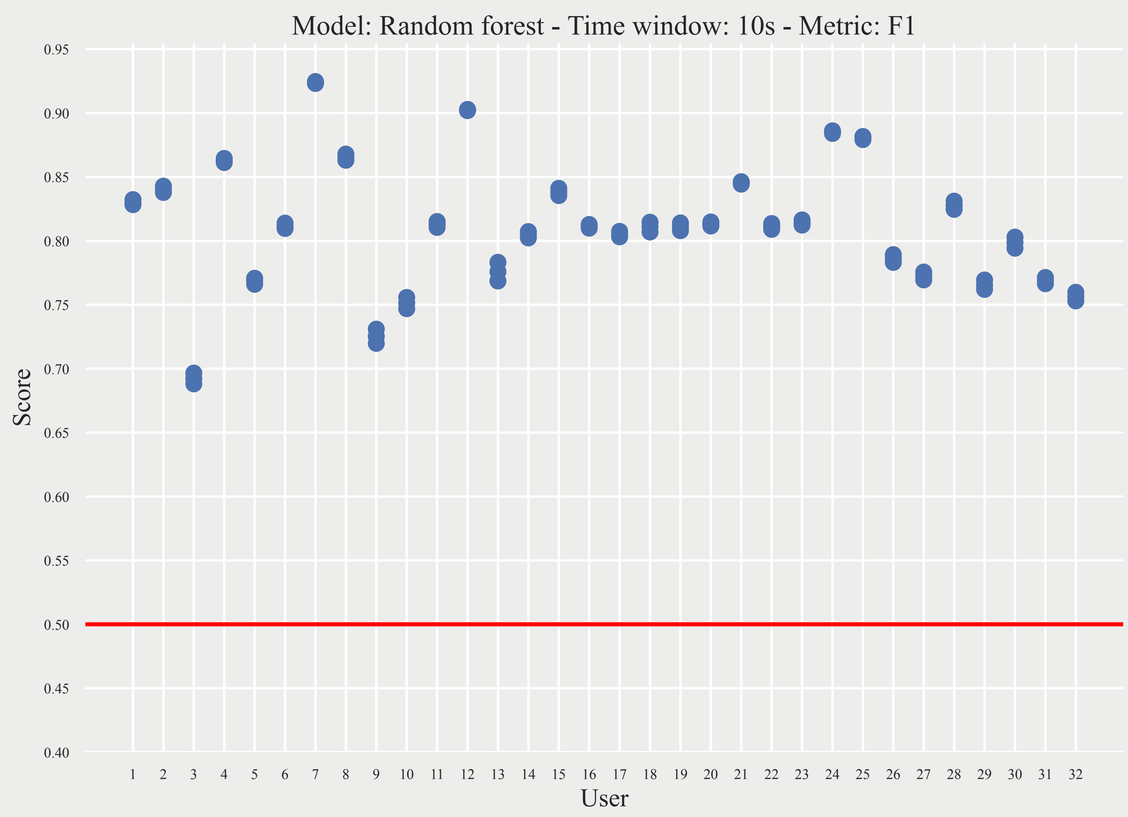
Algorithm

Require: User u to identify

$P_u(y = 1) \leftarrow 0.5$ ▷ Initialize prediction
loop
  $TW \leftarrow ()$ ▷ Clear time window
  while Current time period has not elapsed **do**
    $TW \leftarrow (TW, e_t)$ ▷ Add current event
  end while
  $\vec{x}_t \leftarrow$ Compute features from TW
  $P_u(y = 1) \leftarrow P_{u,t}(y = 1 \mid \vec{x}_t)$ ▷ Update prediction
end loop

Experiment

- **Own data set:** Keystroke and mouse dynamics data from 32 subjects - tasks ranging from single word input to extended free typing in German.



Conclusion

- The proposed algorithm ensures continuous classification for dynamic texts of any length.
- Because of *sequential Bayesian hypothesis testing*, our algorithm is very memory efficient.

References

[1] M. Karnan, M. Akila, and N. Krishnaraj. Biometric personal authentication using keystroke dynamics: A review. *Applied Soft Computing*, 11(2):1565 – 1573, 2011. The Impact of Soft Computing for the Progress of Artificial Intelligence.

[2] R. Moskovitch, C. Feher, A. Messerman, N. Kirschnick, T. Mustafic, A. Camtepe, B. Lohlein, U. Heister, S. Moller, L. Rokach, and Y. Elovici. Identity theft, computers and behavioral biometrics. In *2009 IEEE International Conference on Intelligence and Security Informatics*, pages 155–160, June 2009.