

Analyzing keystroke dynamics using transformations and successive averaging

Ashhadul Islam, Samir Brahim Belhauari





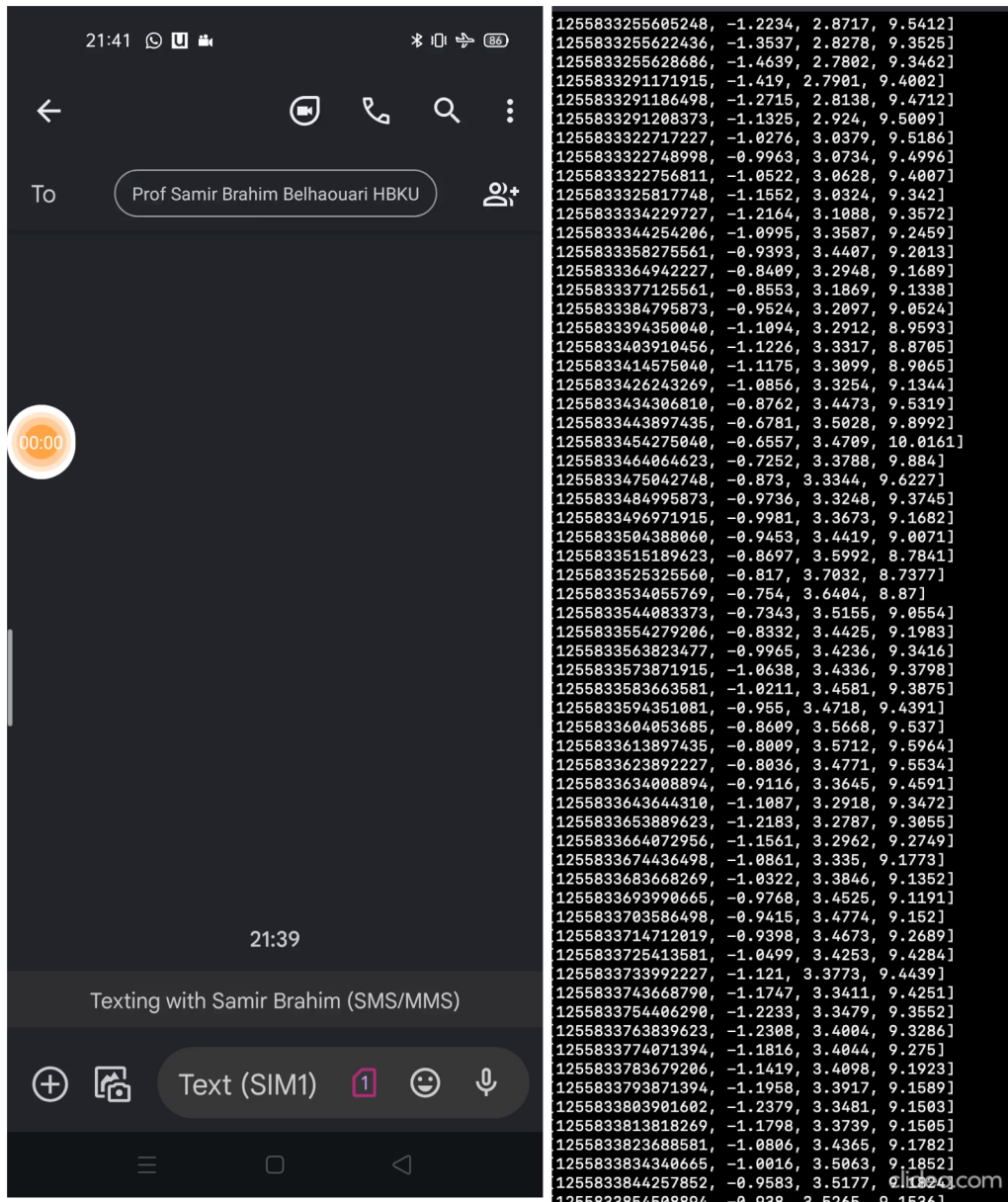
SECURITY IN A DIGITAL AGE

- First line of defense: passwords
- Bio-metric features
 - Face
 - Finger print
 - Iris
 - Additional hardware required
- One-Time Password
 - Expensive

KEY-STROKE DYNAMICS BASED AUTHENTICATION



- Behavioral authentication method
- Quantitative data from all user interaction with touchscreens and device sensors
- No need of additional hardware
- Useful for
 - Continuous monitoring of device usage
 - Detecting suspicious activity on a device



Typing 70 characters
in 43 seconds in a
smartphone
generates over 24480
rows of data by touch
sensors

Stragapede, Giuseppe, Ruben Vera-Rodriguez, Ruben Tolosana, and Aythami Morales,
'BehavePassDB: Benchmarking Mobile Behavioral Biometrics', 2022
<<http://arxiv.org/abs/2206.02502>>



FEATURE EXTRACTION FROM HIGH VOLUME DATA IN SHORT TIME

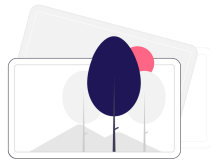
DATA TRANSFORM AND SUCCESSIVE AVERAGING



Transform on each feature

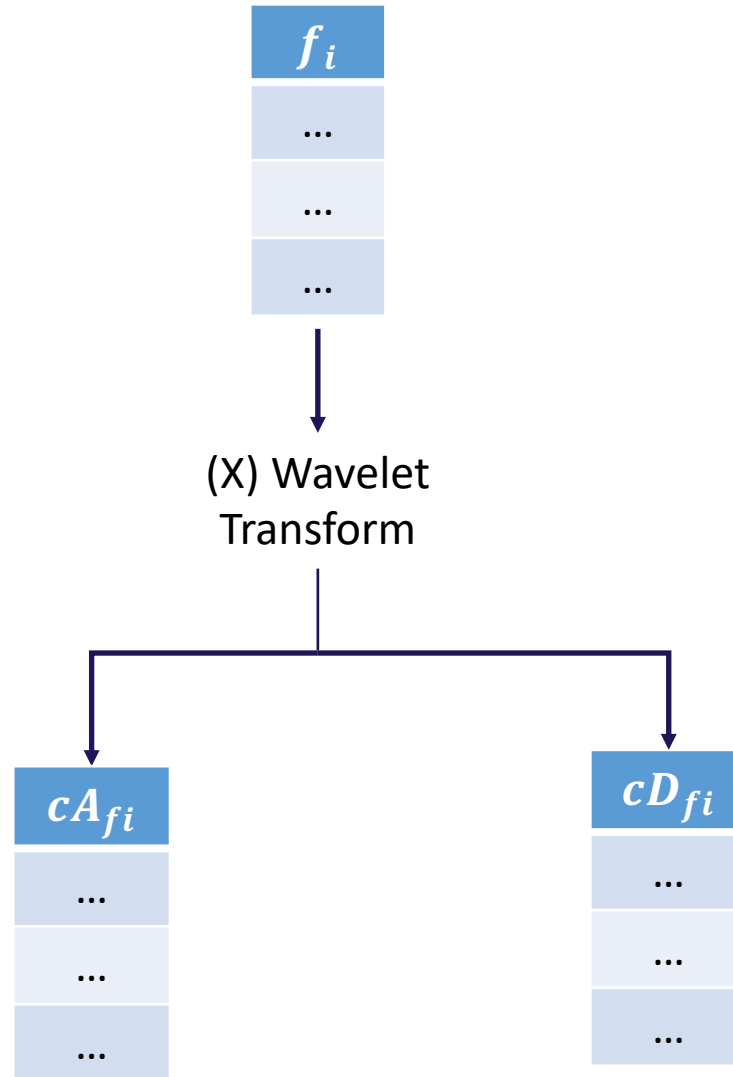


Successive averaging of generated coefficients

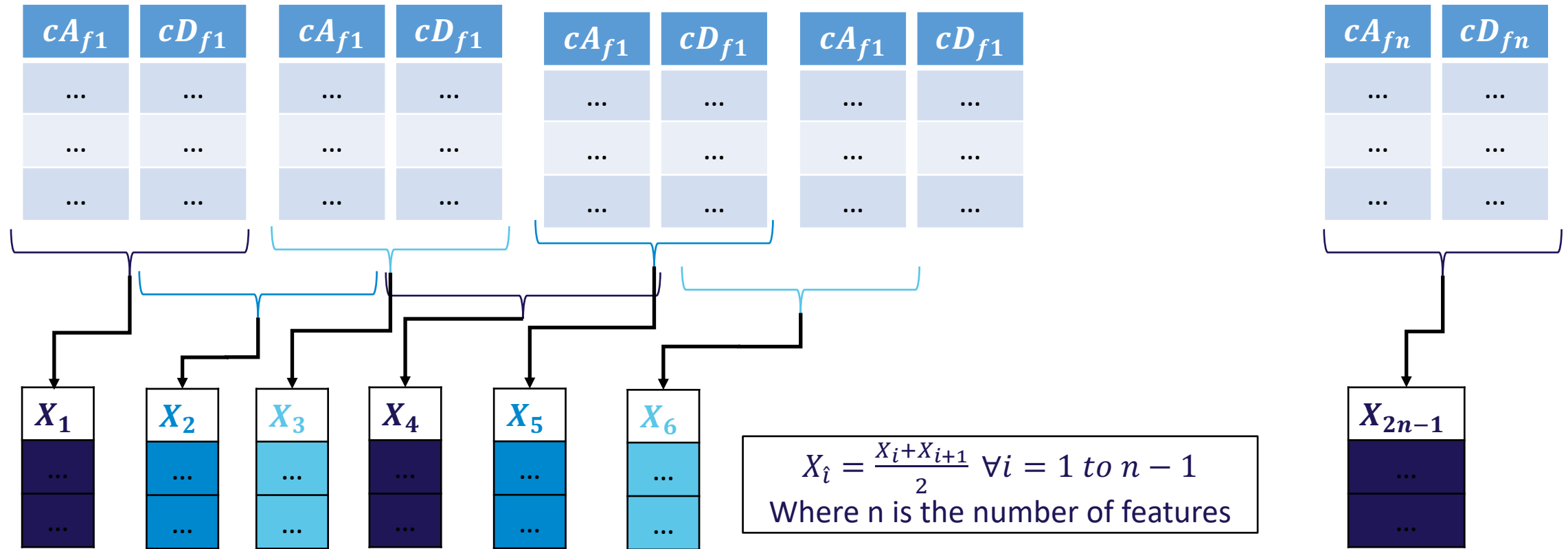


Combine to form RGB images

TRANSFORM ON EACH FEATURE

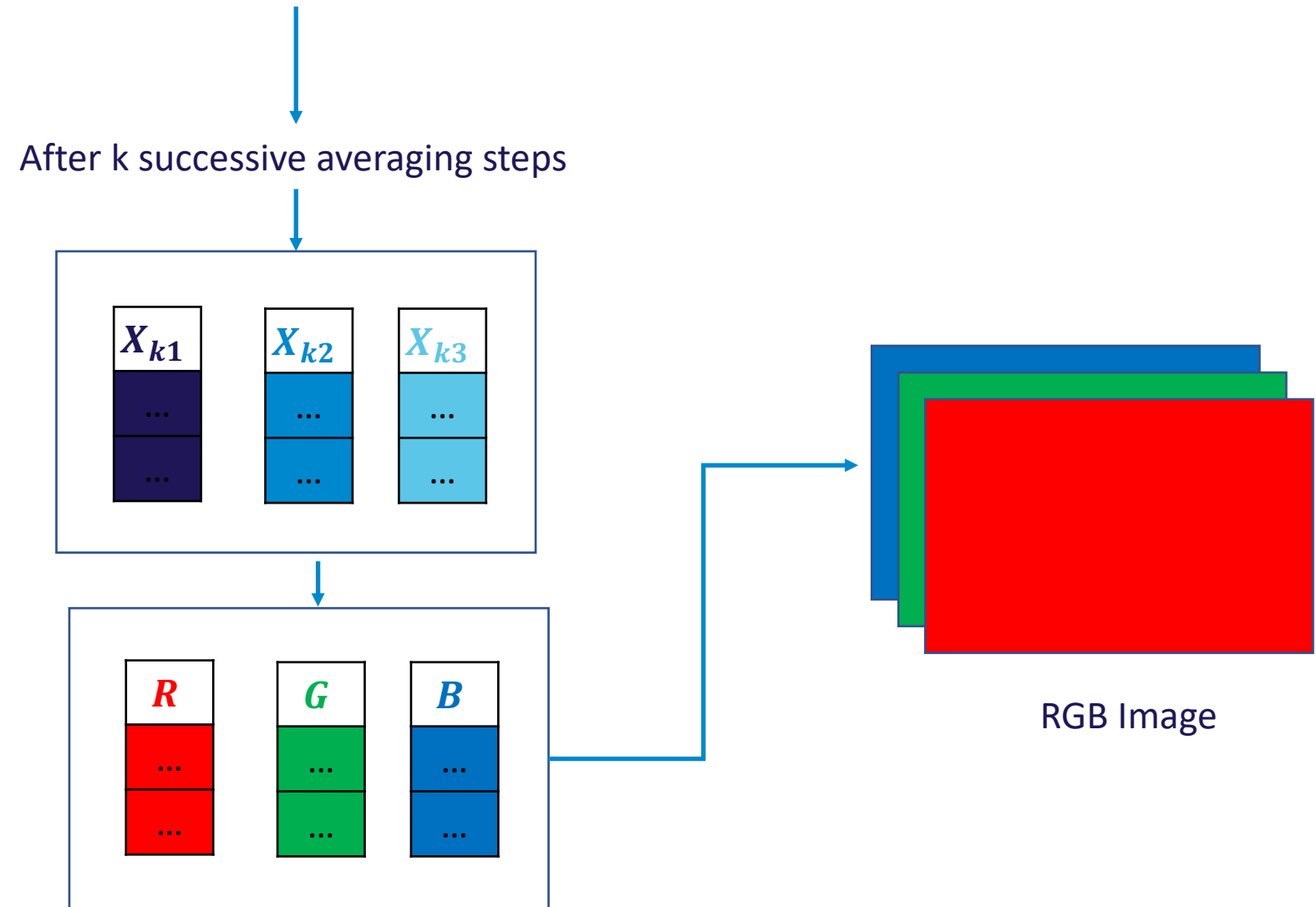


SUCCESSIVE AVERAGING



At every step, number of features created is 1 less than number of features in previous step

TRANSFORMATION





EXAMPLES ON KEY-STROKE DATASETS



DSL-STRONG PASSWORD DATA

51 subjects (typists), each typing a password (.tie5Roanl) 400 times

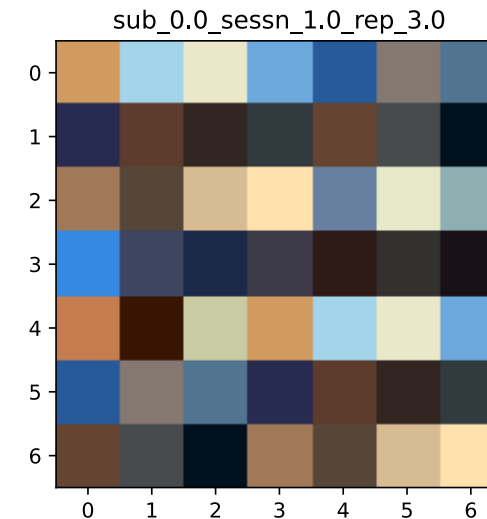
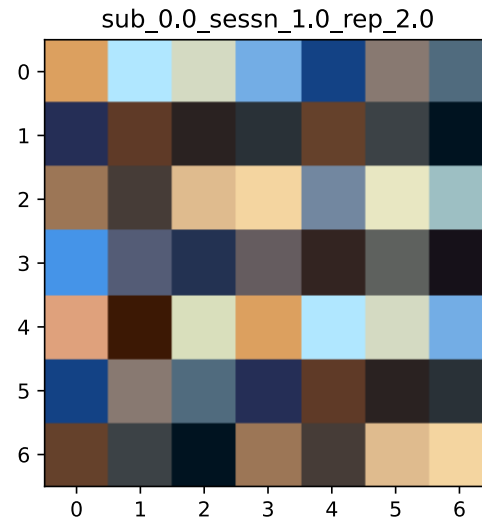
Kevin S. Killourhy and Roy A. Maxion. "Comparing Anomaly Detectors for Keystroke Dynamics," in Proceedings of the 39th Annual International Conference on Dependable Systems and Networks (DSN-2009), pages 125-134, Estoril, Lisbon, Portugal, June 29-July 2, 2009. IEEE Computer Society Press, Los Alamitos, California, 2009

T. Sing, O. Sander, N. Beerenwinkel, T. Lengauer. "ROC: visualizing classifier performance in R," Bioinformatics 21(20):3940-3941 (2005).



DSL-STRONG PASSWORD DATA

Same subject performing same activity at different sessions



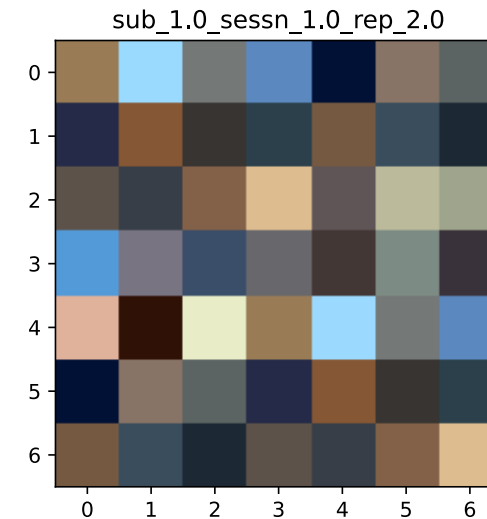
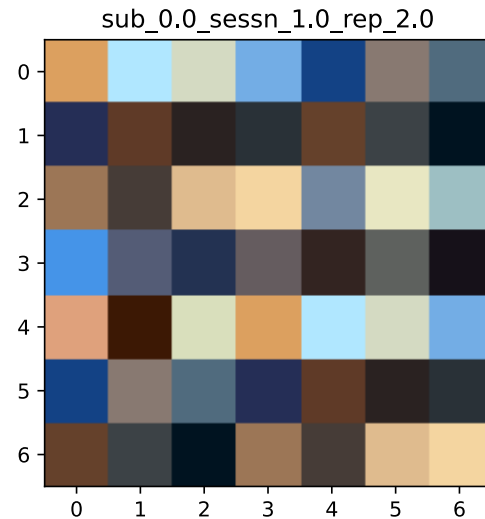
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DSL-STRONG PASSWORD DATA

Different subjects performing same activity



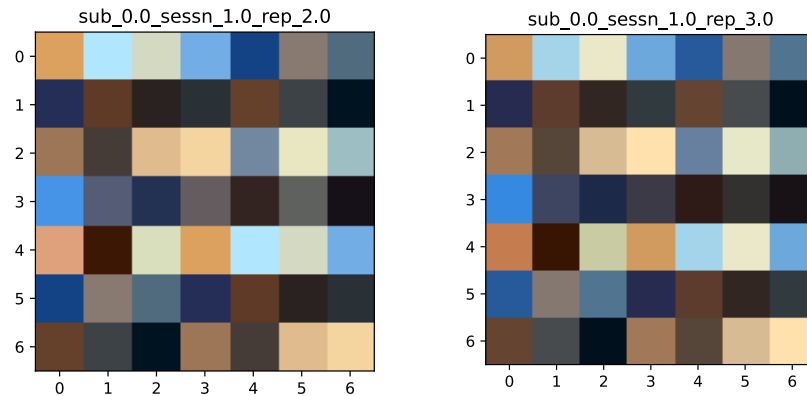
Kevin S. Killourhy and Roy A. Maxion. "Comparing Anomaly Detectors for Keystroke Dynamics," in *Proceedings of the 39th Annual International Conference on Dependable Systems and Networks (DSN-2009)*, pages 125-134, Estoril, Lisbon, Portugal, June 29-July 2, 2009. IEEE Computer Society Press, Los Alamitos, California, 2009

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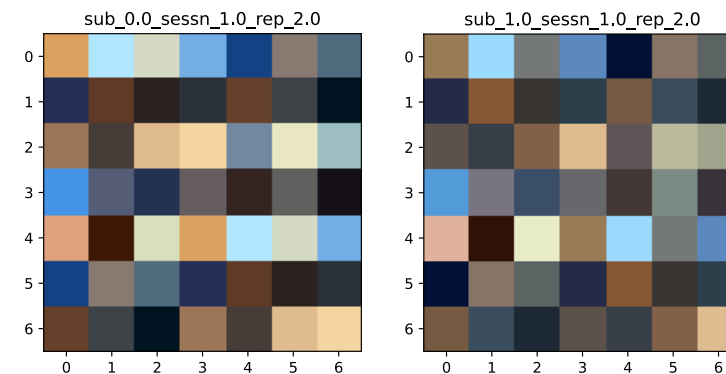


DSL-STRONG PASSWORD DATA

Same subject performing same activity at different sessions



Different subjects performing same activity



Kevin S. Killourhy and Roy A. Maxion. "Comparing Anomaly Detectors for Keystroke Dynamics," in *Proceedings of the 39th Annual International Conference on Dependable Systems and Networks (DSN-2009)*, pages 125-134, Estoril, Lisbon, Portugal, June 29-July 2, 2009. IEEE Computer Society Press, Los Alamitos, California, 2009

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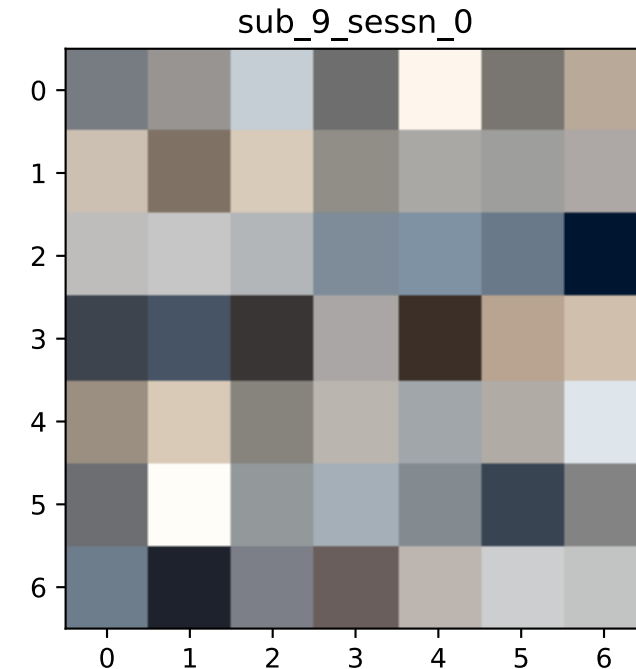
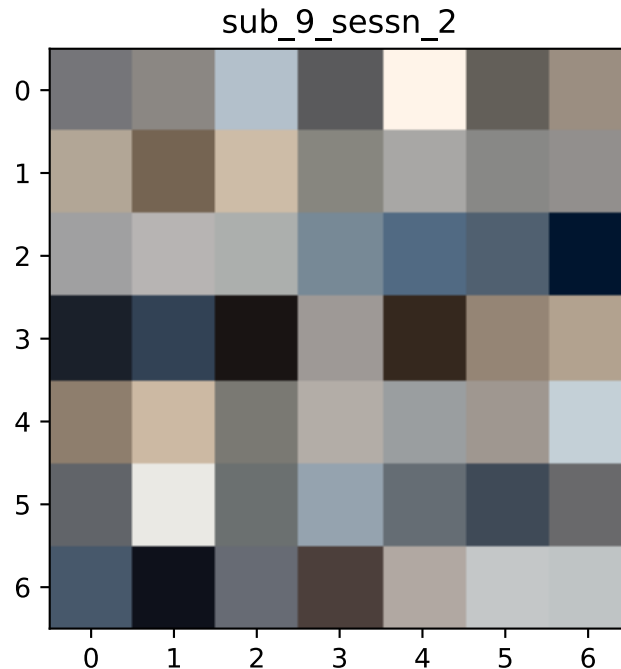
RHU KEYSTROKE DATA

53 participants typing the term "rhu.university" 15 times in 3 sessions



RHU KEYSTROKE DATA

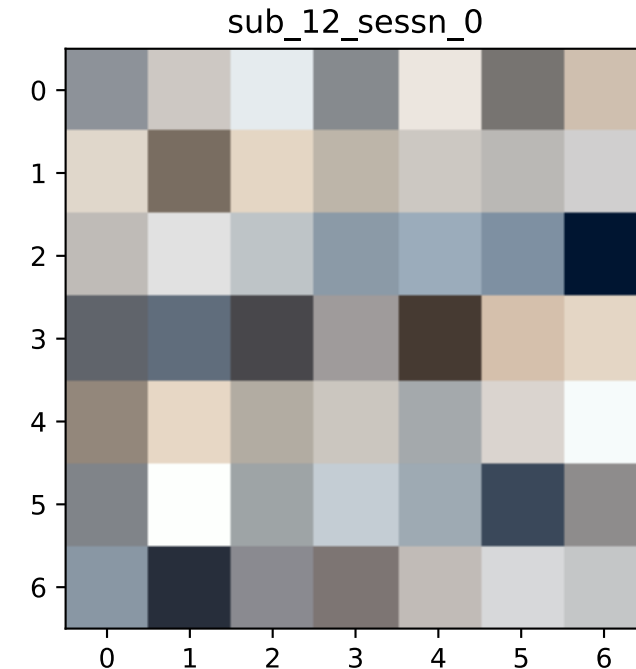
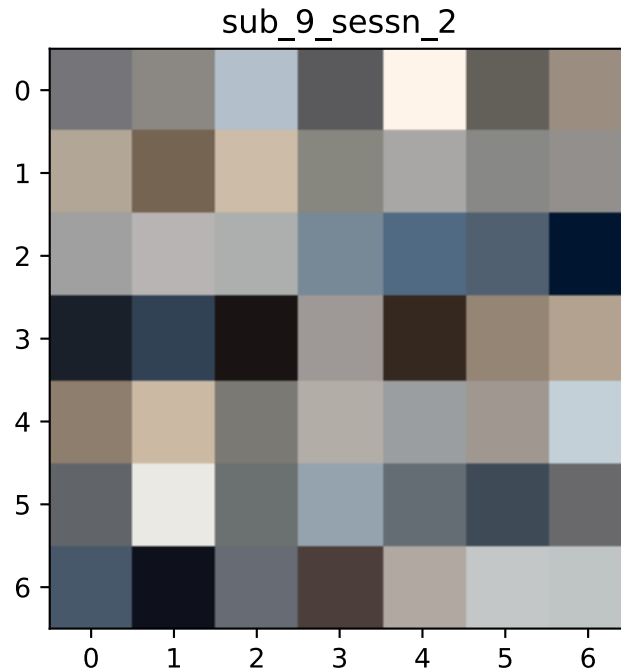
Same subject performing same activity at different sessions





RHU KEYSTROKE DATA

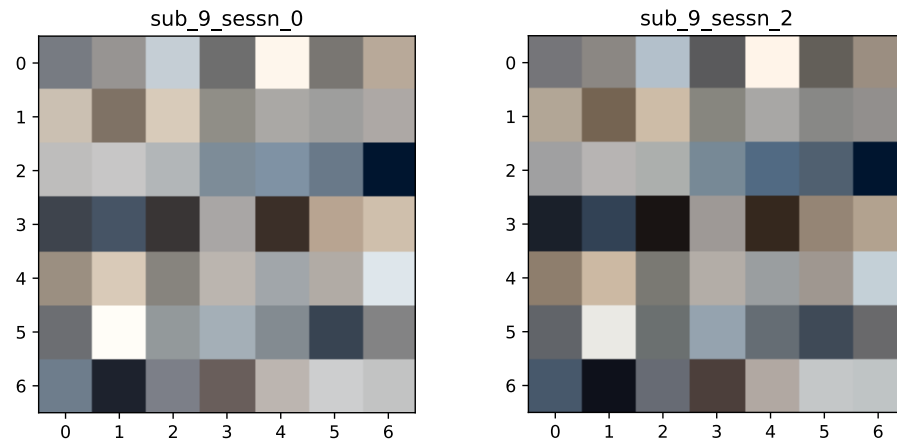
Different subjects performing same activity



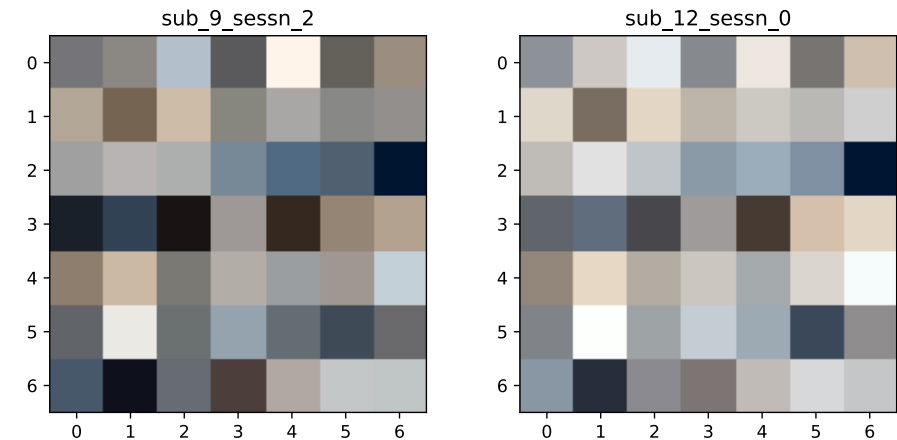


RHU KEYSTROKE DATA

Same subject performing same activity
at different sessions



Different subjects performing
same activity





BEHAVE PASS DB

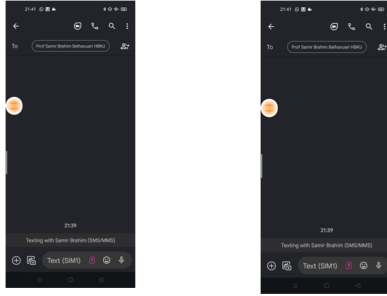
Includes several touch gestures

- Free-text keystroke
- Swipe
- tap dynamics

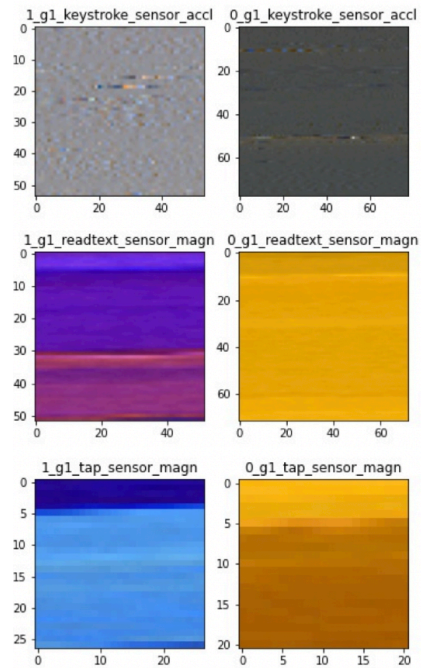
Background sensors

- Accelerometer
- Gyroscope
- Magnetometer
- linear accelerometer
- gravity sensor).

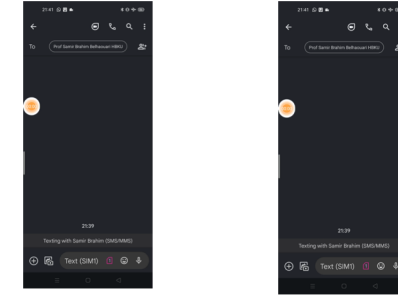
EXAMPLE



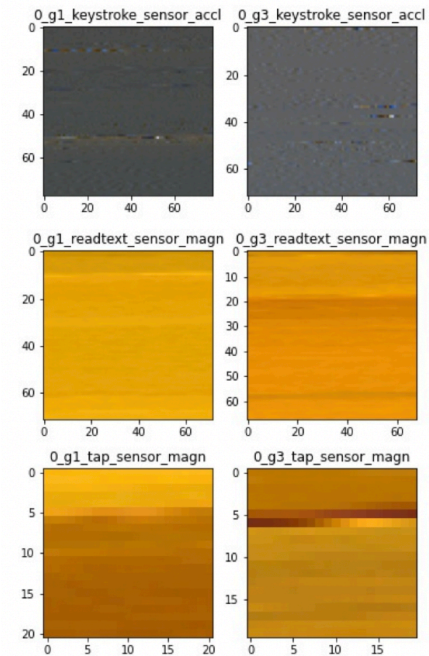
Impersonator vs authentic user.



Stragapede, Giuseppe, Ruben Vera-Rodriguez, Ruben Tolosana, and Aythami Morales, 'BehavePassDB: Benchmarking Mobile Behavioral Biometrics', 2022 <<http://arxiv.org/abs/2206.02502>>



Authentic User performing same activity





GITHUB REPOSITORY WITH SAMPLE TRANSFORMATION CODE

<https://github.com/ashhadulislam/ICCST2022KeyStrokeDynamics>

Contacts:

1. Dr Samir Brahim Belhaouari
 - sbelhaouari@hbku.edu.qa
2. Ashhadul Islam
 - aislam@hbku.edu.qa