

# Headbanger: Authenticating Smart Wearable Devices Using Unique Head Movement

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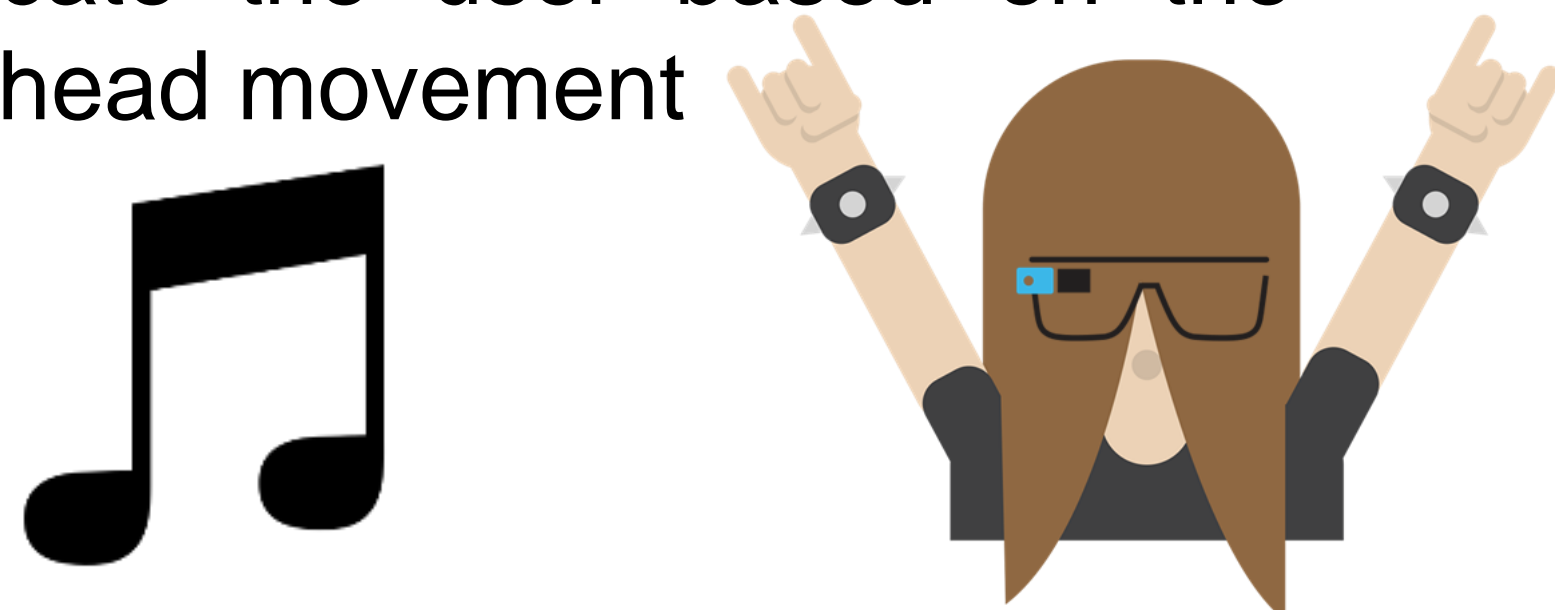
## Head Movement for Authentication

### Challenges:

- For the head movement:
  - No long-term personal habit
  - Low degree of freedom
- For the device:
  - Limited input & display area
  - Constraint computing resource

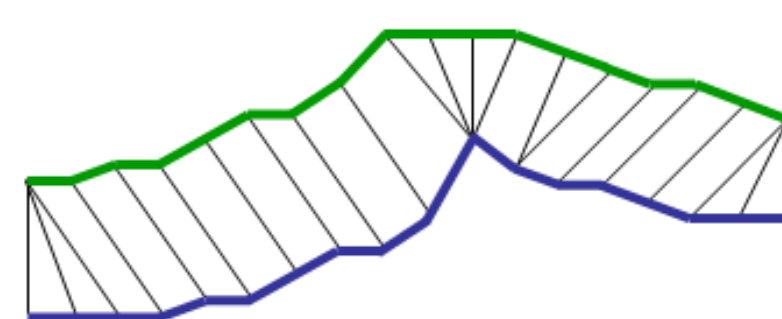
### Our solution:

1. Induce the user by a music cue
2. Authenticate the user based on the musical head movement

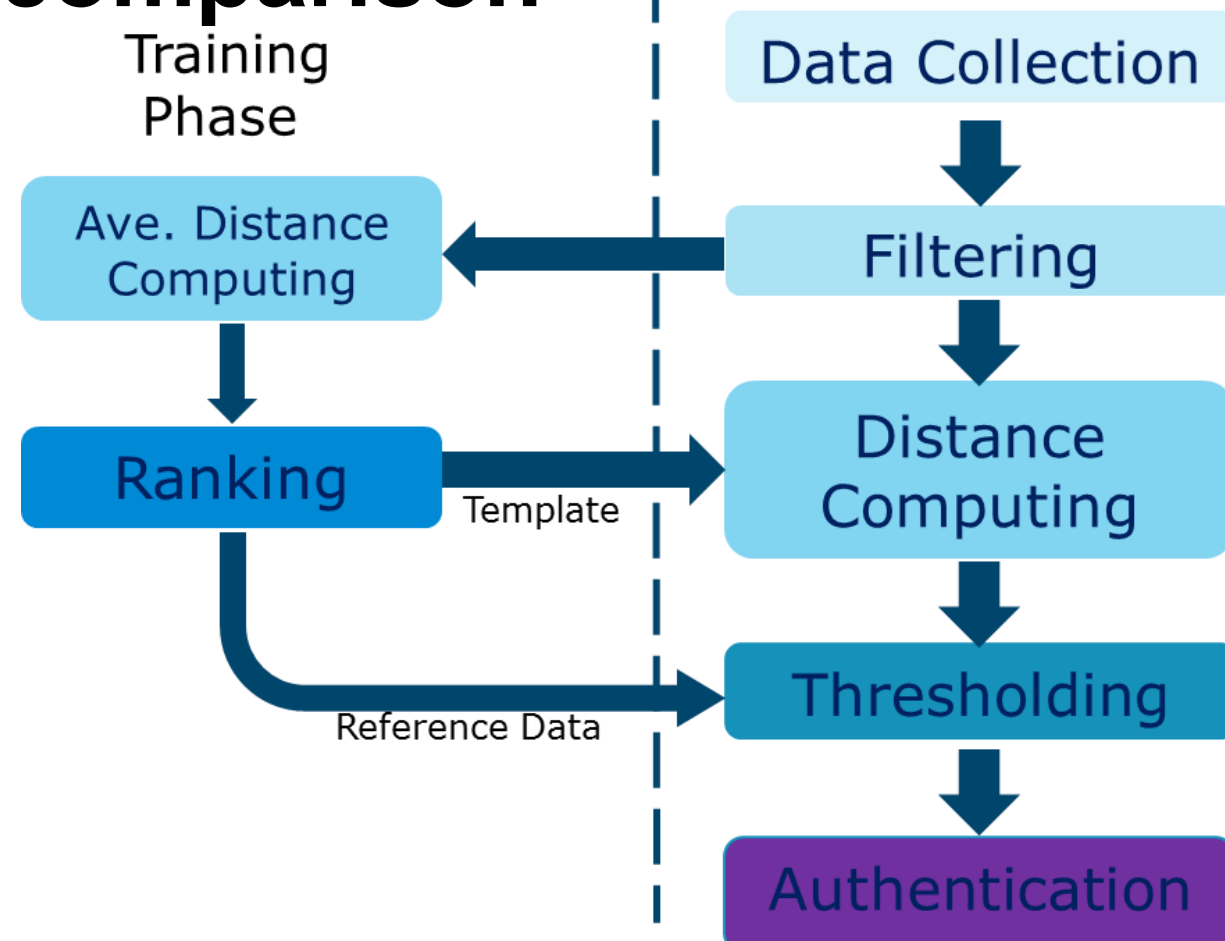


## System Overview

- Filtering: remove high frequency noise
- Distance computing: use Dynamic Time Warping to find the best alignment path

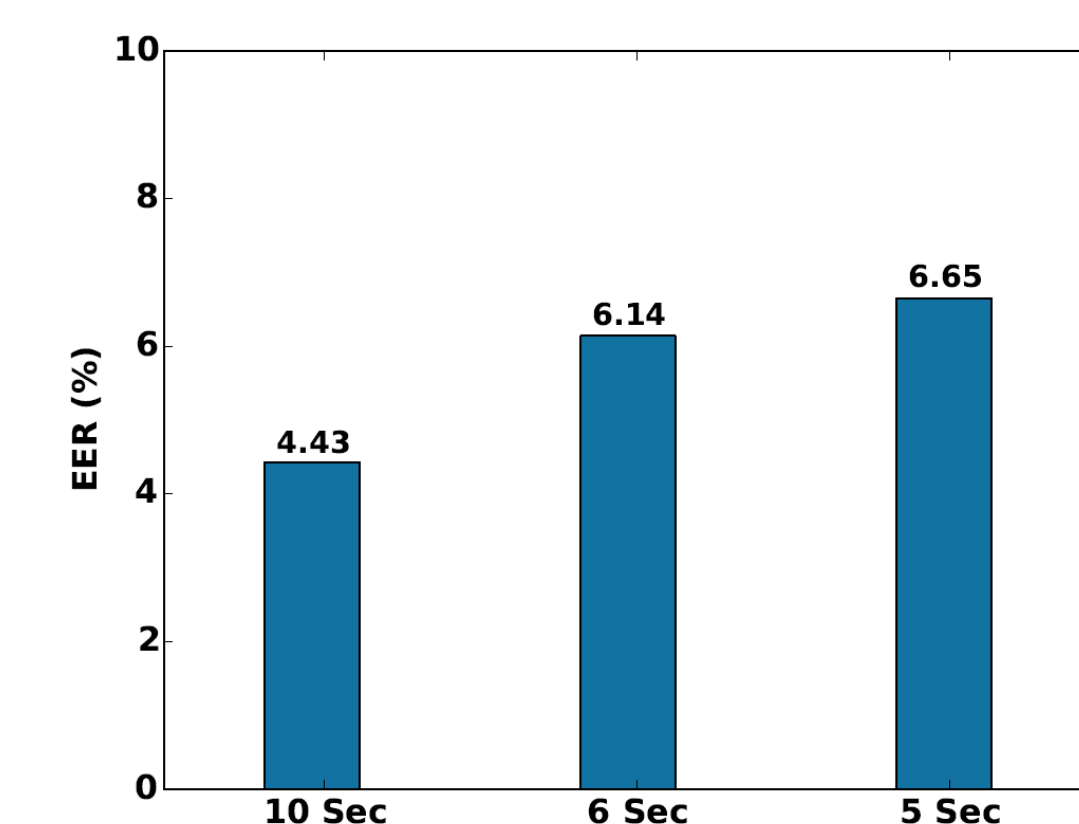


- Ranking: find the represented samples for the comparison



## Performance

- Low Equal Error Rate (EER) : 4.43%

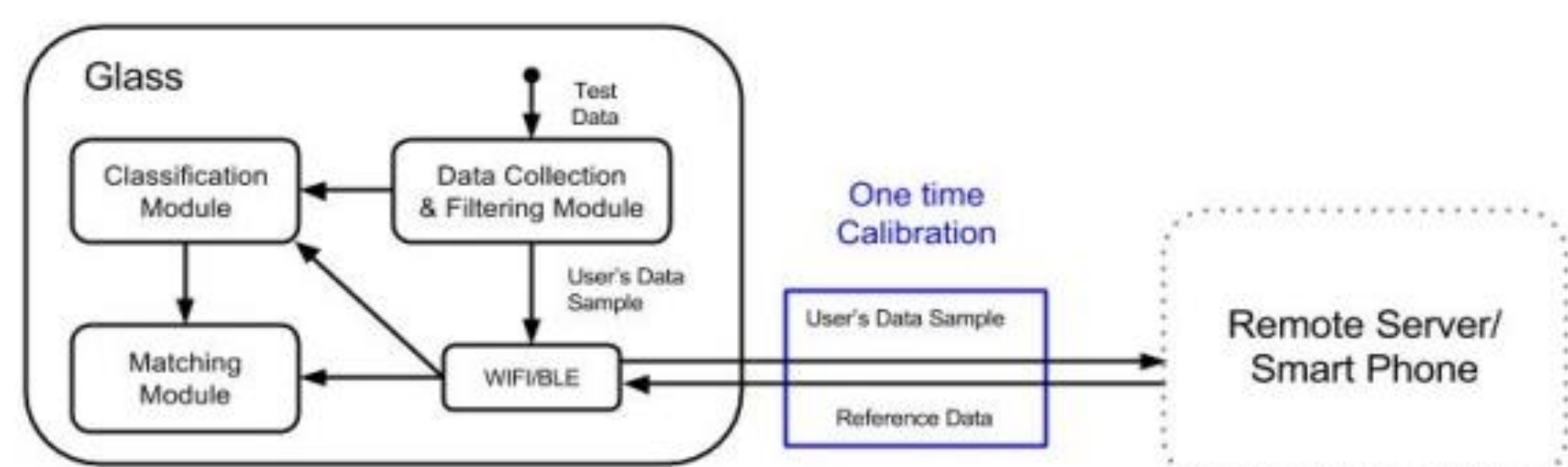


- Low False Accepted Rate in Attack Mode : 6.94%

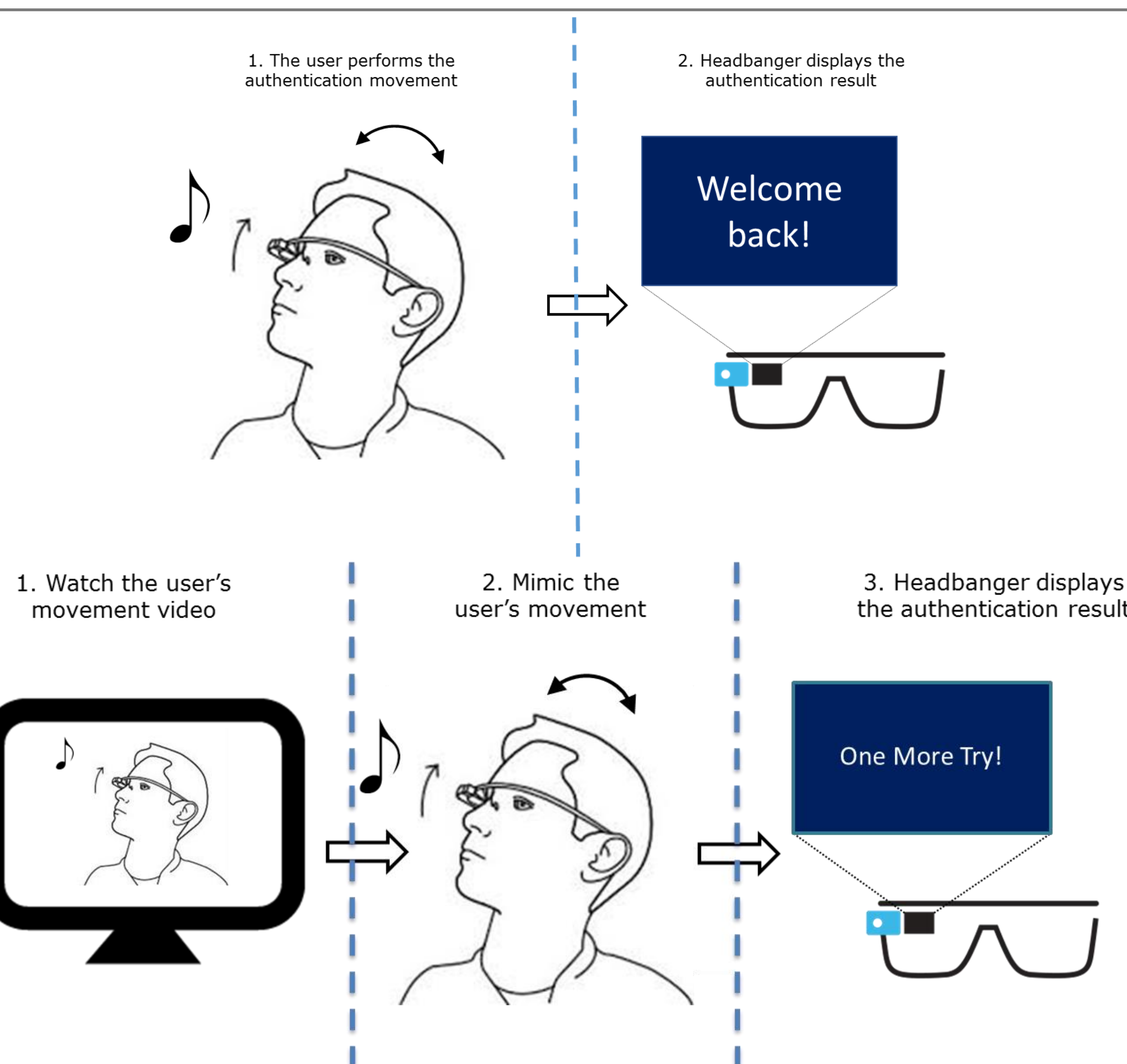
Target	# of Attackers	# of Successful Attackers	Average # of Trails before 1 <sup>st</sup> Successful Attack	FAR (%)
A	12	7	10	15.83
B	13	3	14	2.77
C	12	3	17	2.72
Overall	38	13	13	6.94

## Prototype

- Google Glass SDK
- Java Speech Tool Kits
- Fast DTW:  $O(n^2) \rightarrow O(n)$



## Demo Scenario : Attack Challenge



### Owner can be authenticated:

1. Owner wears the Glass and perform the movement
2. The Glass displays "Welcome Back !"

### Attacker imitates the Owner:

1. Attacker watches the video
2. Attacker tries to mimic the movement shown in the video
3. Headbanger displays the result of this attack.