Reconstruction of Periscope

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1 Data Collection

Figure 1: Illustration of the prototype

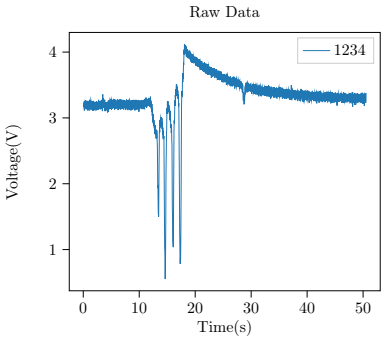

Figure 2: Digit sequence "1234"

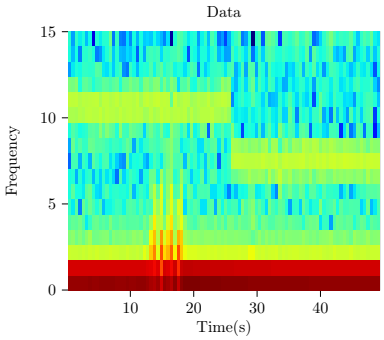

Figure 3: Spectrogram of the raw data

where $|V_m(t)|$ is the amplitude of the measured voltage, $|V_m(t)|^*$ is the maximum value of the measurement. We use 0.6 mm as z_{min} for our device iPhone 8.

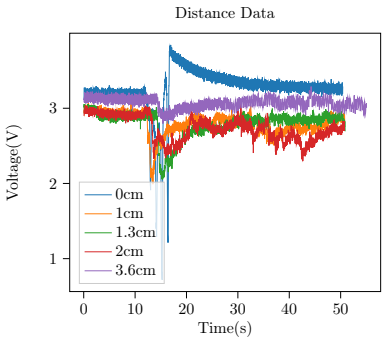

Figure 4: Data collected for calibration of the parameter

2 Data Processing

2.1 Spectrogram

Here is one example of the spectrogram.

2.2 Calibration of γ_1 and γ_2

In the paper, the distance from the finger to the screen $z(t)$ is estimated by:

$$z(t) = 1/(\frac{2\gamma_1}{1 - \frac{|V_m(t)|}{|V_m(t)|^*}\frac{3}{5}} - 4 + \gamma_2) \times z_{min} \quad (1)$$

Data Processing:

- Hold the finger at a fixed distance to the screen and measure the distance
- The base voltage is set as the minimum value of the envelope of the raw data.
- For 0CM data, we touch the screen four times and use the maximum value of the voltage. For other data, we use the first peak data as the recorded voltage.

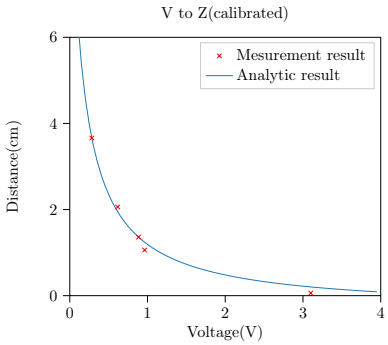

Figure 5: Calibration result

3 Fitting the trace

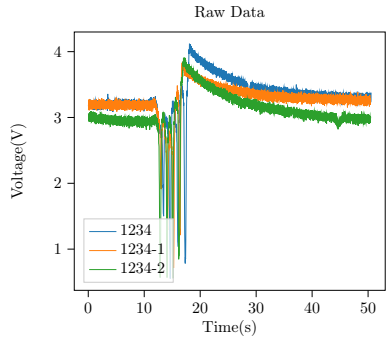

Figure 6: Three digit sequences of "1234"

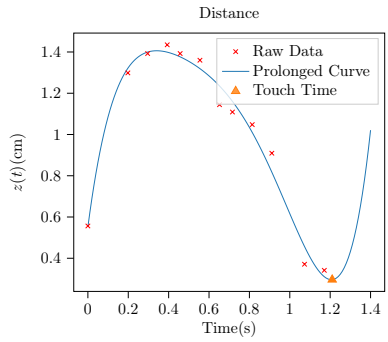

Figure 7: One example of key pair

The final prediction for the raw data is:

Data Label	Move
1234	[0,1], [0,1], [0, 1]
1234-1	[1,1], [0,1], [0, 1]
1234-2	[0,1], [1,1], [1, 1]

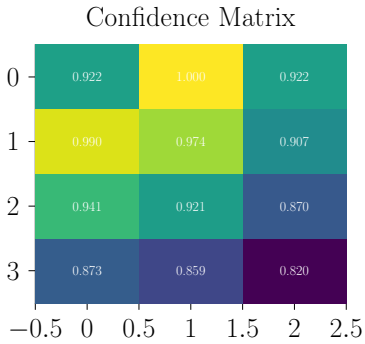

Figure 8: Confidence matrix of the key pair