

Investigating Multi-touch Gestures as a Novel Biometric Modality

Multi-touch Gestures





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Gesture Recognition

Preprocessing 1.

200

300

400

500

2.

Sorting the set of touch points according to the corresponding fingertips

$$f_{t} = \underset{f}{\operatorname{argmin}} \sum_{i \in I} \|f_{t-1}^{-1}(i) - f^{-1}(i)\|$$

s.t. the sorted set constructs a simple polygon

Feature Transformation

Transforming the point sets from Cartesian coordinate system to Euclidean distances among the members

$$F_t(i,j) = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2},$$

$$F'_t(i,k) = \sqrt{(x_i^t - x_{i+k}^{t+1})^2 + (y_i^t - y_{i+k}^{t+1})^2}, k = 0,$$

DTW and Frechet dist. with the following matching cost:

- Manhattan distance
- Euclidean distance
- Cosine distance
- **Decision Rules** 4.
 - K-nearest neighbors
 - Score-based rule

$$Score\left(G,T^*\right) = \min_{i}\left(D\left(T^*_i,G\right)\right)$$

Results

TABLE III: EER for DTW distance function of 20 features set with three different cost functions based on score-based classifier

Gesture	First 5 samples training			Leave-one-out test		
	d_M	d_E	d_C	d_M	d_E	d_C
'CCR'	5.50	4.95	8.14	2.54	2.84	4.34
'CR'	7.21	7.26	9.45	4.32	4.30	6.93
'Close'	8.34	9.02	9.15	4.86	5.13	7.30
'Drag'	9.50	9.56	8.69	6.64	6.57	6.19
'DDC'	4.46	4.43	8.14	2.62	2.83	5.31
'DUO'	6.80	6.53	8.70	3.70	4.24	6.28
'FBD'	11.53	11.62	13.13	9.36	9.0	9.79
'FBSB'	6.85	7.89	6.61	4.67	4.52	5.27
'FBSA'	9.96	9.84	11.27	4.60	4.49	6.17
'FPCCR'	10.60	10.60	10.63	3.84	3.75	4.88
'FPC'	8.83	8.87	11.46	5.34	5.99	6.08
'FPO'	13.32	14.45	12.42	8.70	8.01	8.88
'FPP'	11.01	10.80	13.85	6.71	6.17	6.79
'FTCCR'	4.48	4.54	5.33	3.37	3.36	4.21
'FTCR'	6.22	6.42	7.98	2.68	2.87	5.69
'FTC'	5.88	5.94	8.88	3.92	4.17	5.54
'FTO'	9.52	9.39	9.98	5.23	4.82	7.30
'FTP'	4.66	4.91	7.36	5.07	5.18	7.12
'Flick'	10.75	10.98	12.85	6.54	6.91	9.49
'Open'	6.80	8.02	9.90	4.80	5.16	8.30
'Scrawl'	2.98	2.85	5.86	1.38	1.07	3.52
'Swipe'	8.25	9.00	10.14	5.80	6.16	7.31
verage EER	7.88	8.09	9.54	4.85	4.89	6.49



Detection error trade-off curve of different combinations and the base line curves from a single gesture using first five samples as the templates

