SHARK2 Decoder

Task

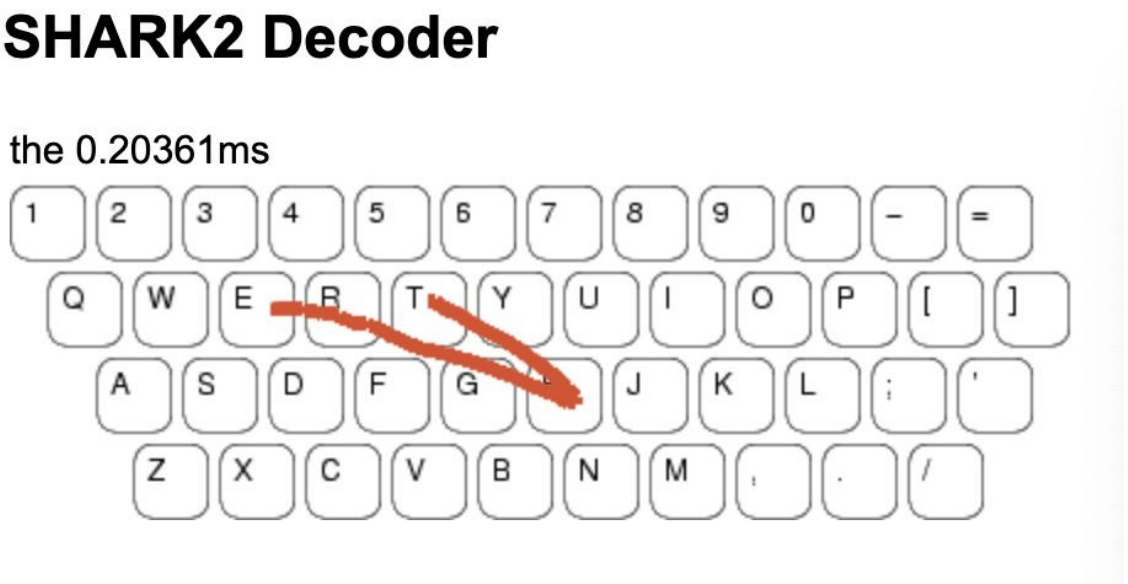
Given a dictionary containing 10000 words, use SHARK2 algorithm to decode a user input gesture and output the best decoded word.

Important reference: http://pokristensson.com/pubs/KristenssonZhaiUIST2004.pdf

Please go through the algorithm part of this paper so that you can implement it correctly.

PyCharm CE recommended.

Demo


SHARK2 Decoder
the 0.20361ms
1 2 3 4 5 6 7 8 9 0 - =
Q W E R T Y U I O P [ ]
A S D F G J K L ; '
Z X C V B N M , . /

Sampling

SHARK2 actually is doing camparations between user input pattern with standard templates of each word.

When we compare different patterns, it is important to make them comparable.

No matter how long or how short the gesture is, we uniformly sample 100 points along the pattern.

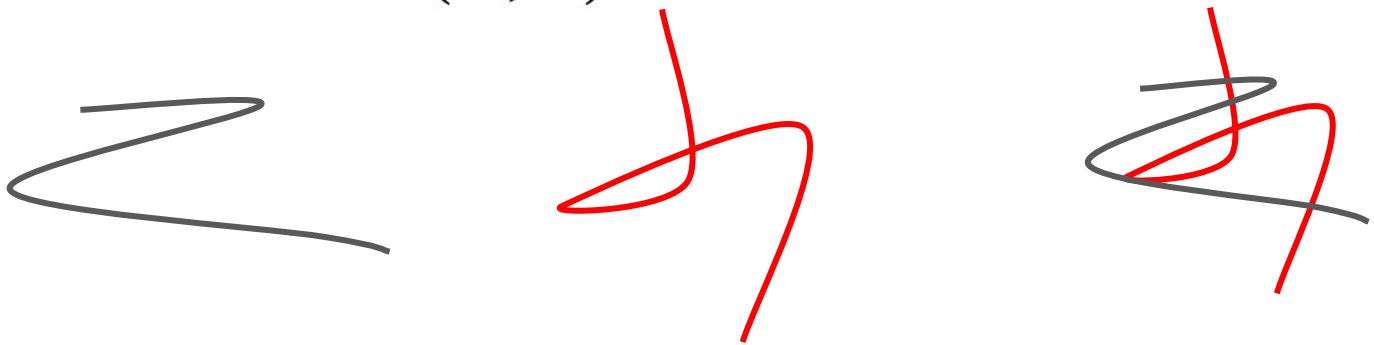
Pruning

Compute start-to-start and end-to-end distances between a template and the unknown gesture.

Note that the two patterns are all normalized in scale and translation.

Normalization is achieved by scaling the largest side of the bounding box to a parameter L.

$$s = L / \max(W, H)$$



Shape Channel

Relative coordinate, normalized

$$x_s = \frac{1}{N} \sum_{i=1}^{N} \left\| u_i - t_i \right\|_2$$

Location Channel

Absolute coordinate, unnormalized

$$x_L = \sum_{i=1}^{N} \alpha(i)\delta(i) \tag{3}$$

where N is the number of points in the patterns. δ is defined as:

$$\delta(i) = \begin{cases} 0, & D(u,t) = 0 \wedge D(t,u) = 0 \\ \left\| u_i - t_i \right\|_2, & \text{otherwise} \end{cases} \tag{4}$$

where u_i is the i th point of u. D is in turn defined as:

$$D(p,q) = \sum_{i=1}^{N} \max\left(d(p_i,q) - r, 0\right) \tag{5}$$

where d is

$$d(p_i,q) = \min\left(\left\| p_i - q_1 \right\|_2, \left\| p_i - q_2 \right\|_2, \ldots, \left\| p_i - q_N \right\|_2\right) \tag{6}$$

Integration

Integration score = a * shape score + b * location score

where a + b = 1

Determine a good (a, b) by yourself.

Get Best Word

Select top-N, say, top-3 words with highest integration scores.

Multiply with their corresponding probabilities.

For example, integration_score(“too”) == integration_score(“to”), since prob(“too”) < prob(“to”), integration_score(“too”) * prob(“too”) < integration_score(“to”) * prob(“to”)

Hence we choose word “to” and algorithm terminated.

Grading

Please check the assignment folder and locate Python file server.py. All work you should do is within this server.py file. You don’t need to worry about the front-end things.

Five core functions in server.py: 12 points each, 60 in total

10 words for testing and 2 times for each word: 40 points in total

Time penalty: If your decoding time is longer than a threshold (TBD but must be reasonable), deduct 10 points.

Time reward: If your average running time is ranked in top-3 among the peers under the same grading TA, reward 10 points.

Turning in

Upload a zip file named as [LastName]_[FistName]_[SBU_ID].zip on Blackboard, for example, Jordan_Michael_111222333.zip, containing:

-SHARK2 project folder

-README.txt, anything you want to point it out.

TA Info

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We still have 3 more TAs, whose office hours and contacts will posted on Piazza soon.