

Homework

SHARK2 Decoder

Task

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

SHARK2 Decoder

the 0.20361ms

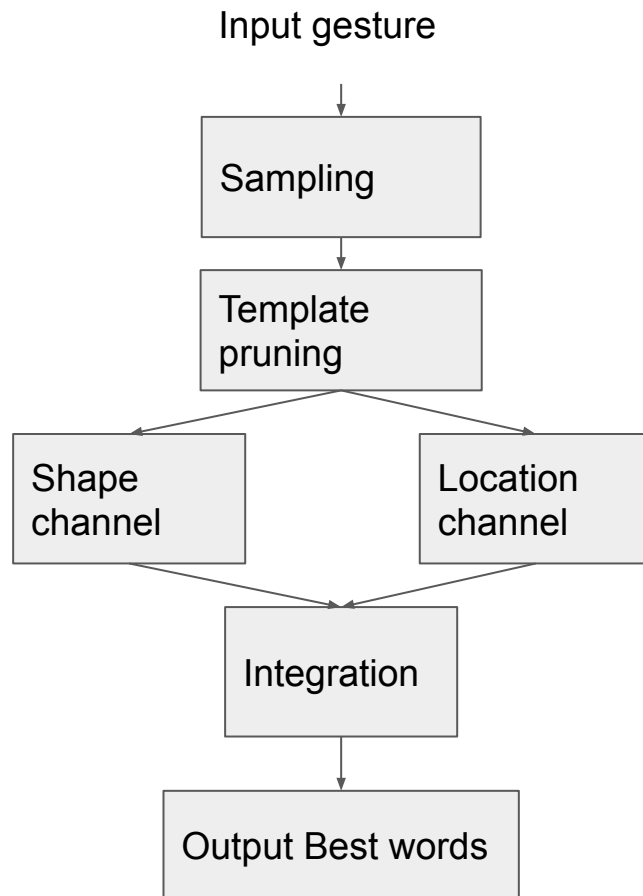


Important reference: <http://pokristensson.com/pubs/KristenssonZhaiUIST2004.pdf>

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

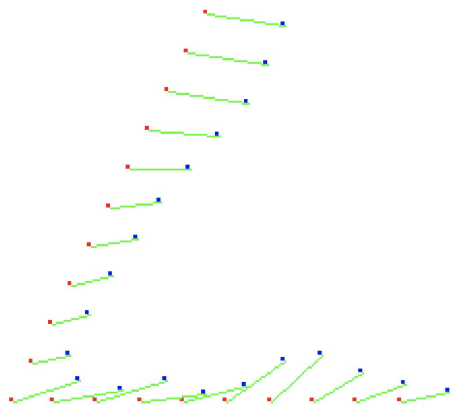
PyCharm IDE recommended.

SHARK2 overview



Sampling

To make the input gestures and the standard templates comparable, SHARK2 uniformly samples 100 points from the gestures or templates, no matter how long or how short the gesture is.



Template Pruning

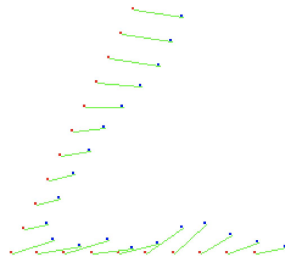
To filter out some templates, SHARK2 computes start-to-start and end-to-end distances between a template and the unknown gesture.

If either of the two distances is greater than a set threshold, the template will be discarded.

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 pre-determined length L .

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



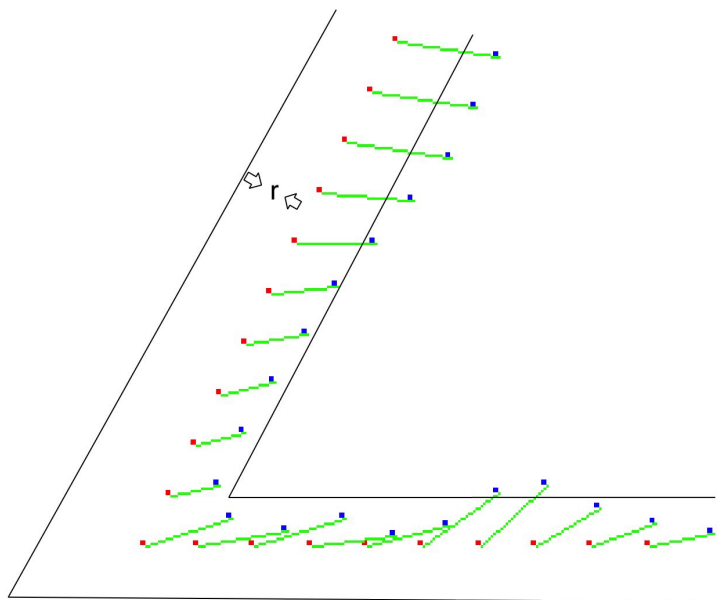
Shape Channel

Relative coordinate, normalized

$$\mathbf{x}_s = \frac{1}{N} \sum_{i=1}^N \|\mathbf{u}_i - \mathbf{t}_i\|_2$$

Location Channel

Absolute coordinate, unnormalized



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

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

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

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

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

where d is

$$d(p_i, q) = \min(\|p_i - q_1\|_2, \|p_i - q_2\|_2, \dots, \|p_i - q_N\|_2) \quad (6)$$

Integration

Integration score = $a * \text{shape score} + b * \text{location score}$

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.

$\text{Final_score}(x) = \text{integration_score}(x) * \text{word_probability}(x)$

The probabilities for words are in 'words_10000.txt'.

the	1204816	0.07088129435243373
of	606545	0.03568403364745896
and	595372	0.03502670779703886

Grading

Please check the assignment folder and locate Python file `server.py`. All work you should do is within this `server.py` file.

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]_[FirstName]_[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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