

A simple symbol recognition application

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Define, organize and visualize a dataset of symbols defined with mouse movements.

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Train a HMM-based recognition engine on a symbol dataset.

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Recognize new symbols and view classification metrics.

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Train a HMM-based recognition engine on a symbol dataset.

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Recognize new symbols and view classification metrics.

Default included symbols: **left arrow**, **right arrow**, **circle**, **square**, **infinity**

A simple symbol recognition application - A View

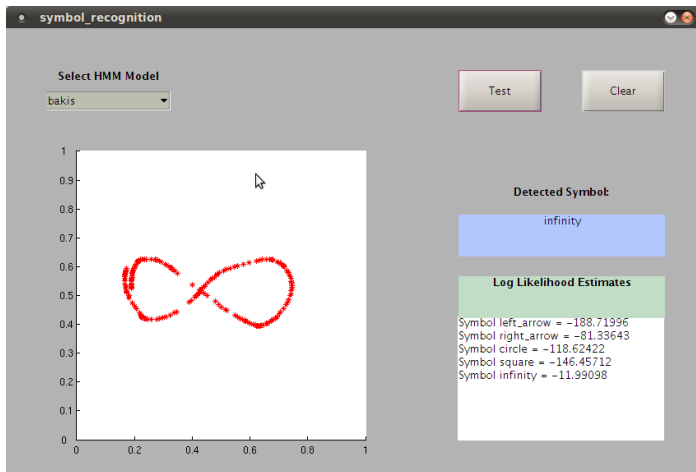
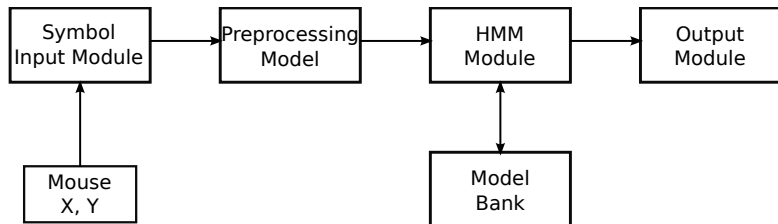


Figure: A view of the symbol recognition application GUI

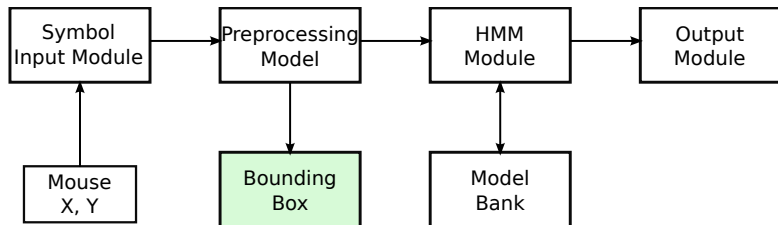
A simple symbol recognition application - Approach (I)

Adapted from (Yang and Xu 1994).



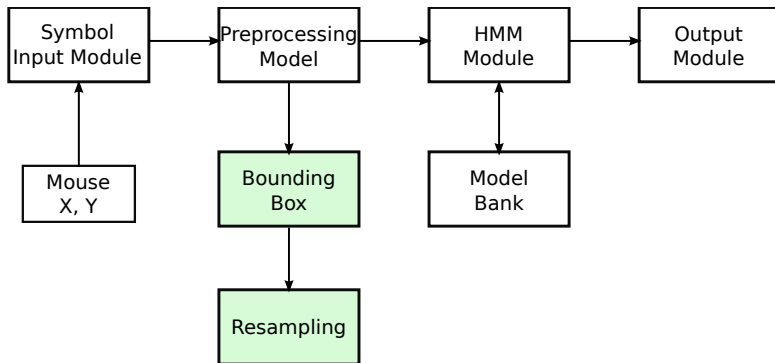
A simple symbol recognition application - Approach (I)

Adapted from (Yang and Xu 1994).



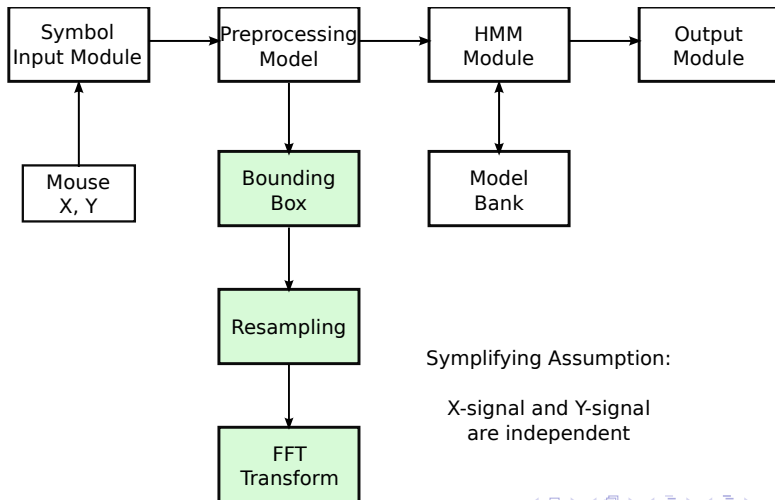
A simple symbol recognition application - Approach (I)

Adapted from (Yang and Xu 1994).



A simple symbol recognition application - Approach (I)

Adapted from (Yang and Xu 1994).



A simple symbol recognition application - Approach (II)

Adapted from (Yang and Xu 1994).

HMM Structure

$N(\text{number of states}) = 8$

2 discrete observable variables per state - $\text{coef}_{FFT}(x)$, $\text{coef}_{FFT}(y)$

$M(\text{number of values for each observable variable}) = 256$

Transition model:

- Bakis
- Ergodic

A simple symbol recognition application - Results

Dataset size

5 symbols: left arrow, right arrow, circle, square, infinity

100 samples per symbol: 50 training, 10 validation, 40 testing

```
>> symbol_performance_test('ergodic')
===== Testing trained HMM models =====
## Results for the model of symbol "left_arrow":
Accuracy: 0.97500
Precision: 1.00000
Recall: 0.97500
Confusion matrix line: 39 0 1 0 0 0

## Results for the model of symbol "right_arrow":
Accuracy: 1.00000
Precision: 1.00000
Recall: 1.00000
Confusion matrix line: 0 40 0 0 0 0

## Results for the model of symbol "circle":
Accuracy: 0.90244
Precision: 0.97368
Recall: 0.92500
Confusion matrix line: 0 0 37 2 1 0

## Results for the model of symbol "square":
Accuracy: 0.95238
Precision: 0.95238
Recall: 1.00000
Confusion matrix line: 0 0 0 40 0 0

## Results for the model of symbol "infinity":
Accuracy: 0.97561
Precision: 0.97561
Recall: 1.00000
Confusion matrix line: 0 0 0 0 40 0
```

```
>> symbol_performance_test('bakis')
===== Testing trained HMM models =====
## Results for the model of symbol "left_arrow":
Accuracy: 0.90000
Precision: 1.00000
Recall: 0.90000
Confusion matrix line: 36 0 1 0 0 3

## Results for the model of symbol "right_arrow":
Accuracy: 1.00000
Precision: 1.00000
Recall: 1.00000
Confusion matrix line: 0 40 0 0 0 0

## Results for the model of symbol "circle":
Accuracy: 0.97561
Precision: 0.97561
Recall: 1.00000
Confusion matrix line: 0 0 40 0 0 0

## Results for the model of symbol "square":
Accuracy: 0.97500
Precision: 1.00000
Recall: 0.97500
Confusion matrix line: 0 0 0 39 0 1

## Results for the model of symbol "infinity":
Accuracy: 1.00000
Precision: 1.00000
Recall: 1.00000
Confusion matrix line: 0 0 0 0 40 0
```