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1.

P1. Please specify the model parameters after the first and 50th iterations of Baum-Welch training

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P1-1: Please specify the model parameters after the first iterations of Baum-Welch training:
Trainset1:
Transition probability:
[[0.34033227 0.32986981 0.32979793]
 [0.33032246 0.33979929 0.32987825]
 [0.33040315 0.32979393 0.33980292]]
Observation probability:
[[0.37053146 0.29974655 0.32972199]
 [0.36034642 0.30933789 0.33031569]
 [0.36002181 0.30001528 0.33996291]]
Initial state probability:
[0.33334411 0.33223366 0.33442223]
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Trainset2:
Transition probability:
[[0.33935867 0.33128458 0.32935674]
 [0.32935716 0.34131791 0.32932493]
 [0.32935301 0.33127013 0.33937686]]
Observation probability:
[[0.26812754 0.45540232 0.27647014]
 [0.25870285 0.46646297 0.27483418]
 [0.2600776 0.45514096 0.28478143]]
Initial state probability:
[0.33219978 0.33446689 0.33333333]
#####
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P1-2: Please specify the model parameters after 50th iterations of Baum-Welch training
Trainset1:
Transition probability:
[[0.15333345 0.80217719 0.04448936]
 [0.04509576 0.11749123 0.83741301]
 [0.82929875 0.1002473 0.07045395]]
Observation probability:
[[0.91051143 0.06108324 0.02840533]
 [0.08138737 0.85181556 0.06679706]
 [0.07433977 0.0409133 0.88474693]]
Initial state probability:
[0.2989071 0.16097812 0.54011478]
-----
Trainset2:
Transition probability:
[[0.3650821 0.34082692 0.29409097]
 [0.34923008 0.35035579 0.30041413]
 [0.31900786 0.32600306 0.35498908]]
Observation probability:
[[0.29640311 0.46808624 0.23551065]
 [0.27084791 0.47614436 0.25300773]
 [0.21980044 0.4329042 0.34729536]]
Initial state probability:
[0.26581983 0.29951919 0.43466098]
#####
```

2.

P2. Please show the recognition results by using the above training sequences as the testing data (The so-called inside testing).

*You have to perform the recognition task with the HMMs trained from the first and 50th iterations of Baum-Welch training, respectively.

First iteration:

Accuracy: 77.7777777777779 %

50th iteration:

Accuracy: 100.0 %

```
#####
P2: Please show the recognition results by using the above training sequences as the testing data (The so-called inside testing).
First iteration:
Accuracy: 77.7777777777779 %
-----
50th iteration:
Accuracy: 100.0 %
```

3.

P3. Which class do the following testing sequences belong to?

ABCABCCAB

AABABCCCCBBB

```
P3. Which class do the following testing sequences belong to?
Using 50th iteration models.
test data 1: ABCABCCAB
test data 1 is model 1
-----
test data 2: AABABCCCCBBB
test data 2 is model 2
```

4.

P4. What are the results if Observable Markov Models were instead used in P1, P2 and P3?

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P1-1: Please specify the model parameters after the first iterations of Baum-Welch training:
Trainset1:
Transition probability:
[[0.15      0.8      0.05      ]
 [0.05555556 0.11111111 0.83333333]
 [0.89473684 0.      0.10526316]]
Observation probability:
[[1. 0. 0.]
 [0. 1. 0.]
 [0. 0. 1.]]
Initial state probability:
[0.33333333 0.22222222 0.44444444]
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Trainset2:
Transition probability:
[[0.38461538 0.46153846 0.15384615]
 [0.32      0.56      0.12      ]
 [0.07142857 0.28571429 0.64285714]]
Observation probability:
[[1. 0. 0.]
 [0. 1. 0.]
 [0. 0. 1.]]
Initial state probability:
[0.22222222 0.44444444 0.33333333]
#####
```

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P1-2: Please specify the model parameters after 50th iterations of Baum-Welch training
Trainset1:
Transition probability:
[[0.15      0.8      0.05      ]
 [0.05555556 0.11111111 0.83333333]
 [0.89473684 0.      0.10526316]]
Observation probability:
[[1. 0. 0.]
 [0. 1. 0.]
 [0. 0. 1.]]
Initial state probability:
[0.33333333 0.22222222 0.44444444]
-----
Trainset2:
Transition probability:
[[0.38461538 0.46153846 0.15384615]
 [0.32      0.56      0.12      ]
 [0.07142857 0.28571429 0.64285714]]
Observation probability:
[[1. 0. 0.]
 [0. 1. 0.]
 [0. 0. 1.]]
Initial state probability:
[0.22222222 0.44444444 0.33333333]
```

P2: Please show the recognition results by using the above training sequences as the testing data (The so-called inside testing).

First iteration:

Accuracy: 100.0 %

50th iteration:

Accuracy: 100.0 %

```
#####  
P2: Please show the recognition results by using the above training sequences as the testing data (The so-called inside testing).  
First iteration:  
Accuracy: 100.0 %  
-----  
50th iteration:  
Accuracy: 100.0 %  
#####
```

```
P3. Which class do the following testing sequences belong to?  
Using 50th iteration models.
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test data 1: ABCABCCAB
```

```
test data 1 is model 1
```

```
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```

```
test data 2: AABABCCCCBBB
```

```
test data 2 is model 2
```