

## Lab 4 report: Viterbi and Beam search

### 1. The speed comparison between Viterbi and standard structured perceptron:

#### The speed of Viterbi

```
[dyn118103:Lab 4 vvvvv$ python lab4.py -v train.txt test.txt  
When using viterbi algorithm and the iteration times = 1 :  
The F1 score = : 0.871264367816092  
Time used 0.207419 seconds:
```

```
When using viterbi algorithm and the iteration times = 5 :  
The F1 score = : 0.8754022988505747  
Time used 0.887388 seconds:
```

```
When using viterbi algorithm and the iteration times = 10 :  
The F1 score = : 0.8758620689655172  
Time used 1.837663 seconds:
```

The average time is : 0.183279 seconds

#### The speed of Standard structured perceptron

```
[dyn118103:Lab 3 vvvvv$ python lab3.py train.txt test.txt  
When using standard structured perceptron and the iteration times = 1 :  
The F1 score = : 0.871264367816092  
Time used 21.488415 seconds:
```

```
When using standard structured perceptron and the iteration times = 5 :  
The F1 score = : 0.8754022988505747  
Time used 99.754317 seconds:
```

```
When using standard structured perceptron and the iteration times = 10 :  
The F1 score = : 0.8758620689655172  
Time used 207.005641 seconds:
```

The average time is : 20.515523 seconds

### Conclusion:

Compare to standard structured perceptron, the Viterbi increases the speed greatly, the average time from **20.515523** seconds to **0.183279** seconds, but because we only consider the current word and tag, so it doesn't change accuracy.

### 2. The speed comparison between different beam size of beam search algorithm:

The beam size = 1, the iteration times is 1,5,10

When the beam size = 1  
When using beam search algorithm and the iteration times = 1 :  
The F1 score = : 0.871264367816092  
Time used 0.162243 seconds:

When the beam size = 1  
When using beam search algorithm and the iteration times = 5 :  
The F1 score = : 0.8754022988505747  
Time used 0.818941 seconds:

When the beam size = 1  
When using beam search algorithm and the iteration times = 10 :  
The F1 score = : 0.8758620689655172  
Time used 1.473358 seconds:

The average time is : 0.153409 seconds

**The beam size = 5, the iteration times is 1,5,10**

When the beam size = 5  
When using beam search algorithm and the iteration times = 1 :  
The F1 score = : 0.871264367816092  
Time used 0.327681 seconds:

When the beam size = 5  
When using beam search algorithm and the iteration times = 5 :  
The F1 score = : 0.8754022988505747  
Time used 1.520913 seconds:

When the beam size = 5  
When using beam search algorithm and the iteration times = 10 :  
The F1 score = : 0.8758620689655172  
Time used 2.910038 seconds:

The average time is : 0.297415 seconds

**The beam size = 10, the iteration times is 1,5,10**

When the beam size = 10  
When using beam search algorithm and the iteration times = 1 :  
The F1 score = : 0.871264367816092  
Time used 0.459894 seconds:

When the beam size = 10  
When using beam search algorithm and the iteration times = 5 :  
The F1 score = : 0.8754022988505747  
Time used 2.094375 seconds:

When the beam size = 10  
When using beam search algorithm and the iteration times = 10 :  
The F1 score = : 0.8758620689655172  
Time used 4.013709 seconds:

The average time is : 0.410499 seconds

## Conclusion:

Because we only consider the current word and tag, so the accuracy doesn't change, no matter what size I choose. About speed, when beam size = 1, or small, compare to Viterbi and standard structured perceptron the speed will be improved, but when the size is bigger, the speed will go down, but still faster than standard structured perceptron, only slower than Viterbi.