1. How many documents are there for each language? Add a line of code to display the learned prior distribution over classes. What is it? Ensure that it is correct.

language	count
ARA	494
DEU	337
FRA	473
HIN	352
ITA	516
JPN	557
KOR	557
SPA	450
TEL	533
TUR	504
ZHO	593

A line for printing prior distribution:

```
for y in self.priorProbs:
    print ((y, self.priorProbs[y]))
```

Prior Probabilities:

('FRA', 0.08814759597465524)
('TEL', 0.09932910920611256)
('JPN', 0.10380171449869549)
('TUR', 0.09392471114424152)
('DEU', 0.06280283265001864)
('ITA', 0.09616101379053299)
('ARA', 0.0920611256056653)
('ZHO', 0.11051062243756989)
('SPA', 0.08386134923592993)
('KOR', 0.10380171449869549)
('HIN', 0.06559821095788297)

2. How many documents are there for each language in the dev set? What would be the **majority class baseline** accuracy on the dev set?

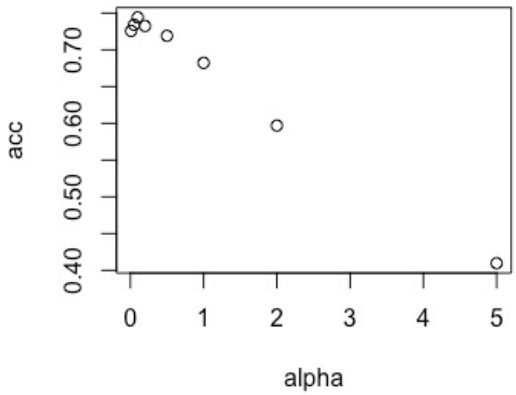
language	count
ARA	51
DEU	34
FRA	53
HIN	47

ITA	53
JPN	60
KOR	60
SPA	52
TEL	62
TUR	57
ZHO	69

majority class baseline accuracy: 0.6822742474916388

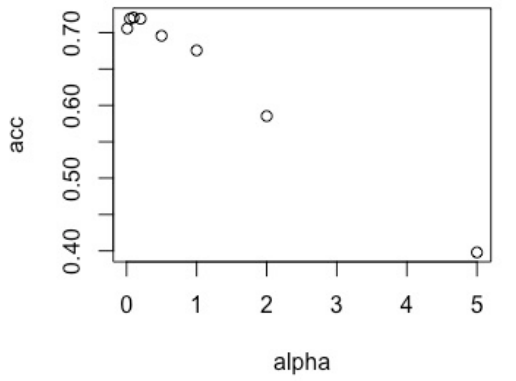
3. Tune the value of α by measuring performance on the dev set. Try α ∈ {0.01, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0}. Create a table or plot of each α value and the corresponding dev accuracy

alpha	accuracy
0.01	0.725752508
0.05	0.734113712
0.1	0.744147157
0.2	0.732441472
0.5	0.719063545
1	0.682274247
2	0.596989967
5	0.409698997



4. Lemmatization is a way to counteract the sparsity introduced by morphological inflection

alpha	accuracy
0.01	0.705685619
0.05	0.719063545
0.1	0.720735786
0.2	0.719063545
0.5	0.695652174
1	0.675585284



2	0.585284281
5	0.397993311

So for both lemmatize or baseline, the best α turns out to be 0.1, lemmatization doesn't affect the best value of α, but does affect the accuracy. That's because by lemmatization, feature number decreases, and thus some spelling mistakes that would help a lot with prediction get corrected.

5. Final Result

alpha	baseline	lemma
0.1	0.700331126	0.675496689

The best model is baseline model with α = 0.1.