(11) Laplace Smoothing (Multinomial Naive Bayes)

Problem with Naive Bayes Assumption:

$$P(y=+ve \mid x) = \pi\, P(x_i \mid y="+ve")\, P(y="+ve")$$

Train
- good -
- happy -
- awesome -
- ---- -
- liked

Test: "I was overjoyed after watching"

$$P("overjoyed" \mid y="+ve") = 0$$

Problem:
So, wrong idea. To estimate over things which we have not seen yet.

Probability should not be zero because reating is good but not present in train set in this case

Problem: Can't estimate P of unseen word as 0.

Solution:
Laplace Smoothing. (Add one Smoothing)

- Add 1 to the count

$$P(x_i \mid y=c) = \frac{[count(x_i, y=c) + 1]}{[\sum_{w \in v} (count(w, y=c) + 1)]}$$

will never be zero

$$= \frac{count(x_i, y=c) + 1}{\sum_{w \in v} (count(w, y=c)) + |v|}$$

$|v|$ = vocab size