Naive Bayes Text Classification

CS 585 Homework-1

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You can run the code like:

python NaiveBayes.py data/aclImdb 1.0

Classification and Evaluation (40 Points)

self.P_positive = P(+) = 0.5

self.P_negative = P(-) = 0.5

size of self.count_positive = 252192

size of self.count_negative = 252192

self.vocab_len = 252192

self.total_positive_words = 2958696

self.total_negative_words = 2885722

ALPHA	Accuracy	self.deno_pos	self.deno.neg
0.1	0.81688	2983915.2	2910941.2
0.5	0.82668	3084792.0	3011818.0
1.0	0.8304	3210888.0	3137914.0
5.0	0.83632	4219656.0	4146682.0
10.0	0.83712	5480616.0	5407642.0

Probability Prediction (20 Points)

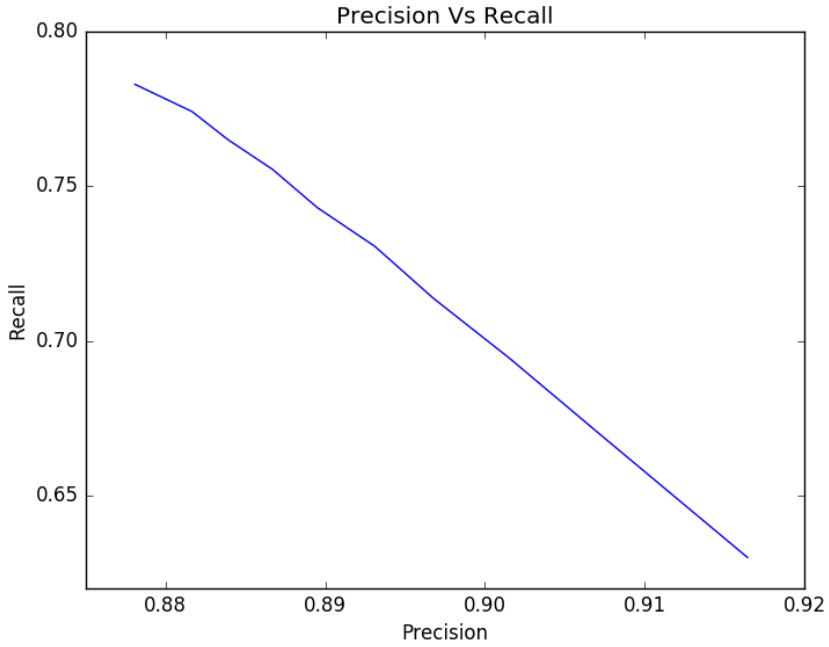
The probability estimated for the first 10 reviews in the test data.

ALPHA = 1.0

Index of test.X[i]	test.Y[i]	predicted_prob_positive	predicted_prob_positive
0	-1.0	0.9365132665902932	0.06348673340965141
1	-1.0	1.4294347203216804e-07	0.9999998570565469
2	-1.0	4.388356852437946e-17	1.0
3	-1.0	4.078027965195846e-13	0.9999999999995453
4	-1.0	4.775228165409764e-13	0.9999999999995453
5	-1.0	8.66332518621793e-08	0.9999999133667681
6	-1.0	3.3444380516436173e-08	0.9999999665556066
7	1.0	0.020877247067161847	0.9791227529328611
8	-1.0	0.9794966557702657	0.020503344229679848
9	-1.0	1.4350093016703943e-05	0.9999856499070662

Precision and Recall (20 Points)

Graph precision vs. recall for the positive and negative classes by varying the threshold.



Precision α (1/Recall)

i.e. there is **inverse relationship** between Precision and Recall.

Features (20 points)

The 20 most positive and 20 most negative words in the vocabulary sorted by their weight according to model.

negative_word_weight = log(P(-|w)) - log(P(+|w))

positive_word_weight = log(P(+|w)) - log(P(-|w))

Top +ve words = [('edie', 4.395851321341416), ('gundam', 4.320816135398502), ('antwone', 4.10414509858991), ('yokai', 3.8482117244527085), ('/>8/10', 3.8482117244527085), ('gunga', 3.827158315254877), ('/>7/10', 3.827158315254877), ('/>10/10', 3.805652110033913), ('din', 3.7836732033151375), ('gypo', 3.7836732033151375), ('othello', 3.7382108292383798), ('7/10.', 3.6145968732712035), ('tsui', 3.560529652000927), ('paulie', 3.546543410026187), ('blandings', 3.532358775034231), ('goldsworthy', 3.4735182750112976), ('kells', 3.442746616344545), ('gino', 3.442746616344545), ('/>9/10', 3.442746616344545), ('harilal', 3.410997918029963)]

Top -ve words = [('/>4/10', 4.0660405542897315), ('seagal', 4.057229924607578), ('2/10', 3.914809584565809), ('boll', 3.9045530843986196), ('uwe', 3.894190297363073), ('*1/2', 3.8516306829442772), ('unwatchable.', 3.829651776225502), ('thunderbirds', 3.76065890473855), ('/>3/10', 3.736561353159491), ('gamera', 3.736561353159491), ('4/10', 3.673647527748921), ('wayans', 3.633907199099406), ('awful!', 3.5783373479445952), ('slater', 3.488725189254909), ('/>avoid', 3.488725189254909), ('segal', 3.4569764909403276), ('drivel.', 3.4569764909403276), ('tashan', 3.4569764909403276), ('kareena', 3.424186668117338), ('aztec', 3.424186668117338)]

Resources:

[1] http://docs.scipy.org/doc/scipy-0.15.1/reference/generated/scipy.sparse.csr_matrix.html - scipy.sparse.csr_matrix

[2] https://en.wikipedia.org/wiki/List_of_logarithmic_identities

[3] https://stats.stackexchange.com/questions/105602/example-of-how-the-log-sum-%20exp-trick-works-in-naive-bayes