Yelp Data Prediction

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Monday Group 1

1 Introduction and Data Cleaning

Introduction

- Small set of informative features
- Accurate predictive model
- Based on about 1.5 million Yelp reviews

Data Cleaning

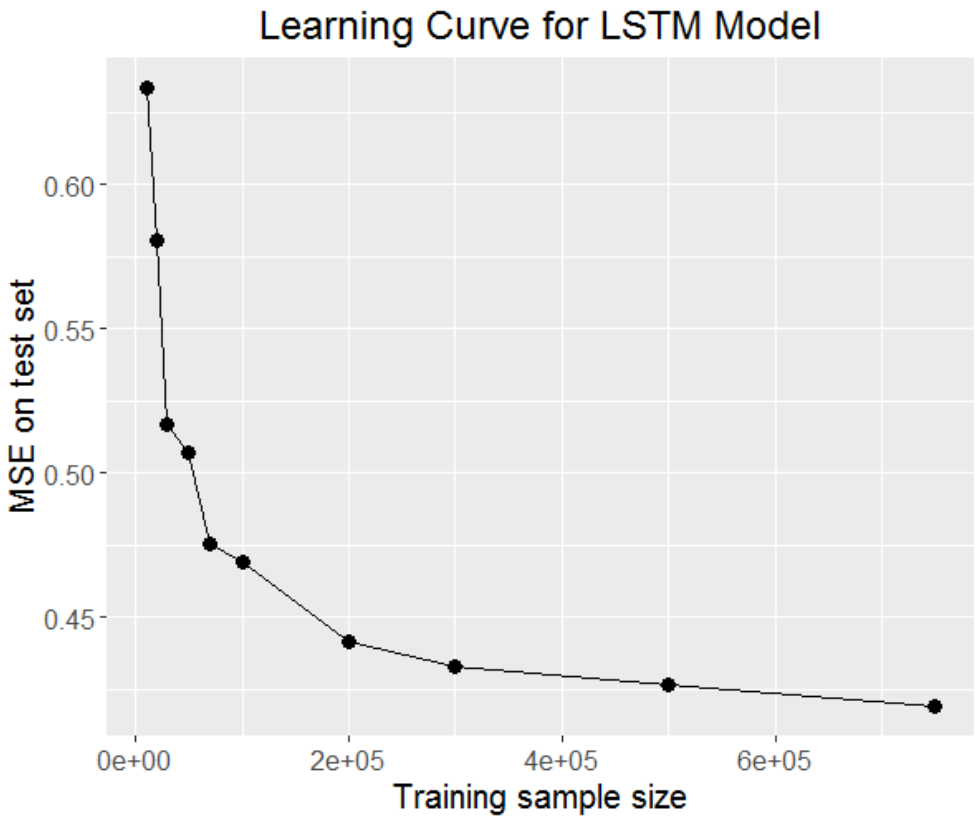
- Modify Abbreviation and Special Symbol
- Remove Non-English
- Negative Sentences
- Remove Punctuation

2 Model: LSTM

Model: Neural Network with 3 layers

- layer1: LSTM layer with 50 output units
- layer2: Dense layer with 5 output units
- layer3: Dense layer with 1 output unit

2 Model: LSTM

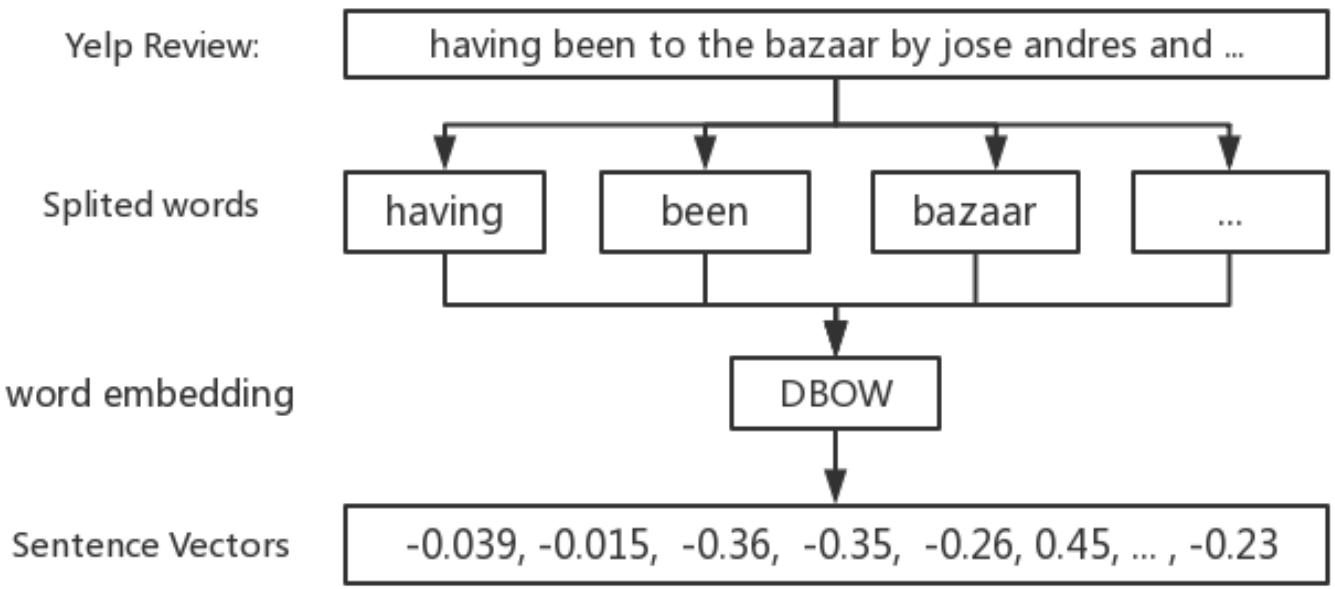

Learning Curve for LSTM Model
MSE on test set
0.60
0.55
0.50
0.45
0e+00
2e+05
4e+05
6e+05
Training sample size

2.1 Doc2vec

Model Features

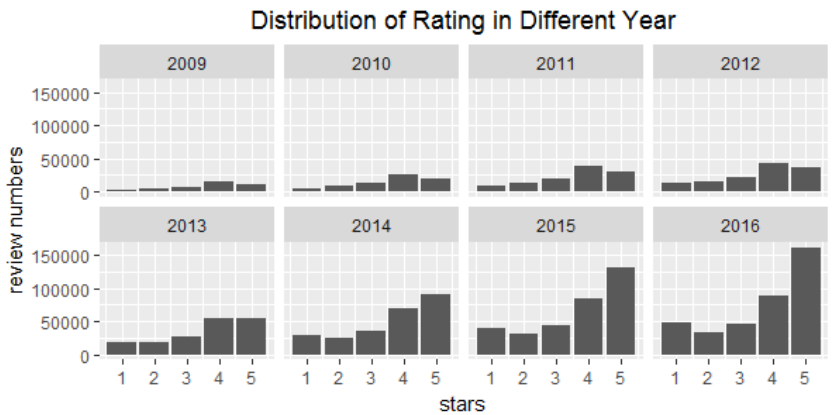
Pre-trained Sentence Vectors: Capture word counts and order

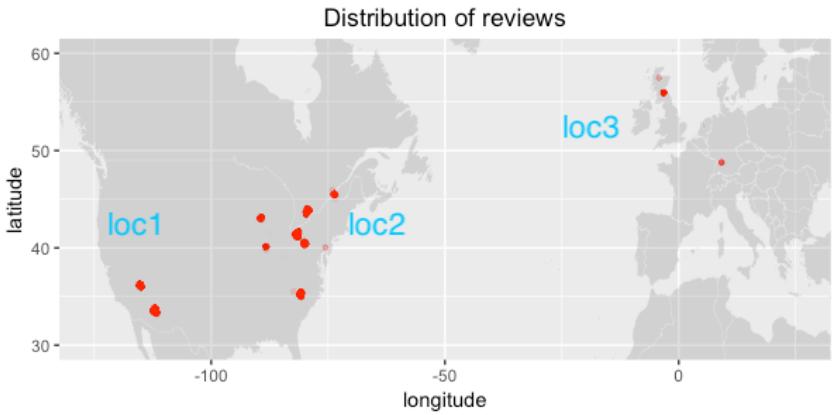
Additional Variables: Capture sentiment, review date and location



2.2 Additional Variables

- **year**: scaled year variable.
- **loc1**: 1 if the restaurant is in the western United States, otherwise 0.
- **loc2**: 1 if the restaurant is in the eastern United States, otherwise 0.
- **loc3**: 1 if the restaurant isn't in the United States, otherwise 0.





2.2 Additional Variables

- **Score1∼5**: $\text{Score1[word]} = \frac{\text{P(this word is included in reviews with 1-star)}}{\text{P(this word is included in reviews with other stars)}}$
- **S1 ∼ S5**: S1[review] = # of words with high Score1 in the review.

Word	Variable	1-star	2-star	3-star	4-star	5-star
refund	frequence	115	15	7	4	2
	probability	0.011	0.002	0	0	0
	Score	34.200	1.080	0.300	0.072	0.025
notdisappoints	frequence	0	2	5	43	110
	probability	0	0	0	0.002	0.003
	Score	0	0.116	0.188	0.917	3.870
and	frequence	9196	8691	12851	25604	32071
	probability	0.859	0.886	0.877	0.895	0.886
	Score	0.968	1.000	0.991	1.020	1.000

2.2 Additional Variables

Positive

Negative

3 Compare MSE with other method

MSE

Feature\ Model	LM	NB	NN	LSTM	GLM	SVM
vector + ad	0.673	0.974	0.494	**0.493**	0.698	NA
vector	0.720	1.112	0.524	0.526	0.756	0.585
additional	**0.836**	1.459	0.614	0.612	0.894	NA
frequence	NA	1.126	1.210	NA	0.864	0.790
tf-idf	0.889	1.114	0.804	NA	0.836	0.770

tested on 100000 data

4 Interpretable Model

$$\hat{y} = 3.65 + 0.04 * scale(year) + 0.04 * loc1 + 0.06 * loc2$$
$$- 0.11 * S1 - 0.17 * S2 - 0.03 * S3 + 0.03 * S4 + 0.14 * S5$$

5 Strengths and Weaknesses

Strengths

MSE 0.493 for best model feature combination prediction

Inclusion of additional informative variables contributes to the reduction of MSE by 0.033

Weaknesses

Grid search over various model parameters

Thank You!