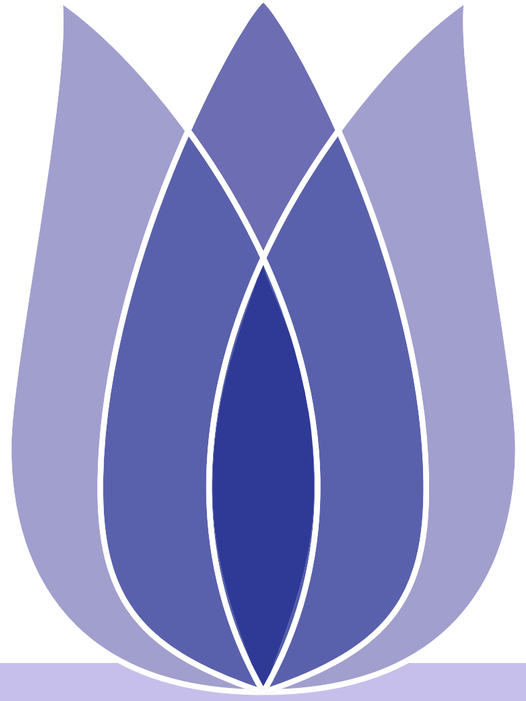
Natural Language Processing with Disaster Tweets

Jiaqi Liu

Jilin University

2021-07-23

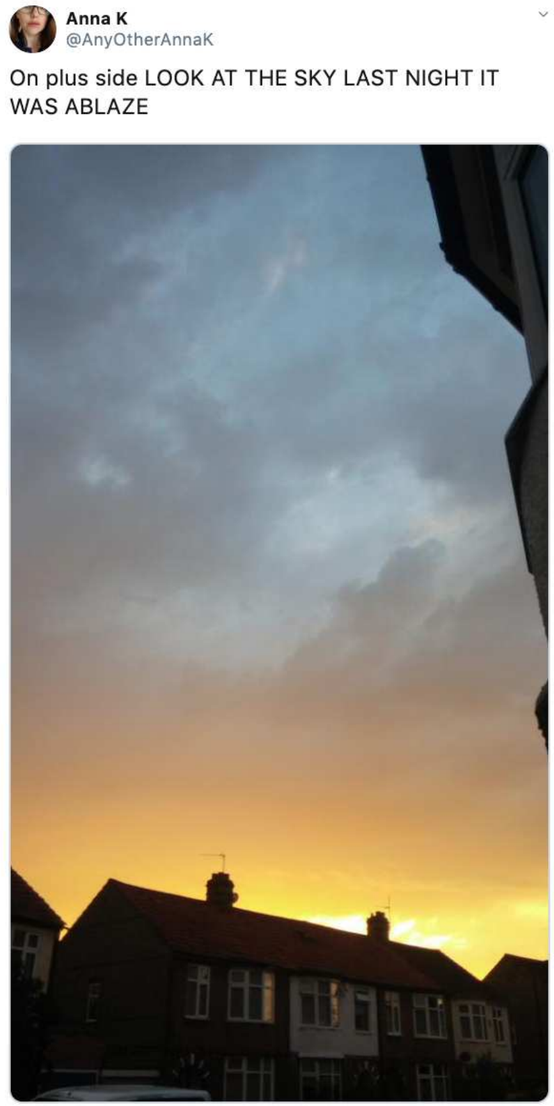


Overview

Problem Definition

Background

Twitter has become an important communication channel in times of emergency. But, it's not always clear whether a person's words are actually announcing a disaster. Take the tweeter in figure 1 as as example: Although the author used word "ablaze", clearly it wasn't about an incident. This is quite clear to human, but not to computers. Our goal is to develop a model that predicts whether a tweet is about a disaster or not.



Data Introduction

file name	size	line number	columns
train.csv	965*KB*	7613	*id*,*keyword*,*location*,*text*,*target*
test.csv	411*KB*	3263	*id*,*keyword*,*location*,*text*

Property Explaination

- id : the identity key of every recorded tweet.
- keyword : a label representing important words in the tweet
- location : where the tweet is written
- text : the content of the tweet
- target : whether the tweet is related to a disaster

Data Process

Word Spliting

- The first task of the model is to turn text into word sequence.
  - Mainly based on regex matching.

Normal regex matching.

- List all the possible seperations and replace them with blanks.
- Split the tweet according to blanks.

Consider the vocabulary deformation.

- Match and replace them with their original forms.
  - won't → will not
  - can't → can not
  - …

Encode the words

Encode the words mentioned so that we can further turn it into vectors.

Use the pre-trained word vector&dictionary GloVe developed by Stanford.

- Include 400000 words.
- PAD & UNK also indexed.
- The proportion of recruited words is shown in Figure 1

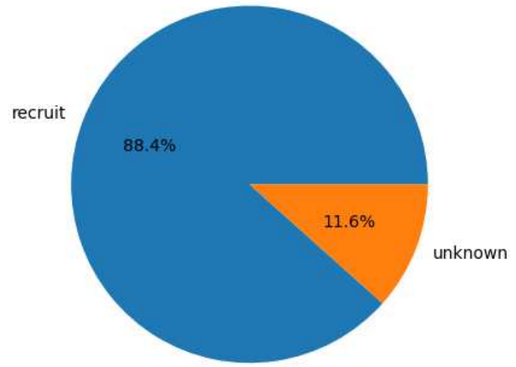


Figure 1

Model Construction

The Embedding Layer

- Pretrained word vector GloVe.
- Turning word into vector of 100 dimensions.
- Based on co-occurence matrix.

GloVe

Probability and Ratio	$k = solid$	$k = gas$	$k = water$	$k = fashion$
$P(k\|ice)$	1.9×10^{-4}	6.6×10^{-5}	3.0×10^{-3}	1.7×10^{-5}
$P(k\|steam)$	2.2×10^{-5}	7.8×10^{-4}	2.2×10^{-3}	1.8×10^{-5}
$P(k\|ice)/P(k\|steam)$	8.9	8.5×10^{-2}	1.36	0.96

- It can be seen that the ratio represents the correlation between words.

Ratio	word j,k related	word j,k non-related
word i,k related	close to 1	very big
word i,k non-related	very small	close to 1

- As word vector also represents correlation between words, $\exists F$,so that:

$$F(w_i, w_j, w_k) = \frac{P_{ik}}{P_{jk}}$$

GloVe

$$F(w_i, w_j, w_k) = \frac{P_{ik}}{P_{jk}}$$

(consider i,j without k)

$$F(w_i - w_j, w_k) = \frac{P_{ik}}{P_{jk}}$$

(Right is a scalar)

$$F((w_i - w_j)^\top w_k) = \frac{P_{ik}}{P_{jk}}$$

$$F(w_i{}^\top w_k - w_j{}^\top w_k) = \frac{P_{ik}}{P_{jk}}$$

(Consider turning minus form into fraction)

$$exp(w_i{}^\top w_k - w_j{}^\top w_k) = \frac{exp(w_i{}^\top w_k)}{exp(w_j{}^\top w_k)} = \frac{P_{ik}}{P_{jk}}$$

$$exp(w_i{}^\top w_k) = P_{ik} \quad exp(w_j{}^\top w_k) = P_{jk}$$

$$w_i{}^\top w_k = log(\frac{X_{ik}}{X_i}) = logX_{ik} - logX_i$$

$$(w_i{}^\top w_k = w_k{}^\top w_i)$$

$$logX_{ik} = w_i{}^\top w_k + b_i + b_k$$

$$J = \sum_{ik}(w_i{}^\top w_k + b_i + b_k - logX_{ik})^2$$

$$J = \sum_{ik} f(X_{ik})(w_i{}^\top w_k + b_i + b_k - logX_{ik})^2$$

TextCNN

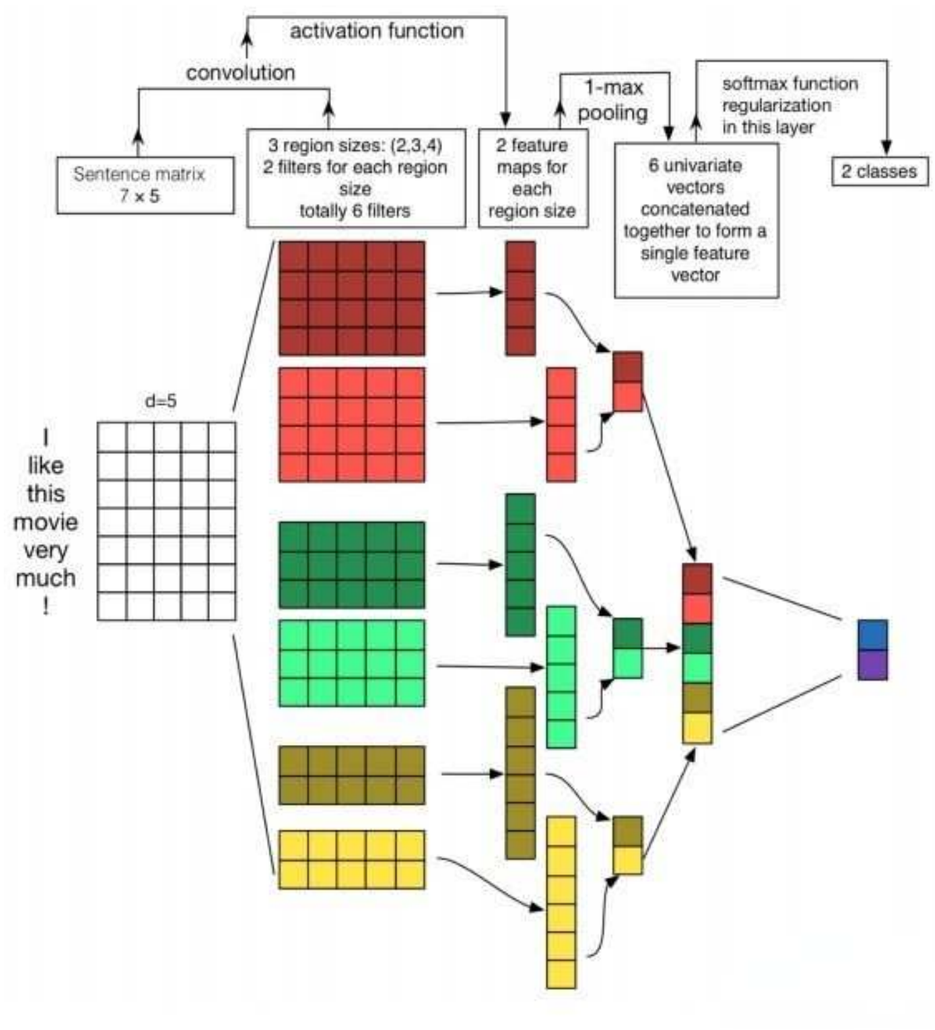


Figure 2

Model Training

Training Settings

Training Settings are listed as followed:

- $batch\_size = 10$
- $learning\_rate = 0.005$
- $loss = BinaryCrossEntropy$
- $optimizer = AdamOptimizer$
- $accuracy = (\sum_{i=0}^{N} 1 - |\frac{1}{2}(sign(\hat{y}_i - 0.5) + 1) - y_i|)/N$

Training Process

Accuracy & Loss during the training process is as the figures show:

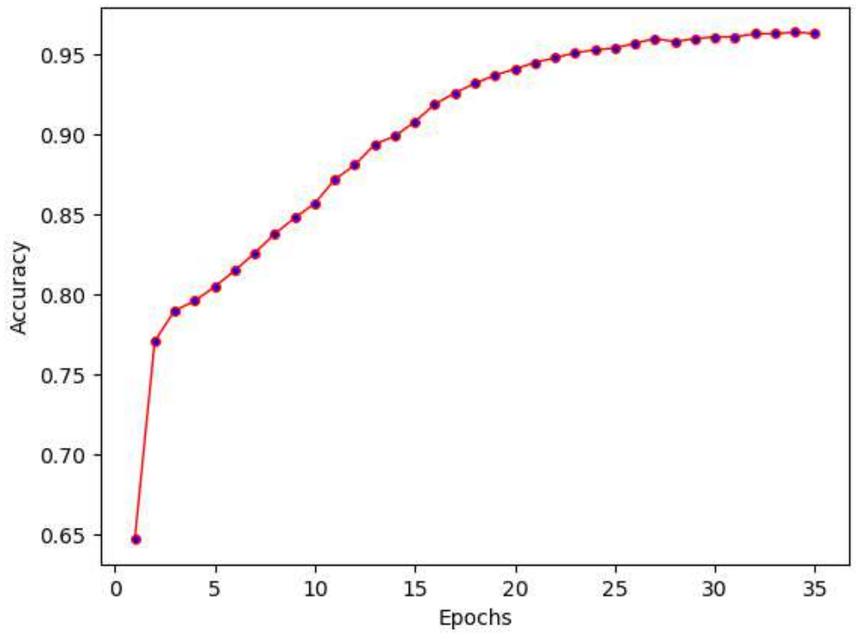


Figure 3: Training Accuracy

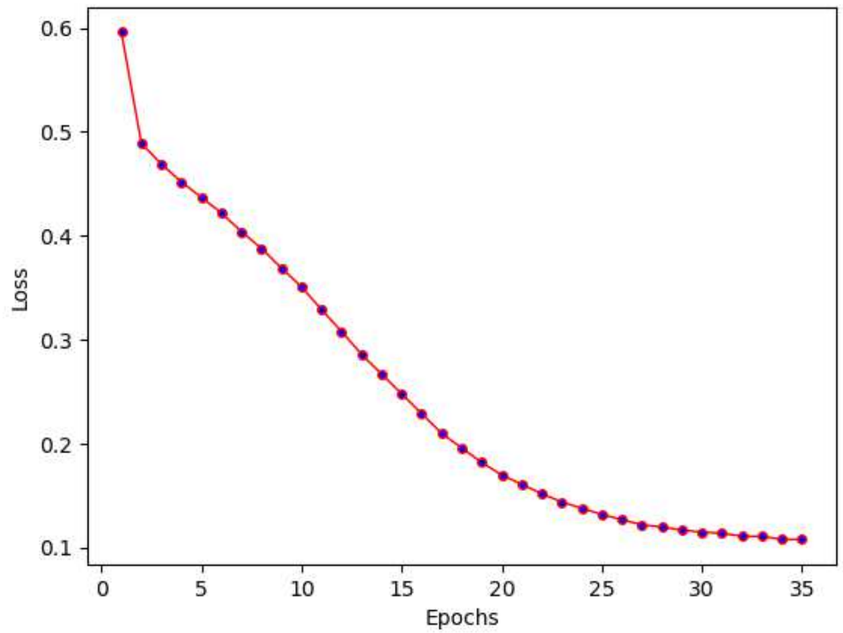
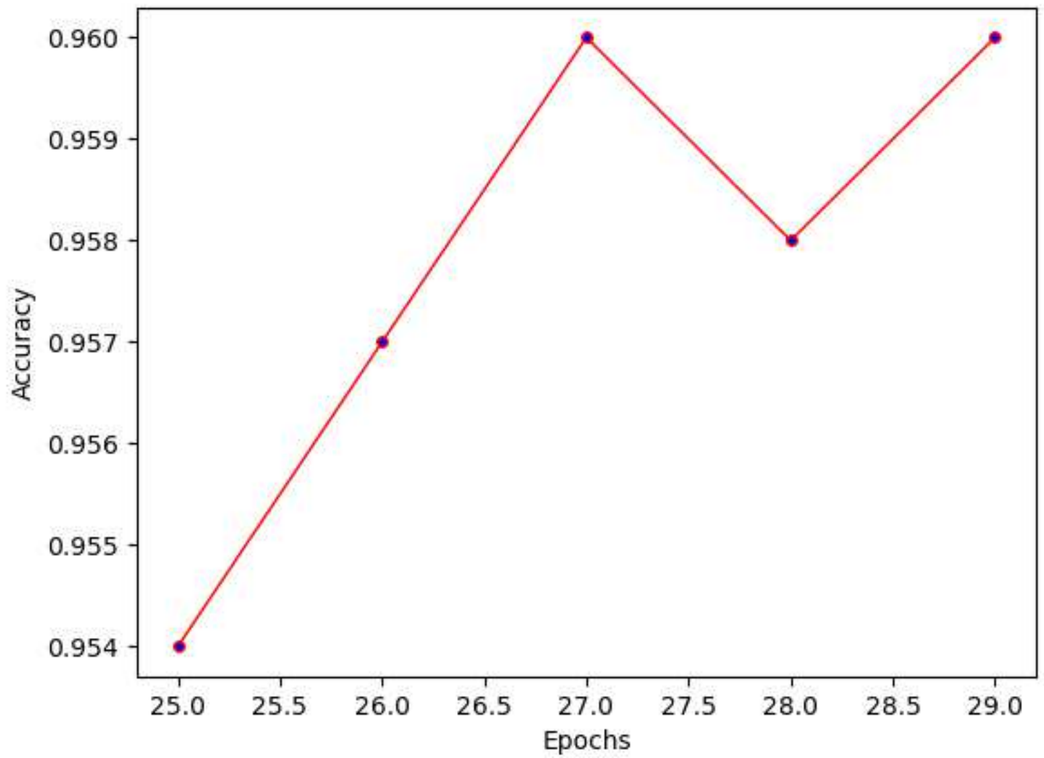


Figure 4: Training Loss

Training Process

- An interesting phonomenonhappened near $epochs = 27$, as the figure shows.



- By testing epochs near 27, we can find the best epochs.

Training Process

Epochs	Accuracy
26	0.76340
27	0.78455
28	0.77811
29	0.76371
30	0.77106

- $epochs = 27$

Result

Result

- Final accuracyreahces 0.78455 with 27 epochs.
- Rank:2349/3625

Contact Information

Jiaqi Liu

Department of Computer Science and Technology

Jilin University, China

JQLIU@TULIP.ACADEMY

TEAM FOR UNIVERSAL LEARNING AND INTELLIGENT PROCESSING