

# Natural Language Processing & Word Embeddings

TOTAL POINTS 10

## 1.Question 1

Suppose you learn a word embedding for a vocabulary of 10000 words. Then the embedding vectors should be 10000 dimensional, so as to capture the full range of variation and meaning in those words.

☐ True

☒ False

1 point

## 2.Question 2

What is t-SNE?

☐ A linear transformation that allows us to solve analogies on word vectors

☒ A non-linear dimensionality reduction technique

☐ A supervised learning algorithm for learning word embeddings

☐ An open-source sequence modeling library

1 point

## 3.Question 3

Suppose you download a pre-trained word embedding which has been trained on a huge corpus of text. You then use this word embedding to train an RNN for a language task of

recognizing if someone is happy from a short snippet of text, using a small training set.

x (input text)	y (happy?)
I'm feeling wonderful today!	1
I'm bummed my cat is ill.	0
Really enjoying this!	1

Then even if the word “ecstatic” does not appear in your small training set, your RNN might reasonably be expected to recognize “I’m ecstatic” as deserving a label  $y = 1$ .

☒ True

☐ False

1 point

#### 4.Question 4

Which of these equations do you think should hold for a good word embedding? (Check all that apply)

☒  $e_{boy} - e_{girl} \approx e_{brother} - e_{sister}$

☐  $e_{boy} - e_{girl} \approx e_{sister} - e_{brother}$

☒  $e_{boy} - e_{brother} \approx e_{girl} - e_{sister}$

☐  $e_{boy} - e_{brother} \approx e_{sister} - e_{girl}$

1 point

### 5.Question 5

Let  $E$  be an embedding matrix, and let  $\mathbf{o}_{1234}$  be a one-hot vector corresponding to word 1234. Then to get the embedding of word 1234, why don't we call  $E * \mathbf{o}_{1234}$  in Python?

- ☒ It is computationally wasteful.
- ☐ The correct formula is  $E^T * \mathbf{o}_{1234}$ .
- ☐ This doesn't handle unknown words (<UNK>).
- ☐ None of the above: calling the Python snippet as described above is fine.

1 point

### 6.Question 6

When learning word embeddings, we create an artificial task of estimating  $P(\text{target} \mid \text{context})$  okay if we do poorly on this artificial prediction task; the more important by-product of this task is that we learn a useful set of word embeddings.

- ☐ True
- ☒ False

1 point

### 7.Question 7

In the word2vec algorithm, you estimate  $P(\mathbf{t} \mid \mathbf{c})$  where  $\mathbf{t}$  is the target word and  $\mathbf{c}$  is a context word. How are  $\mathbf{t}$  and  $\mathbf{c}$  chosen from the training set? Pick the best answer.

- ☐  $\mathbf{c}$  is a sequence of several words immediately before  $\mathbf{t}$ .
- ☐  $\mathbf{c}$  is the sequence of all the words in the sentence before  $\mathbf{t}$ .
- ☐  $\mathbf{c}$  is the one word that comes immediately before  $\mathbf{t}$ .
- ☒  $\mathbf{c}$  and  $\mathbf{t}$  are chosen to be nearby words.

1 point

### 8.Question 8

Suppose you have a 10000 word vocabulary, and are learning 500-dimensional word embeddings. The word2vec model uses the following softmax function:

$$P(t \mid c) = \frac{e^{\theta_t^T e_c}}{\sum_{t'=1}^{10000} e^{\theta_{t'}^T e_c}}$$

Which of these statements are correct? Check all that apply.

- ☒  $\theta_t$  and  $e_c$  are both 500 dimensional vectors.
- ☐  $\theta_t$  and  $e_c$  are both 10000 dimensional vectors.
- ☒  $\theta_t$  and  $e_c$  are both trained with an optimization algorithm such as Adam or gradient descent.

☐ After training, we should expect  $\theta_t$  to be very close to  $e_c$  when  $t$  and  $c$  are the same word.

1 point

#### 9.Question 9

Suppose you have a 10000 word vocabulary, and are learning 500-dimensional word embeddings. The GloVe model minimizes this objective:

$$\min \sum_{i=1}^{10,000} \sum_{j=1}^{10,000} f(X_{ij})(\theta_i^T e_j + b_i + b_j - \log X_{ij})^2$$

Which of these statements are correct? Check all that apply.

- ☒  $\theta_i$  and  $e_j$  should be initialized to 0 at the beginning of training.
- ☐  $\theta_i$  and  $e_j$  should be initialized randomly at the beginning of training.
- ☒  $X_{ij}$  is the number of times word  $j$  appears in the context of word  $i$ .
- ☒ The weighting function  $f(\cdot)$  must satisfy  $f(0) = 0$ .

1 point

### 10.Question 10

You have trained word embeddings using a text dataset of  $m_1$  words. You are considering using these word embeddings for a language task, for which you have a separate labeled dataset of  $m_2$  words. Keeping in mind that using word embeddings is a form of transfer learning, under which of these circumstance would you expect the word embeddings to be helpful?

☒  $m_1 \gg m_2$

☐  $m_1 \ll m_2$

1 point

I, **Zhuo Chen**, understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account.

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