Natural Language Processing & Word Embeddings

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

2. What is t-SNE?

   ☑ A non-linear dimensionality reduction technique.

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

   □ A supervised learning algorithm for learning word embeddings.

   □ An open-source sequence modeling library.

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

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

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

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

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

   ☑ It is computationally wasteful.

☐ The correct formula is $E^T * e_{1234}$.

☐ This doesn’t handle unknown words ().

☐ None of the above: Calling the Python snippet as described above is fine.

6. When learning word embeddings, we create an artificial task of estimating $P(target \mid context)$. It is 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

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

☑ c and t are chosen to be nearby words.

☐ c is the one word that comes immediately before t.

☐ c is the sequence of all the words in the sentence before t.

☐ c is a sequence of several words immediately before t.

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.

☑ θ_t and e_c are both 500 dimensional vectors.

☐ θ_t and e_c are both 10000 dimensional vectors.

☑ θ_t and e_c are both trained with an optimization algorithm such as Adam or gradient descent.

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

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.

☐ θ_i and e_j hould be initialized to 0 at the beginning of training.

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☑ X_{ij} is the number of times word i appears in the context of word j.

☑ The weighting function $f(.)$ must satisfy $f(0) = 0$.

> The weighting function helps prevent learning only from extremely common word pairs. It is not necessary that it satisfies this function.

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?

    ☑ $m_1 >> m_2$

    □ $m_1 << m_2$