Part-of-Speech Tagging with Word Embeddings

CS 9875 Final Project

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December 2, 2025

Outline

Section 1 Longname

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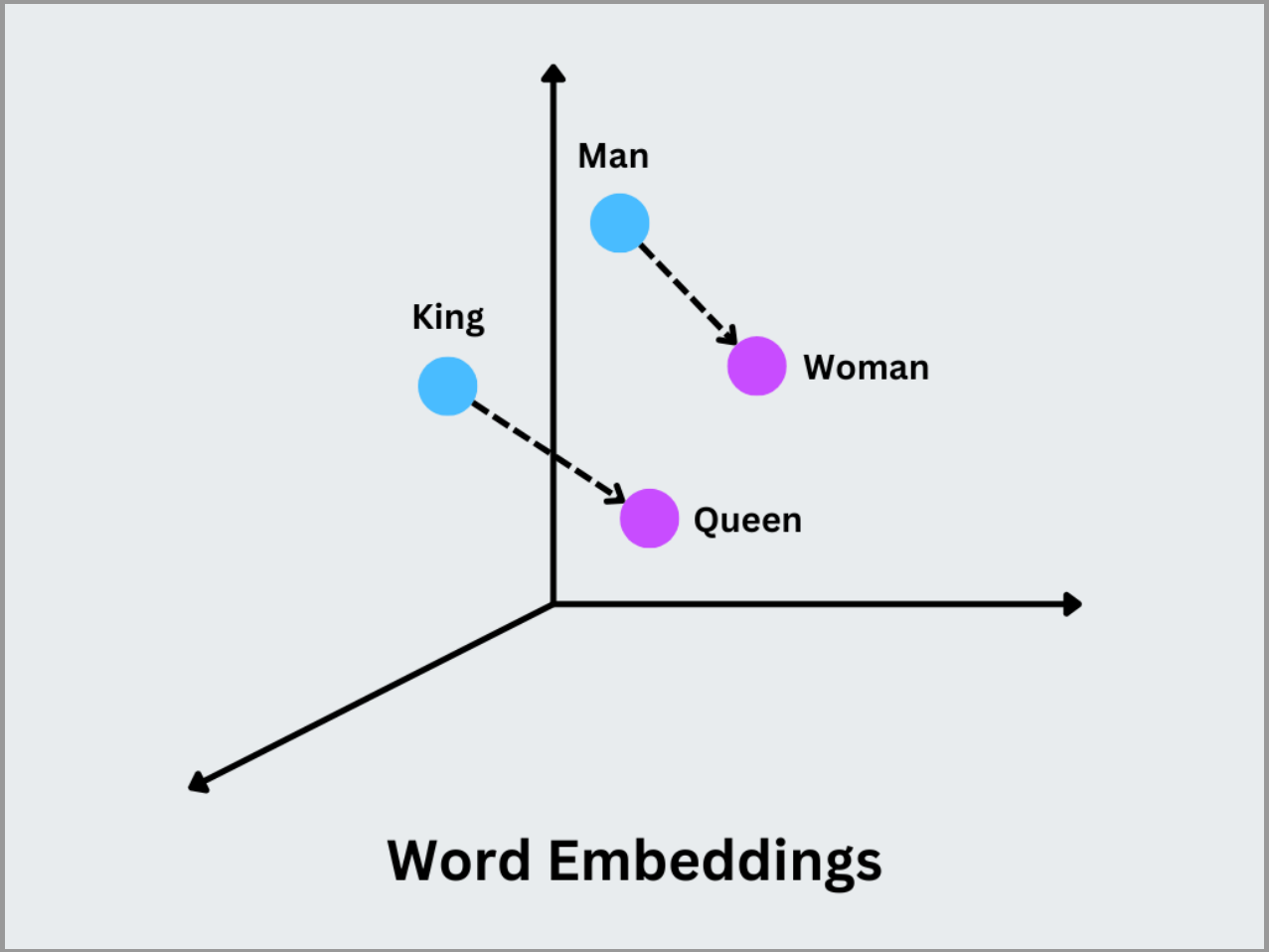
Word Embedding Models

What are word embeddings?

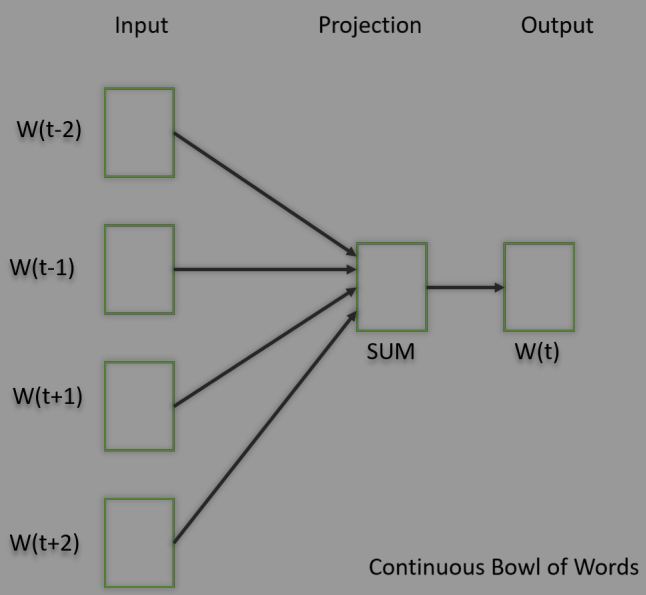


https://assets.zilliz.com/Figure_Word_Embeddings_b021a5a759.png

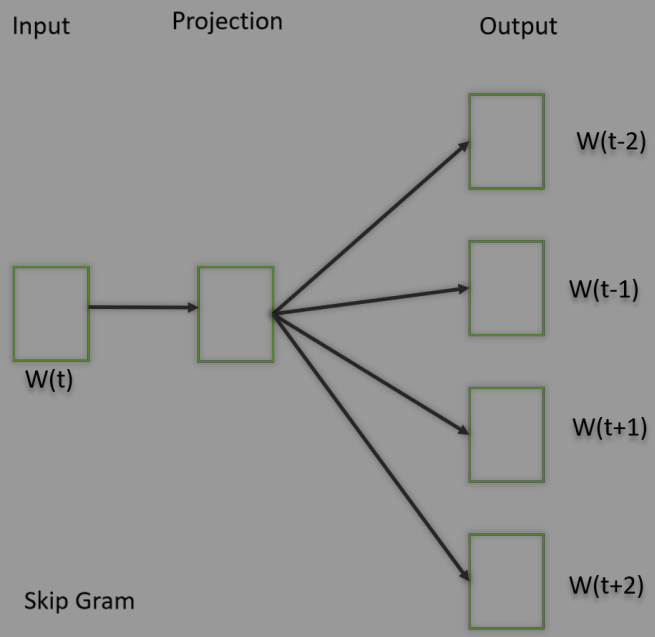
Static Word Embeddings

What are static word embedding models?

Word2Vec



CBOW



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Word2Vec Training Procedures

https://www.geeksforgeeks.org/nlp/word-embeddings-in-nlp/

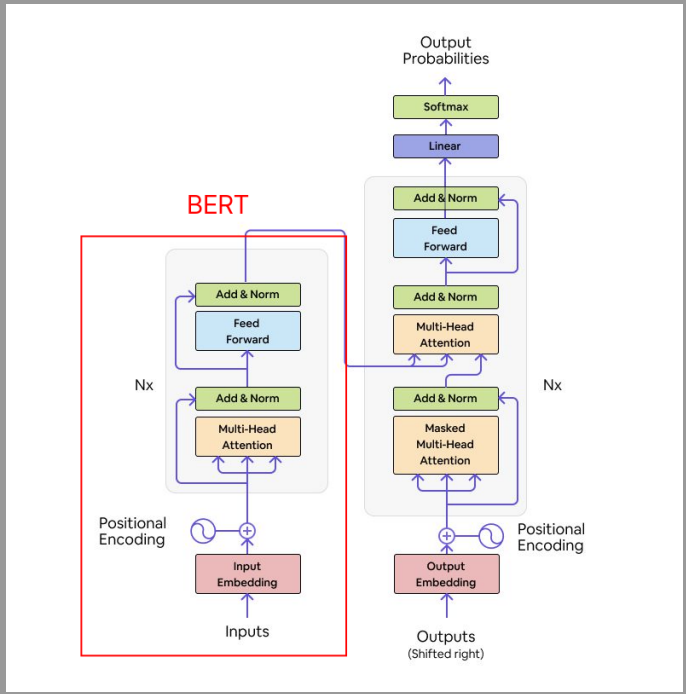
Word2Vec

$$\begin{bmatrix} W_{00} & W_{01} & W_{02} & \dots \\ W_{10} & W_{11} & W_{12} & \dots \\ W_{20} & W_{21} & W_{22} & \dots \\ \dots & \dots & \dots & \dots \end{bmatrix}$$

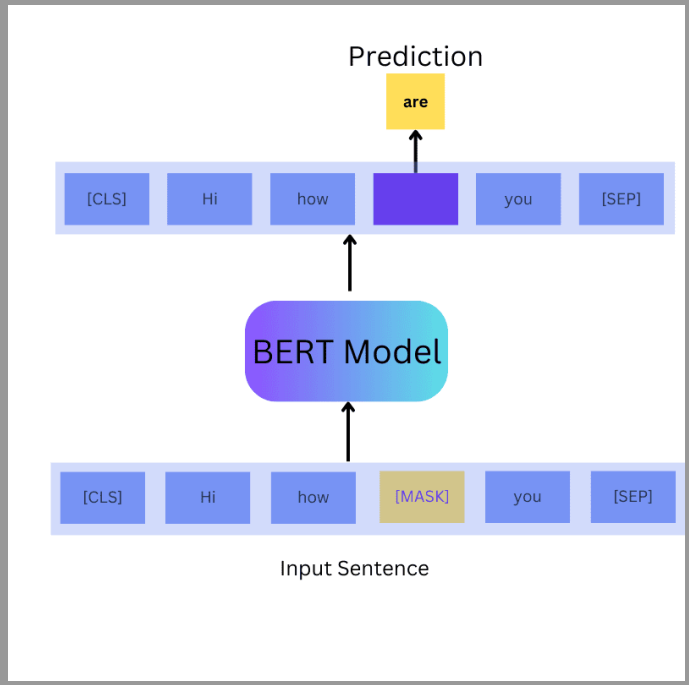
Contextual Word Embeddings

What are contextual word embeddings?

BERT



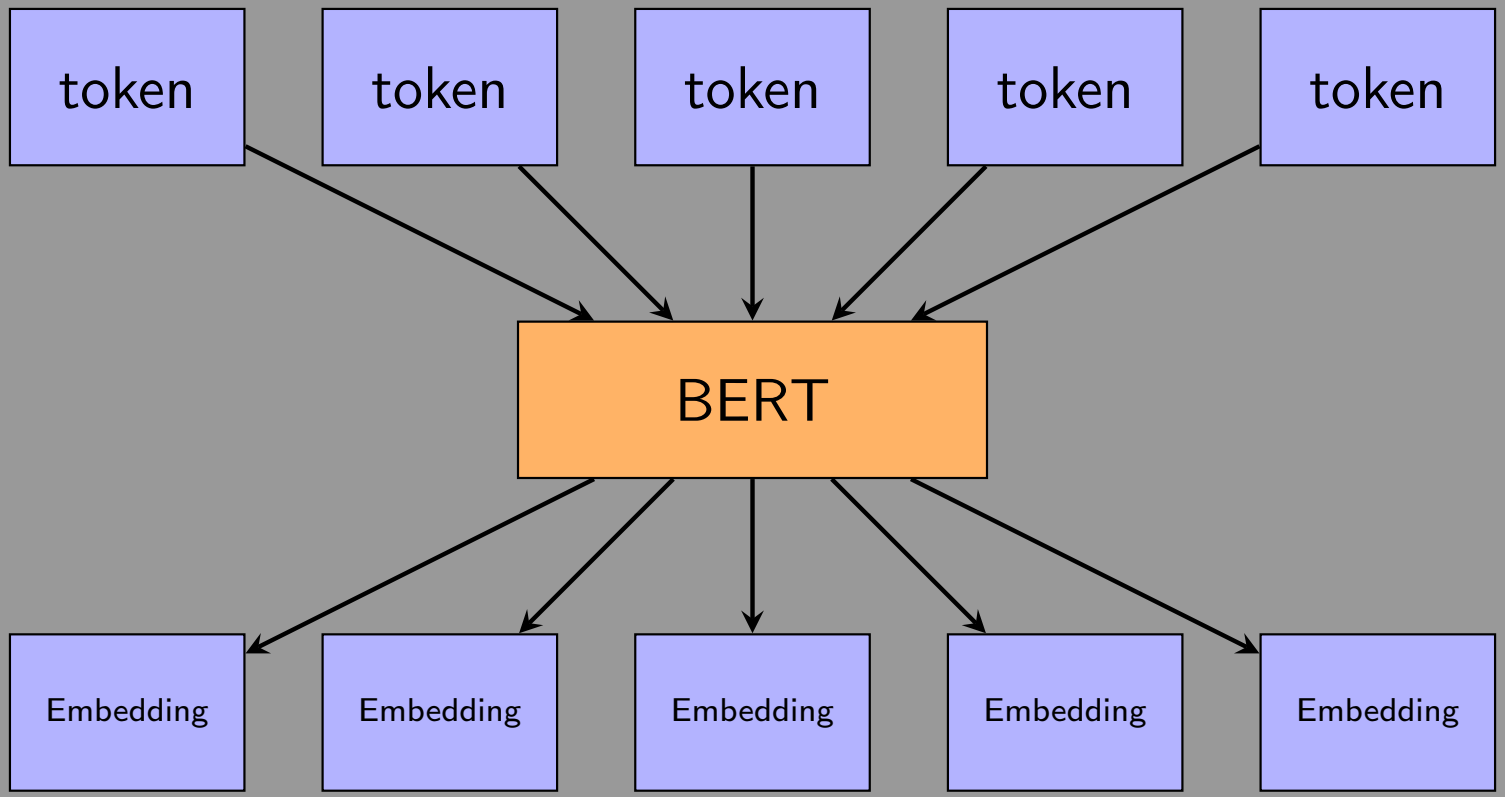
Transformer architecture



MLM

Transformer architecture: https://deeplobe.ai/wp-content/uploads/2021/04/1.jpg
MLM: https://learnopencv.com/wp-content/uploads/2023/10/bert-masked-language-modeling-1.png Devlin, Jacob; Chang, Ming-Wei; Lee, Kenton; Toutanova, Kristina, 2018. BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

BERT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BERT
Embedding
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Embedding

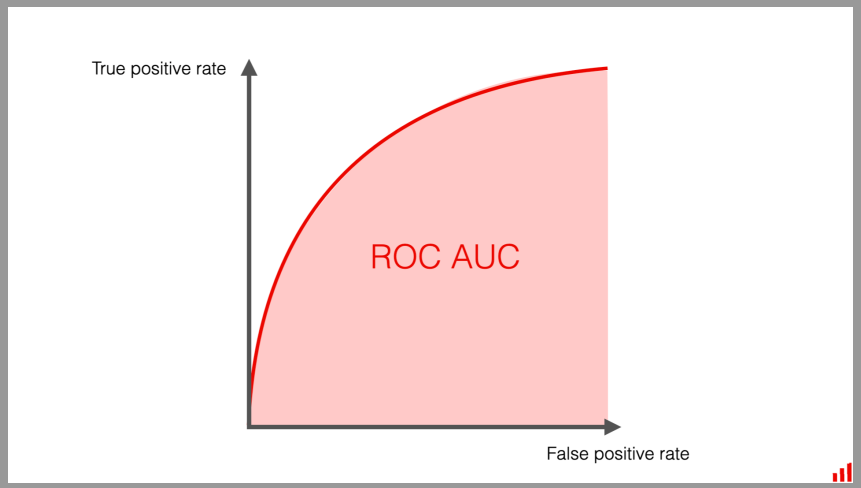
How do we use these embeddings?

How do we use these embeddings?
As input for a downstream model: SVM, Boosting, CNN, etc.

Evaluation and Theoretical Analysis

Evaluation Metrics

We will evaluate each of our models using F1 score and AUC-ROC adapted for this multi-class classification problem.



AUC-ROC

https://uploads-ssl.webflow.com/6266b596eef18c1931f938f9/64760748f6cfb67f889321ad_classification_metrics_016-min.png

Theoretical Analysis

We will conduct a theoretical analysis on the word embedding models, and the downstream classifier models.

Anticipated Results

We anticipate achieving near perfect scores in both evaluation metrics using contextual embeddings from contextual models like BERT and a simple classification model like an SVM, outperforming static embedding models like Word2Vec.