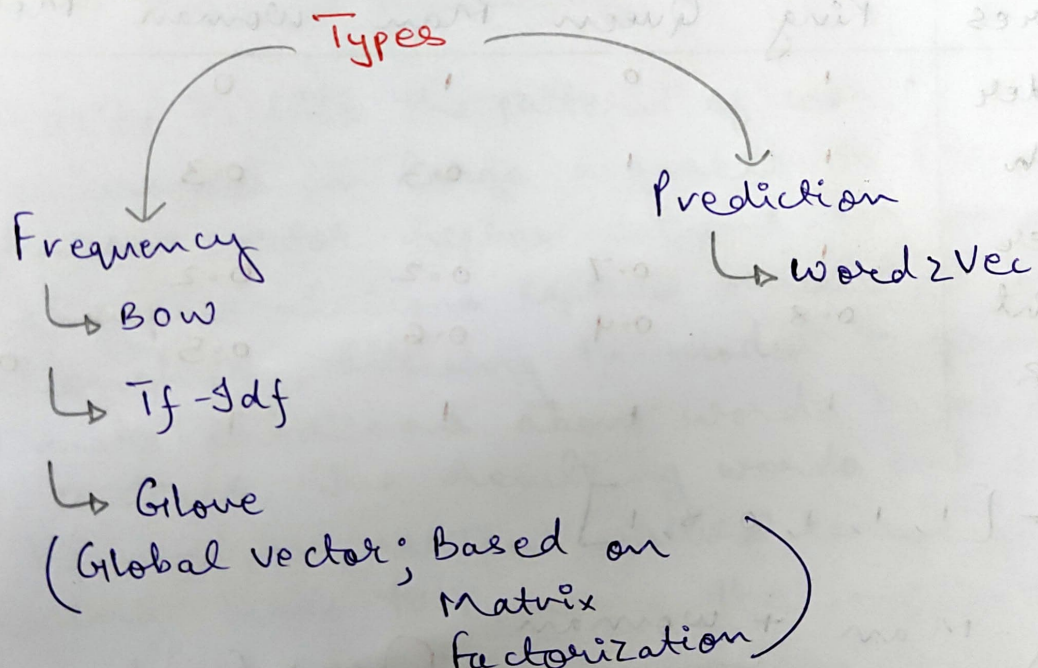
LECTURE-5 WORD-2-VEC

Word Embeddings

↳ In NLP, word embedding is a term used for the representation of words for text analysis, typically in the form of a real-valued vector that encodes the meaning of the word such that the words that are closer in that vector space are expected to be similar in meaning.



Word-2-Vec

Pros: Carries semantic meaning, low dimension therefore high computation, dense vector which means higher no. of non-zero values and thus no problem like overfitting.

Intuition

Features	King	Queen	Man	Woman	Monkey
Gender	1	0	1	0	1
wealth	1	1	0.3	0.3	0
Power	1	0.7	0.2	0.2	0
weight	0.8	0.4	0.6	0.5	0.3
speak	1	1	1	1	0

King - [1, 1, 1, 0.8, 1]

King - Man + woman

1 - 1 + 0 = 0 → Gender

1 - 0.3 + 0.3 = 1 → wealth

1 - 0.2 + 0.2 = 1 → Power

0.8 - 0.6 + 0.5 = 0.7 → weight

1 - 1 + 1 = 1 → speak

NOTE: For a large dataset, the features are made automatically through Neural Networks. So in that case we would not know the features but only the values.

↳ The intution behind word2vec lies in the ~~data~~ idea that words with similar meanings are often used in similar context. By capturing these contextual relationships, word2vec aims to represent words as vectors in a continuous vector space, where the spatial proximity of vectors reflects semantic similarity.

↳ Word2Vec exploits the pattern of word co-occurences in large datasets to learn continuous vector representations for words. These representations capture semantic relationships, allowing the model to generalize and make predictions about words based on ~~their~~ their contexts. The resulting words embeddings can be used in various natural language processing tasks to enhance the understanding of semantic relationships b/w ~~vectors~~ words.

↳ The underlying assumption of word2vec is that two words sharing similar contexts also share a similar meaning and consequently a similar vector representation from the model.

Types of Word2Vec

(a) CBOW (Continuous Bag of Word)

Dummy Problem → Solve → Vector → By product

↳ CBOW, which stands for Continuous Bag of Words is one of the architectures used in the Word2Vec model for generating word embeddings. CBOW aims to predict a target word based on its context, where the context is defined by the surrounding words in a given text.

Example – If we've a sentence;

"The cat sat on the mat", and the target word is "sat", the context window might be ["The", "cat", "on", "the", "mat"].

↳ After training, the word vectors obtained from CBOW capture semantic relationships b/w words. Words with similar meanings or contextual usage have similar vector representations, allowing the model to generalize and make accurate predictions about words based on their context. CBOW is particularly useful when dealing with well-represented and frequent words in a large corpus.

(b) Skip-Grams

Sentence - Watch Campusx for data science.

i/p	o/p
Campusx	watch, for
for	Campusx, data
data	for, science.

↳ Skip-Gram is another architecture used in the Word2Vec model for generating word embeddings. In contrast to the Continuous Bag of Words (CBOW) model, skip-gram operates in the reverse manner. Instead of predicting the target word based on its context, skip-gram predicts the context words (surrounding words) given a target word.

↳ Skip-gram focuses on predicting the context words given a target word. This allows the model to learn representations that capture the contextual usage and semantic relationships of words. Skip-gram is often considered useful in scenarios where the target words are less frequent or when ~~feeling~~ dealing with long range dependencies in language.

NOTE: Small dataset → CBOW
Large dataset → Skip Gram.

* How to increase efficiency of Word2Vec ?
  - ↳ Increasing the training dataset
  - ↳ Increase dimension of vectors
  - ↳ Increase window size.