Notes on Vector Retrieval

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# Introductory Notes

A diagram of a number

AI-generated content may be incorrect.Let us consider a text document in English. Strip the document of grammar and word order and we end up with *a set* of words a.k.a. “bag of words” (BoW).

Figure: Vector representation of a piece of text by adopting BoW approach: a text document, when stripped of grammar and word order, is represented by a vector where each coordinate represents a term in our vocabulary and its value records the frequency of that term or represent some function of the frequency. The resulting vectors are *sparse* – that is , they have few non-zero coordinates.

Similarity in vector space must imply similarity between objects. So, as we engineer features to be extracted from an object or design a protocol to learn a model to produce embeddings of data, we must choose the dimensionality of the target space (a subset of ) along with a distance function . Together, these define an inner product of metric space.

Consider the lexical representation of a text document where d is the size of the English vocabulary

# References

[1] [Foundations of Vector Retrieval, S. Bruch, 2024](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/Foundations_of_Vector_Retrieval_Bruch_2024.pdf)

[2] [Distributed Representations of Words and Phrases and their Compositionality, Thomas Mikolov et al, Google, 2013](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/embeddings/Distributed_Representations_of_Words%20and_Phrases_and_their_Compositionality_Mikolov_2013.pdf)

[3] [Efficient Estimation of Word Representations in Vector Space, Thomas Mikolov et al, Google, 2013](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/embeddings/Efficient_Estimation_of_Word_Representations_in_Vector_Space_Mikolov_2013.pdf)

[4] [GloVe: Global Vectors for Word Representation, Jeffrey Pennington et al, 2014](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/embeddings/GloVe-Global_Vectors_for_Word_Representation_Pennington_2014.pdf)

[5] [BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding, Jacob Devlin et al, 2019](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/embeddings/BERT-Pre-training_of_Deep_Bidirectional_Transformers_for_Language_Understanding_Devlin_2019.pdf)

[6] [Approximate Nearest Neighbors: Towards Removing the Curse of Dimensionality, Piotr Indyk et al, Stanford, 1998](https://github.com/dimitarpg13/vector_db_intro/blob/main/articles/Approximate_Nearest_Neighbors-Towards_Removing_the_Curse_of_Dimensionality_Indyk_1998)

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