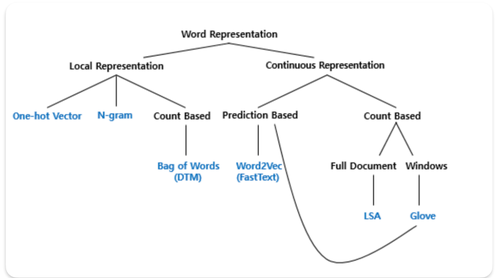

Word Representation Methods

Local Representation (국소 표현) / aka Discrete Representation (이산 표현)

Definition: A method of representing words by assigning a unique, discrete symbol (e.g., an integer) to each word. The representation focuses only on the word itself, without considering its context or relationships to other words.
Mapping: Each word is mapped to a specific value (e.g., 1, 2, 3, ...).

Example:
1 -> puppy
2->cute
3-> lovely

Limitations:
No Semantic Meaning: Fails to capture the semantic relationships between words. Words with similar meanings are treated as completely unrelated.
High Dimensionality: Can lead to high-dimensional representations, especially for large vocabularies (e.g., one-hot encoding).
Sparsity: Often results in sparse vectors (vectors with mostly zero values).

Distributed Representation (분산 표현)

- capture a notion of similarity and semantic meaning by allowing an entity to be represented by a pattern of values across many dimensions.
For example, in NLP, words with similar meanings are **mapped** to points in the vector space that are close to each other. This closeness is not arbitrary but is learned from the context in which words appear.

Definition: n is a method of encoding information where a concept is represented by a pattern of activity across multiple processing units (neurons or other), rather than a single unit

Contextual Information: The representation is based on the surrounding words (the context) in which the word appears.

Example: "puppy" is often found near "cute" and "lovely," so "puppy" is defined as having a "cute, lovely" feeling.

Synonyms: Also known as **Continuous Representation** (연속 표현).
Advantages:

- **Semantic Meaning:** Captures the semantic relationships between words. Words with similar meanings have similar vector representations.
- **Lower Dimensionality:** Results in dense, low-dimensional vectors, which are more efficient for computation and memory.
- **Generalization:** Allows for better generalization to unseen words, as similar words will have similar representations.
- achieved through neural network models, such as Word2Vec or GloVe, which process large corpora of text to learn these representations.

Applications of distributed representations:

Word Similarity: Measuring the semantic similarity between words.
Text Classification: Categorizing documents into predefined classes.
Machine Translation: Translating text from one language to another.
Information Retrieval: Finding relevant documents in response to a query.
Sentiment Analysis: Determining the sentiment expressed in a piece of text.

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Learning Distributed representations

Text : involve predicting a word given its surrounding words (continuous bag of words model) or predicting surrounding words given a word (skip-gram model). During this process, the model learns to place semantically similar words closer together in the vector space.

Images : convolutional neural networks (CNNs) learn distributed representations by being trained to recognize objects within images. Through layers of convolutions and pooling operations, CNNs learn to represent images in a way that captures hierarchical visual features.

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Limitation:
the requirement of large amounts of data to learn meaningful representations. Without sufficient data, the embeddings may not capture the true semantic relationships

computationally expensive to learn, requiring significant processing power and memory, especially for large datasets