

Embeddings in Machine Learning

Embeddings in Machine Learning are a way to represent complex data (like words, images, or items) as numerical vectors in a continuous space. This transformation allows algorithms to understand similarities and relationships between data points more effectively.

Most machine learning models work with numbers, not raw text or images. Embeddings solve this problem by converting high-dimensional or symbolic data into lower-dimensional numeric form. This helps models learn patterns, context, and relationships between data points.

An embedding maps each item (for example, a word) to a vector of real numbers. The goal is for similar items to have vectors that are close together in the embedding space. For example, in a word embedding model, the vectors for “king” and “queen” will be close because they share similar meanings.

Common types of embeddings include:

- Word Embeddings – Represent words as vectors (e.g., Word2Vec, GloVe, FastText).
- Sentence or Document Embeddings – Represent larger text units (e.g., Sentence-BERT, Universal Sentence Encoder).
- Image Embeddings – Represent visual data (used in computer vision tasks).
- Graph Embeddings – Represent nodes in graphs while preserving relationships.

Embeddings are widely used in applications like recommendation systems, search engines, natural language processing, and image recognition. They allow models to understand semantic meaning, similarity, and context beyond simple keyword matching.

In summary, embeddings are the foundation of many modern AI systems. They enable machines to represent and reason about data in a meaningful way, bridging the gap between raw information and intelligent understanding.