

Application and Importance of Vector Space in Deep Learning and Machine Learning

Ashwini Naresh Kudtarkar¹ and Rutuja Abhishek Shinde²

^{1,2} Assistant Professor, School of Engineering & Technology, Atharva University, Mumbai

Abstract: *Vector space plays a crucial role in the field of machine learning and deep learning by providing a mathematical framework for representing and processing data. In modern intelligent systems, real-world data such as text, images, audio, and numerical values are transformed into vectors within high-dimensional vector spaces. These vector representations enable machine learning algorithms to perform operations such as similarity measurement, classification, clustering, and prediction efficiently. Deep learning models, particularly neural networks, rely heavily on vector space operations including matrix multiplication, linear transformations, and optimization techniques for training and inference. Additionally, vector space concepts are fundamental to dimensionality reduction, feature extraction, and embedding techniques that enhance model performance and scalability. Thus, vector spaces form the backbone of data representation, learning, and decision-making processes in machine learning and deep learning systems.*

Keywords: Vector Space, Machine Learning, Deep Learning, Feature Representation, Neural Networks, Embeddings, Linear Algebra, Dimensionality Reduction

