Distributed Deep Learning in Large-Scale Datasets

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*Abstract*—Deep learning is a powerful subset of machine learning that can handle complex tasks such as speech recognition, computer vision, and natural language processing. However, the success of deep learning models is possible due to the availability of large-scale datasets and big computational resources. As a result, the use of distributed processing systems, such as Apache Spark, has become crucial for the efficient processing of the large amount of data required for the deep learning tasks. In this paper, the design and implementation of distributed neural network architectures will be explored, with focus on their application in handling large-scale datasets.

Keywords—distributed deep learning, neural networks, large-scale datasets, big data analytics, Apache Spark, HDFS

# Introduction

The amount of newly created data has been increasing at a remarkable rate. According to predictions cited by Forbes, the volume of data generated in 2020 was expected to grow 44 times, reaching 35 zettabytes (35 trillion gigabytes). Remarkably, just two years prior, the world had already accumulated 33 zettabytes of data, lading experts to forecast that by 2025, the global data volume could increase to 175 zettabytes (175 trillion gigabytes)(Press,2020). The term big data is usually broken down into V’s characteristics, starting from 3 up to 42 (Shafer, 2017, Elder Research). Usually, the most common ones are: Volume – refers to the magnitude of the data that is being generated and collected, Velocity – refers to the rate of generation of data, Variety – refers to different types of data that are being generated. As data is generated from various sources at unprecedented speeds in diverse formats, organizations have to adapt their infrastructure and tools in order to effectively store, process, and analyse the data. One approach for handling big data is by incorporating the use of distributed systems, which distribute data processing tasks across different nodes/machines. Additionally, advanced machine learning techniques, and more specifically neural networks, have emerged as a powerful tool for extracting insights out of big data. Neural networks make decision in a way similar to how the human brain works. It uses interconnected nodes/neurons in a layered structure that resembles the human brain, creating a system that computers use to learn from their mistakes and improve. Exploring the computational capabilities of distributed systems, such as Hadoop and Apache, this study will investigate the capacity of neural networks in processing and analysing large-scale datasets.

# Literature Review

## Introduction

Deep Learning is a subset of Machine Learning, which in turn is a subset of Artificial Intelligence. Deep learning, a type of machine learning inspired by the structure of the human brain, uses multi-layered neural network to simulate the decision-making power of the human brain. The main difference between Machine Learning and Deep learning is the type of data used and the methods in which the algorithms learn. As nowadays the amount of data increases at a unprecedented rate, numerous authors have explored scaling up machine learning algorithms through distribution and parallelization (Dean et al., n.d.; Hegde & Usmani, n.d.). with a First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 paper size. If you are using US letter-sized paper, please close this file and download the Microsoft Word, Letter file.

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