

## A HYBRID APPROACH COMBINING CNN-LSTM MODELS AND STACKING ENSEMBLE METHOD FOR SENTIMENT ANALYSIS

<sup>1</sup>**Kanimozhi.J**, Ph.D Research Scholar, Department of Computer Science, Nallamuthu Gounder Mahalingam College, Pollachi, Tamilnadu, India

<sup>2</sup>**Dr.R.Manicka Chezian**, Associate Professor, Department of Computer Science, Nallamuthu Gounder Mahalingam College, Pollachi, Tamilnadu, India

### Abstract

Opinion mining or sentiment analysis has become a crucial task for businesses that seek to understand and utilize the massive amounts of user-generated content available on the internet. This information can be leveraged to make data-driven decisions that impact product development, marketing strategies, and customer service improvements. In this paper proposed a novel approach to opinion mining that combines deep learning and machine learning techniques to extract and classify sentiment from textual data. This proposed method integrates convolutional neural network (CNN) and long short-term memory (LSTM) models to improve classification accuracy. Furthermore, to employ stacking ensemble machine learning method to further enhances the performance of the proposed approach. This proposed method first preprocesses the textual data to remove noise and irrelevant information. The CNN and LSTM models are then used to extract features and classify the sentiment of the text. The CNN model is responsible for detecting local patterns in the text, while the LSTM model captures the long-term dependencies between words. The stacking ensemble method combines the outputs of multiple models, including this proposed CNN-LSTM model and Stacking Ensemble classifier, to improve classification accuracy. To evaluate this proposed approach on several Kaggle datasets and find that it outperforms existing state-of-the-art techniques in terms of accuracy, precision, recall, and F1 score. The proposed method achieved an accuracy of 97.2%, which is a significant improvement over existing techniques. These results demonstrate that the proposed approach is effective in handling complex textual data and can be applied in various applications that require sentiment analysis.

**Keywords:** Opinion mining, Hybrid Neural Network, CNN, Machine learning

### I. INTRODUCTION

Opinion mining, also known as sentiment analysis, is a branch of natural language processing (NLP) that focuses on the computer analysis of people's expressed thoughts, sentiments, and attitudes [1]. With the exponential growth of user-generated content on the internet, opinion mining has become more important in a variety of industries, including marketing, politics, healthcare, and customer service [2]. The goal of opinion mining is to recognise and extract subjective information from text, such as product reviews, social media posts, and news reports, and classify it as positive, negative, or neutral [3]. This might provide helpful insights into public opinion, help firms improve their products and services, and influence legislative decisions [4]. Yet, because of the richness and ambiguity of human language, as well as the fact that people's thoughts may be influenced by context, cultural background, and personal biases, opinion mining is a challenging job. Opinion mining requires complex machine learning algorithms, linguistic resources, and topic knowledge to provide accurate and trustworthy results [5].

The exponential growth of online user-generated material has increased interest in opinion mining, often known as sentiment analysis [6]. Opinion mining is recognizing and extracting personal information from textual data, such as opinions, attitudes, and emotions [7]. This information may be utilized to make data-driven decisions in various disciplines, including marketing, customer service, and product development [8]. Numerous machine learning and deep learning algorithms for sentiment