



**INFORMATICS  
INSTITUTE OF  
TECHNOLOGY**

INFORMATICS INSTITUTE OF TECHNOLOGY

In Collaboration with

UNIVERSITY OF WESTMINSTER

**Hierarchical Attention Networks (HANs) in combination with  
Recurrent Neural Networks (RNNs) for Named Entity Recognition  
(NER)**

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Submitted in partial fulfilment of the requirements for the BEng (Hons) Software  
Engineering degree at the University of Westminster.

**February 2023**

## ABSTRACT

The problem of lack of study that considers the complementary use of sequential and hierarchical structures in named entity recognition (NER) tasks is addressed in this thesis. Studies already conducted frequently only consider sequential relationships or hierarchical information, neglecting to take advantage of both at once. This study proposes an ensemble strategy that combines Hierarchical Attention Networks (HAN) and Recurrent Neural Networks (RNN) to improve NER performance in an effort to close this gap. Furthermore, the effectiveness of HAN on the dataset used in this study has not received any detailed review.

In order to solve the aforementioned issue, the author provides a novel ensemble model that makes use of the advantages of HAN and RNN in order to better collect local and global contextual information for named entity recognition. With its hierarchical structure, the HAN model can collect data at different levels of precision, whereas the RNN model can catch sequential dependencies within the text. We seek to enhance NER systems' precision, robustness, and generalizability by integrating these two models. The ensemble technique guarantees that both the sequential and hierarchical data structures are employed efficiently, producing a more thorough representation of the named entities included in the text.

We carried out extensive experiments on an untested dataset to evaluate the efficacy of our suggested ensemble technique. This dataset demonstrates distinctive qualities that make it the perfect choice for assessing the effectiveness of HAN and our ensemble model. We acquired strong results by comparing the results to a number of cutting-edge NER techniques. The test accuracy for the RNN model was 97.5%, while the test accuracy for the HAN model was 97.48%. Our ensemble model, however, outperformed both standalone models, obtaining a remarkable test accuracy of 97.56%. These outcomes emphasize the superiority of our ensemble method and point to how named entity recognition tasks could be greatly improved by it.

**Key words:** Natural Language Processing, Named Entity Recognition, Recurrent Neural Networks, Hierarchical Attention Networks