**基於Transformer及遞歸神經網路的自然語言情感分析方法**

**摘要**

本計畫的目的是以遞歸神經網路(Recurrent Neural Network)改良Transformer自注意力機制(Self-Attention)並結合的過程。本研究來源以BERT (Bidirectional Encoder Representation from Transformers) 、SHA-RNN以RNN實現單頭注意力(Single Headed-Attention)及Transformer中的自注意力機制為主軸進行研究。研究中所使用的方法是透過改造後的長短期記憶模型(LSTM)實現單頭注意力機制，取代Transformer解碼器中的自注意力機制，改良Transformer自注意力在長文本序列中弱於捕獲文本中的短期依賴問題。因此，新的模型架構能透過具單頭注意力的RNN及原本的Transformer編碼器，重組編碼器和解碼器架構。新的模型與原本的Transformer和SHA-RNN相比能同時滿足長文本序列輸入所需的短期依賴及具備Transformer原有的長期依賴特點。本研究所獲得的研究成果可以輔助並應用於情感分析、社交網路分析及疾病傳播預測。

**A Sentiment Analysis Method based on Transformer and Recurrent Neural Network**

**Abstract**  
The purpose of this research is to implement the Transformer Self-Attention mechanism with Recurrent Neural Network (RNN). The source of this research is based on BERT (Bidirectional Encoder Representation from Transformers), SHA-RNN (Single Headed-Attention with RNN), and the Transformer Self-Attention mechanism as the main axis. The method proposed in this research is to realize the single-headed attention mechanism through the modified long-short-term memory model (LSTM), then replaces the self-attention mechanism in the Transformer decoder to improve the problem that Transformer self-attention mechanism is weak in capturing short-term dependence in long sequence. As a result, the architecture of the encoder and decoder can be reorganized through the RNN with a single-head attention mechanism and the original Transformer encoder. Compared with the original Transformer and SHA-RNN, the new model can both meets the short-term dependence required for long sequence input and possesses the original long-term dependence characteristics of Transformer. The result of this research is developed for improving specific tasks well by applying to sentiment analysis, social media analysis, and disease spreading prediction.