Language Chatbot 3.0 – The Design and Implementation of English Language Concept Learning Chatbot with the integration of Chaotic Neural Oscillatory Transfer Learning Technology

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ABSTRTACT

Mobile-based e-learning is a hot topic in education and the industry nowadays. With the integration of artificial intelligence (AI), concept learning provides a feasible and practical solution for language learning, especially for mobile learning of oral English. In our project, we proposed an advanced English Concept Learning Agent Chatbot, which is a combination of English concept learning with AI technologies such as chaotic neural oscillatory transfer learning technology and human voice synthesis and recognition technology. The proposed system is deployed on a WeChat mini-program named "Thinking Parrot" aimed to enhance and reinforce student English language capability by providing English dialogues and various English exercises. A Sequence-to-Sequence model using Chaotic Neural Oscillatory Long Short-Term Memory (CNO-LSTM) with Lee-Oscillator is adopted in this chatbot. Based on the Encode-Decoder structure, this application is combined with other mechanisms to improve the chatbot's ability to learn and adapt to the needs of individual learners, thus promoting creative learning.

Keywords: Concept Learning, English Chatbot, LSTM, Attention, Chaotic Neural Network, Lee-Oscillator

INTRODUCTION

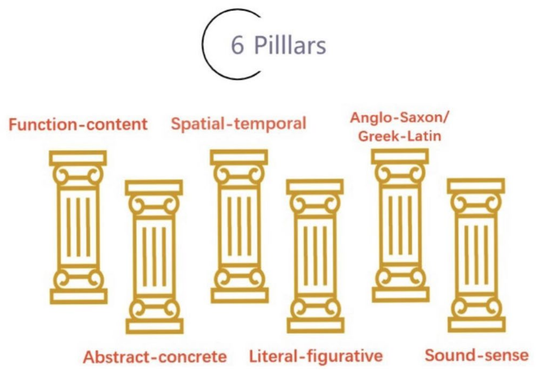
This project aims to create a chatbot that can help students to improve their English language skills. From the technological perspective, the use of concept learning and knowledge graph technology can help the chatbot to understand and respond for a wide range of topics and questions. Additionally, the integration of human voice synthesis and recognition technology allows more natural and interactive experience from the user perspective. The inclusion of chaotic neural oscillatory transfer learning technology also helps the chatbot to adapt and improve its performance over time. Overall speaking, this project has the potential to provide a unique and effective tool for creative learning. This approach contrasts with role learning, which involves simply memorizing facts and information without necessarily understanding their meaning or significance. More importantly, by adopting the reverse engineering process, learners are encouraged to take apart and analyze the building blocks of a concept before trying to rebuild it in their mind. This allows them to understand how the concept works, and to develop their own unique perspective.

CONCEPT LEARNING

Why is there a bottleneck for Chinese learning English? What are their blind spots and what have they overlooked in learning it as a second language?

Why is understanding English so difficult? You can understand every word in a sentence without knowing its overall meaning. This comprehension challenge doesn't exist in Chinese.

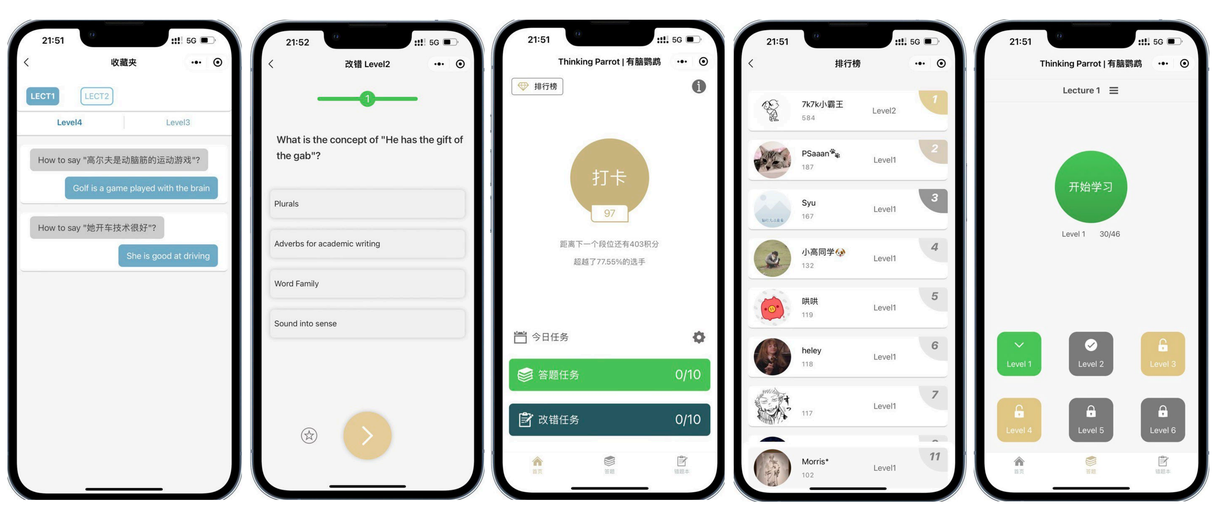
What does it mean to "think in English"? Writing is like cooking. Before you can write authentic English, you must know its elements. Get to know the ingredients first, then follow a proven recipe.



This method is holistic, going beyond grammar and vocabulary words. It is a multilayered and 360-degree look at English, through the eyes of a non-native learner and the sensitivity of a writer. Grammar is important. But there's a fun way to learn grammar. You will discover the 6 pillars and 7 hidden principles in the use of English. We invent new concepts to turn the foreign into the familiar and turn the "subconscious" knowledge of native speakers into our "conscious" knowledge. These concepts will simplify the complex.

THINKING PARROT

The English learning chatbot is implemented in a WeChat mini-program named "Thinking Parrot" which is designed to promote and facilitate English concept learning. The program provides various tools to help and motivate them to learn English. Such as collection, daily check in and rank list. Also, for the whole learning process, we divided it into six levels. Now we have implemented first 4 levels from concept introduction, multiple choices and oral questions. To continue this work, our FYP aim to implement the last level, which is a chatbot to put learner into more realistic English settings, help them to master the concept learning by using them in daily chat.



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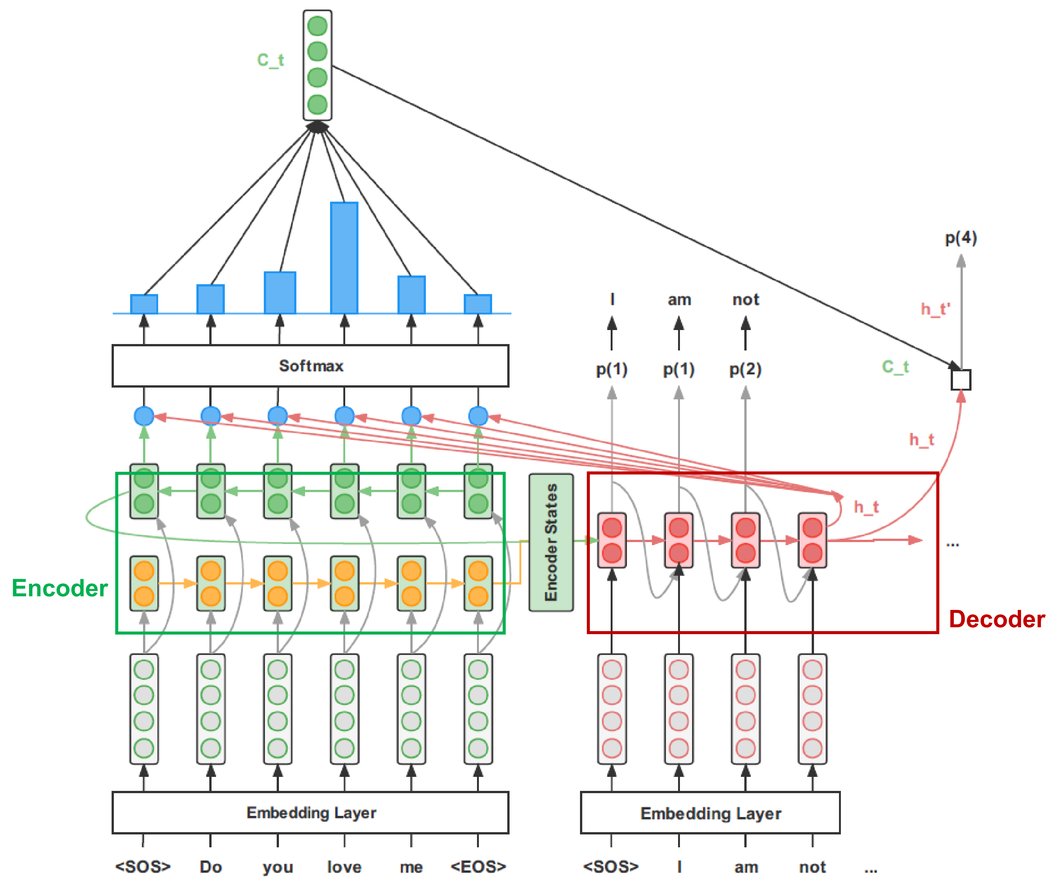
LUONG ATTENTION BASED CNO-LSTM SEQ2SEQ CHATBOT



Sequence To Sequence Learning

Sequence to sequence (seq2seq) learning represents a pattern for using Recurrent Neural Networks (RNN) to tackle complex sequence-to-sequence prediction problems such as machine translation, image captioning, speech recognition, text summarization and question-answering.

Encoder-decoder is the standard modeling paradigm for sequence-to-sequence tasks. This framework consists of two components: Encoder - reads source sequence and produces its representation; Decoder - uses source representation from the encoder to generate the target sequence.

Chaotic Neural Oscillator

Compared with the simple imitation of an artificial neural network, the chaotic neural network simulates the 'real' neuron behaviors of biological neurons and the human brain with high efficiency for the tasks that are dynamic, which plays the role of the dynamic neural unit for transient information processing. Considering the temporal reaction, the chaotic neural oscillator naturally fits the high-efficiency or highly frequent tasks.

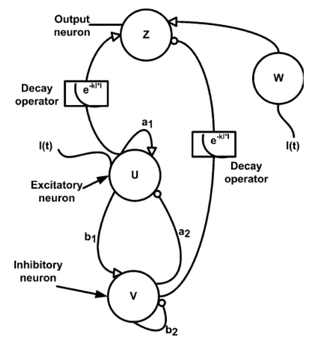
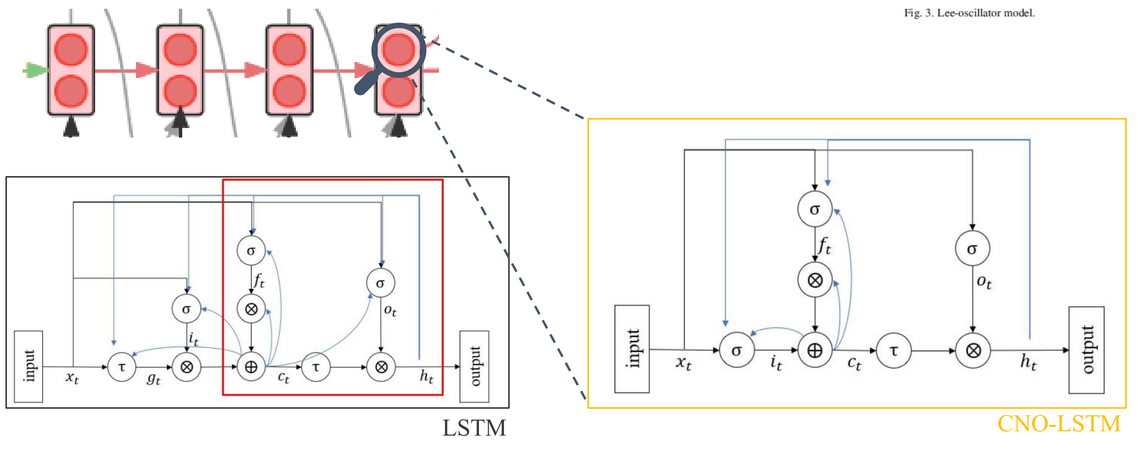


Fig. 3. Lee-oscillator model.



Luong Attention

It decides which source parts are more important. In this case, the encoder does not have to compress the whole source into a single vector - it gives representations for all source tokens (for example, all RNN states instead of the last one). At each decoder step, attention receives attention input: a decoder state and all encoder states; Computes attention scores For each encoder state, then attention computes its "relevance" for this decoder state. Finally, it applies an attention function which receives one decoder state and one encoder state and returns a scalar value score.

CONCLUSION

We design and implement an advanced English Concept Learning Agent Chatbot, which is deployed on a WeChat mini-program aimed to enhance and reinforce student English language capability by providing English dialogues and various English exercises. In the training, the loss of the proposed CNO-LSTM model (as the red line shows) decreases faster than that of vanilla LSTM model (as the green line shows) and is lower when they finally become stable. Hence the accuracy and robustness of CNO-LSTM model are better than vanilla LSTM. The improvement of performance benefits from the oscillation nature of CNO-LSTM, which helps it avoid getting stuck in deadlock and local minimum.