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A Novel Machine Learning Approach to Aid Agrammatism in Non-fluent Aphasia

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Abstract : Agrammatism in non-fluent Aphasia Cases can be defined as a language disorder wherein a patient can only use content words (nouns, verbs and adjectives) for communication and their speech is devoid of functional word types like conjunctions and articles, generating speech of with extremely rudimentary grammar . Past approaches involve Speech Therapy of some order with conversation analysis used to analyse pre-therapy speech patterns and qualitative changes in conversational behaviour after therapy. We describe this approach as a novel method to generate functional words (prepositions, articles,) around content words (nouns, verbs and adjectives) using a combination of Natural Language Processing and Deep Learning algorithms. The applications of this approach can be used to assist communication. The approach the paper investigates is : LSTMs or Seq2Seq: A sequence2sequence approach (seq2seq) or LSTM would take in a sequence of inputs and output sequence. This approach needs a significant amount of training data, with each training data containing pairs such as (content words, complete sentence). We generate such data by starting with complete sentences from a text source, removing functional words to get just the content words. However, this approach would require a lot of training data to get a coherent input. The assumptions of this approach is that the content words received in the inputs of both text models are to be preserved, i.e, won't alter after the functional grammar is slotted in. This is a potential limit to cases of severe Agrammatism where such order might not be inherently correct. The applications of this approach can be used to assist communication mild Agrammatism in non-fluent Aphasia Cases. Thus by generating these function words around the content words, we can provide meaningful sentence options to the patient for articulate conversations. Thus our project translates the use case of generating sentences from content-specific words into an assistive technology for non-Fluent Aphasia Patients.

Keywords : aphasia, expressive aphasia, assistive algorithms, neurology, machine learning, natural language processing, language disorder, behaviour disorder, sequence to sequence, LSTM
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