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Sinhala Sign Language to Grammatically Correct Sentences using NLP

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Abstract : This paper presents a comprehensive approach for converting Sinhala Sign Language (SSL) into grammatically correct sentences using Natural Language Processing (NLP) techniques in real-time. While previous studies have explored various aspects of SSL translation, the research gap lies in the absence of grammar checking for SSL. This work aims to bridge this gap by proposing a two-stage methodology that leverages deep learning models to detect signs and translate them into coherent sentences, ensuring grammatical accuracy. The first stage of the approach involves the utilization of a Long Short-Term Memory (LSTM) deep learning model to recognize and interpret SSL signs. By training the LSTM model on a dataset of SSL gestures, it learns to accurately classify and translate these signs into textual representations. The LSTM model achieves a commendable accuracy rate of 94%, demonstrating its effectiveness in accurately recognizing and translating SSL gestures. Building upon the successful recognition and translation of SSL signs, the second stage of the methodology focuses on improving the grammatical correctness of the translated sentences. The project employs a Neural Machine Translation (NMT) architecture, consisting of an encoder and decoder with LSTM components, to enhance the syntactical structure of the generated sentences. By training the NMT model on a parallel corpus of Sinhala wrong sentences and their corresponding grammatically correct translations, it learns to generate coherent and grammatically accurate sentences. The NMT model achieves an impressive accuracy rate of 98%, affirming its capability to produce linguistically sound translations. The proposed approach offers significant contributions to the field of SSL translation and grammar correction. Addressing the critical issue of grammar checking, it enhances the usability and reliability of SSL translation systems, facilitating effective communication between hearing-impaired and non-sign language users. Furthermore, the integration of deep learning techniques, such as LSTM and NMT, ensures the accuracy and robustness of the translation process. This research holds great potential for practical applications, including educational platforms, accessibility tools, and communication aids for the hearing-impaired. Furthermore, it lays the foundation for future advancements in SSL translation systems, fostering inclusive and equal opportunities for the deaf community. Future work includes expanding the existing datasets to further improve the accuracy and generalization of the SSL translation system. Additionally, the development of a dedicated mobile application would enhance the accessibility and convenience of SSL translation on handheld devices. Furthermore, efforts will be made to enhance the current application for educational purposes, enabling individuals to learn and practice SSL more effectively. Another area of future exploration involves enabling two-way communication, allowing seamless interaction between sign-language users and non-sign-language users.In conclusion, this paper presents a novel approach for converting Sinhala Sign Language gestures into grammatically correct sentences using NLP techniques in real time. The two-stage methodology, comprising an LSTM model for sign detection and translation and an NMT model for grammar correction, achieves high accuracy rates of 94% and 98%, respectively. By addressing the lack of grammar checking in existing SSL translation research, this work contributes significantly to the development of more accurate and reliable SSL translation systems, thereby fostering effective communication and inclusivity for the hearing-impaired community

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