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Opponent review of the master thesis:
Grammar Error Correction using Deep Reinforcement Learning

In the context of a research and development project for Mentorium GmbH in Berlin, I was pleased to support Mr. Raj Kumar Rana in his master thesis *Grammar Error Correction using Deep Reinforcement Learning*.

Detecting, identifying, and correcting grammar errors is currently a highly relevant field for machine learning to support the authoring of texts. In his thesis, the author implements a novel reinforcement learning approach for ML-based correction of grammar errors, thereby circumventing the drawbacks of existing supervised learning systems.

Conventional solutions are based on deep learning architectures (transformers) and use supervised learning to *teach* the model to detect and correct grammar errors. A major disadvantage that traditional supervised learning brings here is the need to prepare the training data. The training data for grammar correction with a sequence-to-label model requires for each erroneous input sentence also the corresponding labels to correct the errors. These labels must be generated in advance. This is an additional effort and a potential weakness, since the quality of this preprocessing can influence or even limit the later performance of the model.

The goal of the master thesis was to circumvent or avoid these limitations using reinforcement learning. This strategy eliminates the need to preprocess the training data. Thus, the model itself *learns* to assign the correct labels to correct an erroneous sentence. The author has thereby provided a first implementation and analysis for the practical application of this strategy.

In the first chapters on the introduction and theoretical foundations, the author gives a thorough introduction and overview of the relevant details. As well as a compact overview of the current state of the art for this novel approach.

The methodology is based on an existing publication of a supervised learning model (GECToR). The author uses this model to measure the performance of his RL approach. For this purpose, established benchmark datasets are used.

During the implementation it becomes apparent that the author has delved deeply into the subject in order to find, for example, an optimal reward function with better explanatory power for evaluating the model predictions.

In evaluating and discussing the results, some more in-depth analysis would be of interest to understand what factors influence the performance of the models. However, the evaluation shows that the novel approach has been successfully implemented.

As a result, the author has demonstrated a deep understanding and familiarization with the underlying subject matter by applying this novel approach of reinforcement learning to the problem of grammar error correction. This thesis provides a promising basis for improving ML-based correction of grammatical errors.

Overall, I recommend the thesis as an excellent work with the highest possible degree.

Tom Cvjetkovic