Summary of "Automatic Slide Generation for Scientific Papers" [1]

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Summary by Ivan Makohon
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The paper describes the ability to use artificial intelligence, machine learning, and deep learning to extract important sentences (features) from a scientific paper and generate presentation slides. The automatic slide generation model proposed in this paper would save time for the presenter by summarizing the scientific paper and preparing presentation slides as a guideline or starting point. The authors point out that related work has been well studied in the area of text summarization using bidirectional deep learning models and leveraging methods, such as TextRank and LexRank, to measure the importance of sentences; however, minimal research has been done with automatic powerpoint slide generation. With text summarization and slide generation in mind, the authors further progress the study in the area of automatic generation of slides using deep learning techniques.

The authors propose some steps to achieve their end goal. The first step involved labelling the sentences by providing a score for each one. Sentences with higher scores were kept since they represented the important ones while sentences with lower scores were excluded. The second step involved ranking the sentence in a model, which includes sentence embedding, summarizing, and extracting features. This step involved training a model by combining both features (syntactical and contextual) and using the mean square error to minimize the embeddings. The third step involved sentence selection using two different algorithms (greedy and integer linear programming). Using the scoring technique in the previous step along with one of these algorithms, a sentence selection was determined. The last step involved the slide generation, which consisted of an algorithm to build the slides along with the sentence selections.

The author's setup and experiment consisted of a large collection of papers (in PDF format), which was used as their dataset along with their proposed steps. Prior to using the data for deep learning, a tool (or library) was used to extract and parse the papers into a readable format for machine learning. Several models, such as Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN), were used in the embedding process and training. An evaluation metric called, Recall-Oriented Understudy for Gisting Evaluation (ROUGE) was used to evaluate their summary's quality against existing baseline scores. The results showed that the combination of the CNN model along with the integer linear programming algorithm performed the best from the ROUGE scores. RNNs was assumed to be better suited for the problem, but showed that overfitting occurred during the model training. And during the prediction, the greedy algorithm was outperformed by the integer linear programming algorithm.

There are two contributions identified in this paper. First, word embedding of sentences along with its contents are used to generate features. These features are ranked and used in the slide creations. Second, integer linear programming is used in the creation of the slide's first bullet point by using noun phrase extracted from the paper. The authors did not address any potential future, but I will suggest one in my questions/comments.

Questions/Comments

1. The Summarization section provided some useful insights on references for identifying important sentences, such as, TextRank and LexRank. I will keep these in mind for later use.

2. Would recommend to the user as a future work to survey and experiment with either *word2vec* and *doc2vec* as a means to perform embedding to encode syntax, semantics, and context of sentences as features.

3. I was very surprised to hear that automatic generation of slides has not been well studied in the academic world. At least in the sense of deep learning.

References

[1] A. Sefid, J. Wu, P. Mitra, and C. Giles, "Automatic slide generation for scientific papers," *CEUR Workshop Proceedings*, vol. 2526, pp. 11–16, 1 2019.