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ACL Paper Summary

The Association for Computational Linguistics (ACL) hosts an anthology of papers relating to computational linguistics and Natural Language Processing. This paper aims to summarize a particularly interesting paper from the 2021 ACL conference: *Align Voter Behavior with Public Statements for Legislator Representation Learning*, which was authored by Xinyi Mou, Zhongyu Wei, Lei Chen, Shangyi Ning, Yangcheng He, Changjian Jiang, Xuanjing Huang (Mou et al., ACL 2021). This summary serves to describe the problem addressed by the paper, the prior work on the subject problem, the unique contributions of the paper, the method of evaluation of their framework, and commentary involving the authors and the results of their paper.

Mou et al. aim to model the behavior of American legislators regarding predictions on whether a legislator will vote *yea* or *nay* on a given legislation and predictions on whether a legislator will post a given hashtag on Twitter. To procure datasets for this task, Mou et al. gathered roll call records (legislation, legislator stances, and legislator sponsorship of legislation), legislator information, and legislator's Twitter posts. To formulate notation for the tasks, they split the information into three categories: Legislators, Legislation, and Hashtags. The legislator list contains their member ID, State they represent, which political party they belong to, and the people they follow on Twitter. The legislation list consists of its title, description, sponsor information, and voting results. The hashtag list is composed of hashtags that have been mentioned by legislators on Twitter, which each contain information on related Tweets and authors. In the representation learning step, these categories are encoded into nodes which are used to construct a heterogeneous graph to cover the Congress and Twitter landscapes. Each legislator is encoded with a continuous low-dimension vector. Legislation and Hashtags are encoded with a Bidirectional Encoder Representation from Transformers (BERT). This graph is fed into a 2-layer Relational Graph Convolutional Network (RGCN) to capture 2nd order relations between the nodes. In the model training step, they use these relations to calculate roll call vote prediction, hashtag usage prediction, and a proximity loss based on who the legislators follow on Twitter. These predictions assist in fulfilling Mou et al.'s goal of modeling legislator behavior and it improves on prior work on the subject matter.

Roll call data analysis is an invaluable tool for quantitative political science in modeling legislator behavior, but prior attempts have suffered from certain pitfalls. (Clinton et al., 2004), uses an ideal point model that represents legislators and legislation as points. This was enhanced by (Gerrish and Blei, 2011) by incorporating textual information of legislation. This methodology presents two pitfalls: the points system fails to uncover the motivation behind legislator voting, and it is unable to model the behavior of newly elected officials because of the unavailability of their voting records. Framing theory, initially proposed by (Entman, 1993), involves exploring public statements to characterize the ideology of legislators. More recently, (Vafa et al., 2020) proposed a text-based ideal point model to analyze legislator's Tweets. This is similar to Mou et al., however Vafa et al. disregards the roll call data and fails to identify deep relationships between Congress sessions and Twitter. Finally, (Conover et al., 2011) reveals that hashtags are often polarized. Combining roll call data analysis, legislation Framing Theory, and polarized Twitter statements and hashtags, Mou et al. procure unique contributions to the task of modeling legislator behavior.

Mou et al. are the first to incorporate voting behavior and the public statements of legislators to jointly depict legislator behavior to further understand their preferences. Mou et al. are the first to utilize a heterogeneous graph to learn the representation of legislation and legislators to densify relationships amongst legislators to mitigate the unavailability of roll call data of new legislators. Mou et al. are the first to predict legislator hashtag usage to characterize their preferences on public discussion and to construct a dataset as the benchmark. Their unique contributions to the field heavily build on prior work, and they have extremely thorough methodology for evaluating the model they trained.

Mou et al. used data from the 112-115th Congress session; they split up the training data and testing data in three different ways and compared it to several other recognized approaches. They split the testing data and training data into two different categories: Random and Timed. The random category has a training and test set where only legislators who were in all four sessions of congress are considered, additionally, the data is chosen randomly within every Congress session. The timed category has an additional constraint where the data must be chosen chronologically. This category is split in two: Mem Train, where only legislators that were in session in the training set are considered in the testing set, and Mem All, where all legislators are fair game in the test set. Mou et al. used the accuracy and the macro F1 score to compare the nine models. The models they used include: a majority baseline, which assumes legislators vote *yea*. Ideal-point-wf, which takes the word frequency of legislation text as features. Ideal-point-tfidf, which is the same as the previous model except it uses term frequency-inverse document frequency instead of word frequency. Ideal-vector, which learns multidimensional ideal vectors for legislators based on legislation texts. CNN, which uses a convoluted neural network to encode legislation. CNN+meta, adds on to CNN by considering the percentage of sponsors of different parties regarding legislation authorship. LSTM+GCN, which uses Long-Short Term Memory to encode legislation and applies a Graph Convolutional Network to update representations of legislators. Vote, using the researcher's framework with only the roll call data. Ours, the researcher's framework. Unsurprisingly, their framework has the highest accuracy of all models (90%) and the highest Macro F1 score (~86%). This work may prove a useful tool for political scientists and will probably be utilized more frequently as elections near.

According to Google Scholar, Mou et al. has been cited a measly four times, which is an injustice considering how thorough their paper is, however, it makes sense considering how specific this paper's subject matter is and how recent it was published. Huang Xuanjing is a professor at Fudan University, and his work has been cited 13,144 times. He is likely the instructor supervising the other author-students, where Zhongyu Wei is the student with the most citations, 2,911. It is interesting to note that this study was largely funded by the National Science Foundation of China, and three of the citations are of other Chinese papers revolving around predicting US legislative behavior. This is probably due to the wide availability of American legislation voting data and outspoken American politicians on Twitter. Ultimately, because of America's global policy reach, this study can be used by American political scientists to better model legislator tendencies on all legislation as well as abroad in predicting how likely upcoming relevant legislation is to pass.

Works Cited

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