

論文 / 著書情報
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	情報通信 情報通信	系 コース	申請学位 (専攻分野)： Academic Degree Requested	博士 Doctor of	(工学)
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要旨 (英文 800 語程度)
Thesis Summary (approx.800 English Words)

Social media has become a popular source of information to analyze current opinions of numerous people. Many researchers have worked to realize automated analytical methods for social media because manual analysis of such vast amounts of data is difficult. Social media has a unique characteristic that allows connections between users and posts to form a social network. Users can be connected by relationships such as follow, friend, or mention. Posts can also be connected by relationships such as reply or mention. Analyses of social media will be likely to benefit from user and post relationships that reflect information flows which are included in a social network. Diverse opinions in social media have brought various automated analyses that differ on its targets. Several examples of these automated analyses are: sentiment analysis, speech and discourse act classification, social sensor, user profiling, violence detection, and fake news detection. These analyses are desired to be deployed to real scenarios but suffered from performance and interpretability issues because automated analyses are often inferior compared to humans. We will tackle these issues to improve social media analysis by integrating user and post relationships with neural networks through the proposals of novel models. Neural networks have shown several strengths compared to traditional machine learning methods. First, they have achieved superior performances on various tasks when large scale data are available. Secondly, they have shown an effectiveness for optimizing end-to-end tasks that compose from multiple dependent subtasks. Thirdly, they have capability to intuitively handle a tree or graph structure with a recurrent or convolutional operation. Fourthly, an attention mechanism has shown effectiveness for interpreting neural models.

In the proposed models, the following ideas are experimented to improve social media analysis by capturing target relationships. User embeddings, label embeddings, hierarchical neural layers, and an attention mechanism are introduced for user relationship. User embeddings and label embeddings are intended to introduce information of users that are connected with user relationships from a target user of an analysis. Hierarchical neural layers and an attention mechanism are set to unify diverse sources such as texts, metadata, and user network information. Recurrent neural networks for tree structure, convolutional neural networks for graph structure, and an attention mechanism are utilized for post relationship. Neural networks for tree structure and graph structure are intended to express information passed between posts. An attention mechanism is inserted to merge multiple approaches to process tree structures and graph structures. The attention mechanisms included in the proposed models are further used to interpret internal processes of neural networks. The unification of diverse sources through the attention mechanism is analyzed to confirm the interpretability of neural networks for user relationships. The merge of multiple approaches with the attention mechanism is analyzed to interpret approaches that are suitable for post relationships.

The effect of the proposed approaches and the analysis of interpretations are tested on three tasks of social media analysis: geolocation prediction, language variety identification, and discourse act classification. Geolocation prediction is a task to predict a geolocation of a user such as current location or home location. Language variety identification is a task to predict a language difference of a user that can be distinguished by a form such as dialect, register, or style. Discourse act classification is a task to classify utterances in a conversation into discourse functions. User relationships are integrated by unifying texts, metadata, and user network information in the geolocation prediction task. Compared to previous ensemble approaches, the proposed neural model of geolocation prediction improved accuracy metrics by a maximum of 6.6%. The following language variety identification task further explored the integration of user relationships by investigating users in four languages. The improvement in accuracy by a maximum of 5.6% was achieved with the proposed neural model of language variety identification against the baseline models. In addition, the different trends of the improvement are observed in this task among the four languages. Post relationships are integrated by the tree-level long short-term memory approaches

and the graph-level convolutional neural network approach in the discourse act classification task. The proposed neural model of discourse act classification outperformed the previous sequential learning approach by the improvement of 1.5% in accuracy and 2.2 in F1 score.

We further investigated some strengths to interpret internal structures of neural models through the social media analysis tasks. In geolocation prediction, we analyzed the attention layers which unifies the multiple sources of information. The analysis revealed that the attention layers can capture some statistical characteristics of the geolocation datasets. In discourse act classification, we inspected the interactions between the different structural components. The inspection suggested that the effective combination of the components rely on characteristics of a thread. The results of the performance improvements and the interpretability analyses encourage the effectiveness of integrating user and post relationships into social media analysis with neural networks.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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