AST Based Sequence to Sequence Natural Language Question to SQL Method

Kai Yang

1Department of Computer Science, Yale University

Introduction

Converting natural language question to SQL queries is an interesting problem and it is one of the key components of Artificial Intelligent agent. However, the current model could only solve very simple SQL queries and due to the limitation of current dataset and evaluation metrics, the real ability of existing models is overestimated. In this paper, we proposed new dataset and evaluation metrics. We also adopt a AST based model and evaluate the model using new dataset and evaluation metrics.

Materials and Methods

We adopt an AST based sequence to sequence model from Yin et al. For decoder part, the RNN decoder each timestamp generate a grammar rule, an abstract syntax tree could construct by applying the rules from top to bottom and left to right. At each timestamp, the hidden state is generated by:

\[ s_t = f_{LSTM}(\{a_{t-1}; c_t; p_t; n_t\}, s_{t-1}) \]

\( a_t \) is the previous action, \( c_t \) is the context vector, \( p_t \) is current node’s parent, \( n_t \) is the embedding of current rule.

Evaluation and Results

We used an AST based evaluation method. First, we converted generated SQL queries and labeled SQL queries into an AST. After that, we compared the two syntax tree. Also, we divided SQL queries into the following parts and compute accuracy:

- a) select columns, b) select all aggregation functions, c) select all without aggregation functions, d) where expressions, e) operations in where, f) nested queries in where, g) group by, h) having, i) order by, k) compound statement: EXCEPT, UNION, INTERSECT

Our dataset contains 4204 training data and 632 test data. Evaluation result is presenting at Table 2. From the result, we can see the model is relatively good at predicting aggregation functions in select clause and the model has very limited ability in generating nested queries and compound statement.

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Reference