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A New Approach to String Transformation

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Abstract: *In this paper we proposed a solution for problems facing in data mining, natural language processing, information retrieval, and bioinformatics can be formalized as string transformation, which is a task as follows. Given an input string, the system generates the M most likely output strings corresponding to the input string. This paper proposes a novel and probabilistic approach to string transformation, which is both accurate and efficient. The approach includes the use of a log linear model, a method for training the model, and an algorithm for generating the top M candidates, whether there is or is not a predefined dictionary. The log linear model is defined as a conditional probability distribution of an output string and a rule set for the transformation conditioned on an input string. The learning method employs maximum likelihood estimation for parameter estimation. The string generation algorithm based on pruning is guaranteed to generate the optimal top M candidates. The proposed method is applied to correction of spelling errors in queries as well as reformulation of queries in web search. Experimental results on large scale data show that the proposed approach is very accurate & efficient improving upon existing methods in terms of accuracy and efficiency in different settings.*

1. INTRODUCTION

This paper addresses string transformation, which is an essential problem, in many Applications. In natural language processing, pronunciation generation, spelling error correction, word transliteration, and word stemming can all be formalized as string transformation. String transformation can also be used in query reformulation and query operators. Here the strings can be strings of words, characters, or any type of tokens. Each operator is a transformation rule that defines the replacement of a substring with another substring. The likelihood of transformation can represent similarity, relevance, and association between two strings in a specific application. Although certain progress has been made, further investigation of the task is still necessary, particularly from the viewpoint of enhancing both accuracy and efficiency, which is precisely the goal of this work.

String transformation can be conducted at two different settings, depending on whether or not a dictionary is used. When a dictionary is used, the output strings must exist in the given dictionary, while the size of the dictionary can be very large. Without loss of generality, we specifically study correction of spelling errors in queries as well as reformulation of queries in web search in this paper. In the first task, a string consists of characters. In the second task, a string is comprised of words. The former needs to exploit a dictionary while the latter does not. Correcting spelling errors in queries usually consists of two steps: candidate generation and candidate selection. Candidate generation is used to find the most likely corrections of a misspelled word from the dictionary. In such a case, a string of characters is input and the operators represent insertion, deletion, and substitution of characters with or without surrounding characters, Obviously candidate generation is an example of string transformation. Note that candidate generation is concerned with a single word; after candidate generation, the words in the context (i.e., in the query) can be further leveraged to make the final candidate selection,

2. EXISTING SYSTEM

Efficiency is not an important factor taken into consideration in these methods. Some work mainly considered efficient generation of strings, assuming that the model is given of misspelling and correction can be frequently observed in web search log data, it has been proposed to mine spelling-error and correction pairs by using search log data. The mined pairs can be directly used in spelling error correction. Methods of selecting spelling and correction pairs with maximum entropy model and

similarity functions have been developed. Only high frequency pairs can be found from log data, however. In this paper, we work on candidate generation at the character level, which can be applied to spelling error correction for both high and low frequency words. Suggestion in search. In data mining, string transformation can be employed in the mining of synonyms and database record matching. As many of the above are online applications, the transformation must be conducted not only accurately but also efficiently. String transformation can be defined in the following way. Given an input string and a set of operators, we are able to transform the input string to the k most likely output strings by applying a number of Either efficiency is achieved or effectiveness is achieved not both. In the existing system the following algorithm are used Generative model. Logistic Regression Model. A discriminative model there are also methods for finding the top k candidates by using n-grams. Efficiency is the major focus for these methods and the similarity functions in them are predefined.

In contrast, our work in this paper aims to learn and utilize a similarity function which can achieve both high accuracy and efficiency. There are two possible settings for string transformation. One is to generate strings within a dictionary, and the other is to do so without a dictionary. In the former, string transformation becomes approximate string search, which is the problem of identifying strings in a given dictionary that are similar to an input string.

Previous work on string transformation can be categorized into two groups. Some work mainly considered efficient generation of strings. Other work tried to learn the model with different approaches. However, efficiency is not an important factor taken into consideration in these methods. The existing work is not focus on enhancement of both accuracy and efficiency of string transformation.

3. PROPOSED SYSTEM

String transformation has many applications in data mining, natural language processing, information retrieval, and bioinformatics. String transformation has been studied in different specific tasks such as database record matching, spelling error correction, query reformulation and synonym mining. The major difference between our work and the existing work is that we focus on enhancement of both accuracy and efficiency of string transformation.

3.1 Spelling Error Correction

Spelling error correction normally consists of candidate generation and candidate selection. The former task is an example of string transformation. Candidate generation is usually Sometimes a dictionary is utilized in string transformation in which the output strings must exist in the dictionary, such as spelling error correction, database record matching, and synonym mining. In the setting of using a only concerned with a single word. For single-word candidate generation, a rule-based approach is commonly used. The use of edit dictionary, we can further enhance the efficiency. Specifically, we index the dictionary in a trie, such that each string in the dictionary corresponds to the path from the root node to a leaf node. When we expand a path (substring) in candidate generation, we match it against the trie, and see whether the expansions from it are legitimate paths. If not, we discard the expansions and avoid generating unlikely candidates. In other words, candidate generation is guided by the traversal of the trie.

3.2 Query Reformulation

Query reformulation involves rewriting the original query with its similar queries and enhancing the effectiveness of search. Most existing methods manage to mine transformation rules from pairs of queries in the search logs. One represents an original query and the first identifies phrase-based transformation rules from query pairs, and then segments the input query into phrases, and generates a number of candidates based on substitutions of each phrase using the rules. The weights of the transformation rules are calculated based on log likelihood ratio. A query dictionary is used in this case

3.3 Efficient Dictionary Matching Algorithm

Sometimes a dictionary is utilized in string transformation in which the output strings must exist in the dictionary, such as spelling error correction, database record matching, and synonym mining.

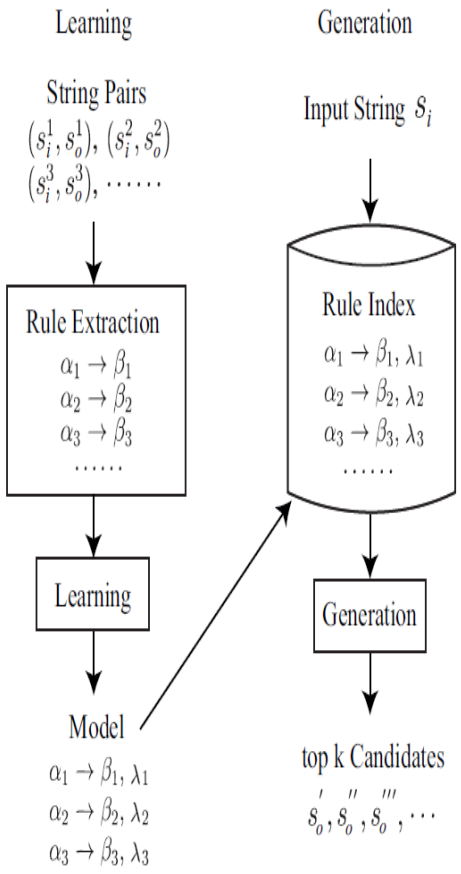

Fig 1. *Overview of our Method*

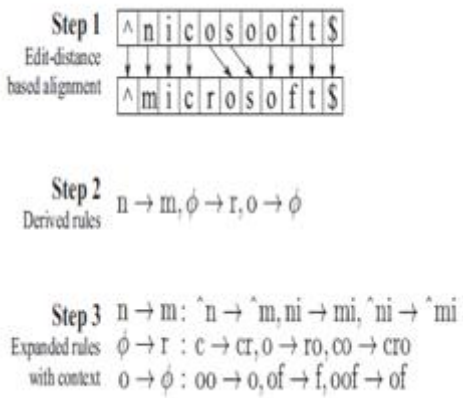

Fig 2. *Example of Rule Extraction*

4. CONCLUSION

In this paper, we have proposed a new statistical learning Approach to string transformation. Our method is novel and unique in its model, learning algorithm, and string generation algorithm. Two specific applications are addressed with our method, namely spelling error correction of queries and query reformulation in web Search. Experimental results on two large data sets and Microsoft Speller Challenge show that our method improves upon the baselines in terms of accuracy and efficiency. Our method is particularly useful when the-problem occurs on a large scale

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