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Improving Business Process Model Using An Efficient Recommendation Method

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Abstract - *In modern commerce, the specialization of business process and custom demands frequently changes the business process modeling. Because of that, require capacity of the modeling process for enterprises effectively and efficiently. Existing processes for improving business modeling use workflow mining and process retrieval and require much manual work. In this paper workflow recommendation method is proposed for automatically creating new business process that is under cogitation with support of process designers. The minimum depth-first search (DFS) codes of business process graphs are using for calculating the distance between process fragments and select candidate node sets for recommendation purpose. The recommendation method will implement for improving the efficiency and accuracy. And last, based on both synthetic and real-world datasets, the proposed method will compare with other methods and the experiment results will prove its effectiveness for practical applications.*

Key Words: Business Process Modeling, Enterprise Systems, Industrial Informatics, String Edit Distance, Workflow, Workflow Recommendation.

1. INTRODUCTION

To facilitate the coordination of work across the organization and cooperation, enterprise systems (ES) have been developed to integrate computer systems that support all phases of an organizations operation. Enterprise System [1] has adopted many organizations for their mission critical [2][3] applications. ES has been fueled by the global economy and the development in information technology including industrial informatics. Enterprise Systems integrate business processes and align IT to support business strategy and workflow technology is essential and is threaded through the very core of the system architecture. Business process is one of the main tool to develop workflow technology. Business process specifies various business logics and handles different business operations. Thus, business process modeling [4][5] plays important role in operating modern enterprises. However, business process is time consuming process which often involves selecting concrete activities to be performed such as determining their execution order and dealing with the exceptions that may occur. Business process is complex process. Besides, in modern commerce, both frequent changes of custom demands and the specialism of the business process require the capacity of modeling business processes for enterprises in an effective and efficient manner. Existing processes improving business modeling use workflow mining and process retrieval and require much manual work.

New business process promotes the efficiency and accuracy of modeling so-called workflow repository which contain set of already developed process models. Business process model repository structurally and semantically related models. Similar to the search on internet a user expresses a BPMN-Q query and results receive a list of process models ordered by germaneness of the query. There are more than hundreds and even thousands of business process models in the repository. Large number of process models could serve knowledge base for guidance for the modeling effort.

Nowadays existing methods based on the graphs. For example, event-driven process chains (EPC), Petri nets, and Business Process Modeling Notation (BPMN)[9].Since similarity of two business process proved the most effective way to distinguish between two business processes ,starting from the graphs and combining with traditional recommendation. We plan to proceed associate rules mining between business activity nodes and process fragments within the workflow repository, and provide related decision support or information for modeling processes. We call it workflow recommendation. A business process modeling fragments under modeling as a reference model and pattern are called the influencing upstream subgraphs of the activity nodes that determine the occurrence of these nodes in the workflows. The rule of mining to refer pattern extraction is the foundation of workflow recommendation. In this paper, we use a graph-mining technique to extract the patterns from the workflow repository. The minimum depthfirst search [6] codes are used as label for business process models of fragments. These codes we proposes an efficient string edit distance (SED) [7]. Similarity metric This turns the graph-matching problem into string matching problem. The method is not only more efficient than GED-based distance metric methods [8], but also overcomes the drawback of the GED method which requires to determine different cost functions for different scenarios, for analyzing

and measuring the distance between reference model and process patterns. Based on the results system selects most probable activities or task for recommendation. I wish you the best of success.

2. RELATED WORK

Nowadays, research work has been focusing on improving business process modeling. Designing the workflow process use workflow mining [9], its time consuming process. Workflow mining helps the modelers improve process modeling with discovered process models. The construction new business process is referred to the pre-discovered template model and modelers have to construct the process themselves. Instead of the workflow repository, our method can not only automate the construction process but also provide guidance for recommending the most likely nodes. However, taking the result form the workflow mining as the provenance for workflow repositories, then accuracy of workflow recommendation will increase, which means have complementary advantage. Process retrieval [10][11] can help modelers improve the modeling by retrieving the similar fragments from the workflow repository. Similar to workflow mining much manual work is still involved.

A limited number of literature [11][12] available for above research. Workflow recommendation technique also called flow Recommendation [12]. flow Recommendation features a more robust exploration capability to identify the upstream
dependency patterns that are essential to the accuracy of workflow recommendation. This leverages source of workflows to provide recommendation for the best node that needs to be chosen to complete the workflow. Flow Recommender consist of complex structure does not support patterns (e.g. AND-join, OR-join, etc.) and it would fail facing with candidate node with multiple influencing upstream sub paths. Flow recommender cannot widely used in real applications. Since our work starts from the graph model its complex structure, in this paper we proposed recommendation method is more practical and could be applied to real application scenarios.

Other related research work was carried out on service discovery and optimization for composition[13][14][15] in the domain of Service Computing. Traditional service composition issues refer to the web services scenarios recommended based on certain given or pre-defined business template in which high-level abstract web services are well specified by users when the workflow is designed.

3. PROPOSED SYSTEM

Through this system designer get improved business process from existing business process. By using this system, cost and manual work of business process is reduces. This system starts by taking business process, after that system do process remodeling for converting process into appropriate form which can give to the subgraph mining. In subgraph mining, node distances between process found by using subgraph of the process and eliminates the duplication of business process subgraph. output of this preprocessing step is given to the pattern discovery step. In pattern discovery, Subgraphs is decomposed into candidate node set and upstream subgraph by subgraph decomposition. This upstream subgraph is used for pattern extraction for deriving patterns. These patterns are stored in pattern table for workflow recommendation.

In workflow recommendation module we calculate the distance between the process nodes from candidate node set. Candidate node set from reference model used by recommendation triggering for identifying efficient candidate node set which is going to be used for improving the business process. This process cycle continuously run until desired task has been fulfilled. When whole design completed, the newly designed business process can be archived to the workflow repository and served as the performance for future recommendation.

This system can do the following objectives:

1) Speed up the business process design and reducing the deliberation time which is needed when domain knowledge is inadequate or missing.

2) Choosing most likely task by minimizing the errors that are possibly made in business process design work.

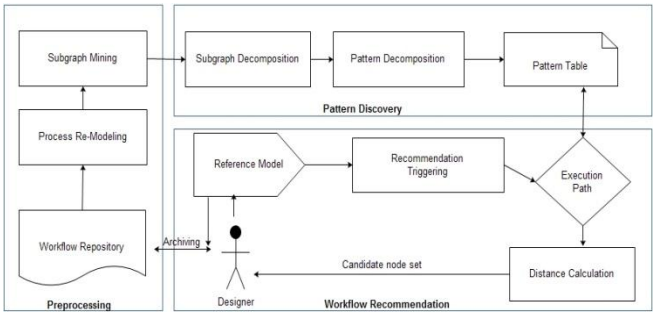


Fig 1. Block diagram of proposed system.

4. PROTOTYPE IMPLEMENTATION

There are introducing three modules respectively.

A. Preprocessing:

As stated in section III, in workflow repository business process are modeled in the form of different graph model. Pattern extraction is facilitating in workflow repository, and remodeling these graphs to uniform models, which is supported in high-level modules in framework. After remodeling, the graph mining algorithm (eg. gSpan [6]) is used for subgraph mining. Note that, frequency of subgraph is set to 0 which means all business process subgraphs are

found on all subgraphs. The output of this module is: the order of edge labels and node labels, a set of subgraphs and frequencies.

B. Pattern Discovery:

In preprocessing module mine all subgraph and count the frequency for each of them. Note that, through the canonical label of the minimum DFS code, eliminate the duplication of business process subgraph and final result is unique. Taking above result use input as pattern discover algorithm. Each mined process subgraph are decomposed in two parts which are candidate node set and upstream subgraph. Candidate node set is used for the extend or complete the refreance model when recommendation occurs, and upstream subgraph is used as the provenance for pattern extraction. To establish the pattern table for influencing upstream subgraph and corresponding candidate node sets, calculating the confidence of each upstream subgraph with the frequency in set is vital and time consuming. When the confidence of an upstream subgraph is larger than a certain threshold, it would be registered into the pattern table. Result of decomposing some patterns are unconnected graphs which cannot be represent the DFS codes. Then reconstruct the patterns by adding mock node where candidate node is located as per the order of node labels and edge labels minimum DFS code recorded in preprocessing module.

C. Workflow Recommendation:

Workflow recommendations have much attention about its accuracy and efficiency and this module is performing online. The distance calculation performs play a very important role in workflow recommendation. Business process is complex structure which may have many execution paths and each of them execute individually most of time. In this module only select the upstream execution path for matching, and reconstruct the selected path same as mentioned in module pattern discovery.

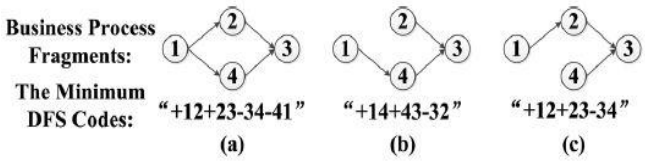
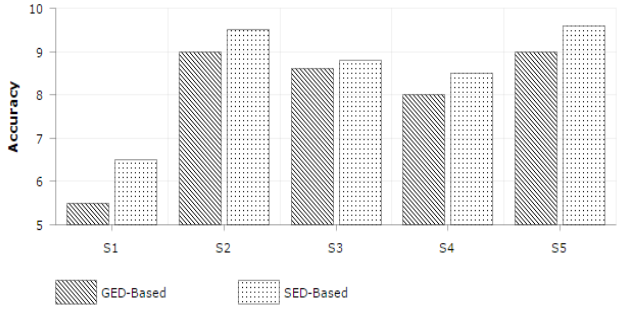


Fig 2. Illustration for filtering the minimum DFS codes.

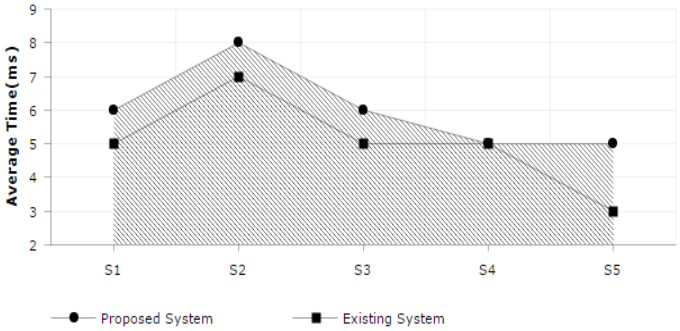
Generally, the SED of the minimum DFS codes of the reference model and the pattern cannot directly determine their distance or similarity. Suppose that the business process shown in Fig. 2(a) is the reference model, and Fig. 2(b) and (c) shows two patterns. Comparing with the model in (a), the patterns in (b) and (c) lack only one edge, respectively, i.e., 1!2 and 1!4, and the rest nodes and edges are same. Thus, from the viewpoint of structure, they should have the same similarity to (a). But, according to the minimum DFS codes shown in the figure, we have SED(a,b)!= SED(a,c). To solve this problem, we filter the minimum DFS codes simplified in last module. Since each edge, in a business process graph, represented by the DFS code has been simplified to a 3-tuple:(f,li, lj), the length of a simplified minimum DFS code is the multiple of 3. Based on these tuples, we compare the codes of the reference model and the pattern. Then, remove the same edges (DFS codes) in both of them and the rest codes are conducted SED
calculation. Note that exchanging two nodes of an edge and reversing its direction, if the edge is same with another, these two 3-tuples are the same too, and they would be removed from the code. As shown in Fig. 2, to determine the similarity between (a) and (c), we could merely calculate the SED of two strings"+12 and" Because, the edge"+23 could be turn to"-32."-34 and "-41 correspond to "+43 and "+14 for the same reason. Based on the discussion, from Fig. 2 can get: SED(a,b)= = SED(a,c). After filtering, we calculate SED for reference model and the pattern. Then get the final distance.

5. RESULT AND DISCUSSION

This graph shows the comparison between Graph Edit Distance and String Edit Distance of test sets.



The Graph shows the recommendation between the proposed system and existing system.



6. CONCLUSION

In this paper not only address the problem of distance calculation between two process containing complicated structures such as AND-Join and OR-Split, but also improved the efficiency for matching two fragments. In this system SEDbased workflow recommendation method which is improving the business process model for providing the guidance to extend or complete the business process under construction And in this paper proposed a framework for prototype implementation and two algorithms respectively for pattern discovery and workflow recommendation. The experimental evaluations conducted on synthetic and real world datasets, which is showed that our method achieved better or equal performance in both efficiency and effectiveness when comparing with other methods (i.e., GEDbased method and FlowRecommender). It turns out to be a promising approach for improving the efficiency and accuracy of business process modeling in real applications.

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