

Process Mining Based Software for Automated Business Process Discovery



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Abstract: Automated Business Process Discovery is a rising field that depends vigorously on computer software. Software do the automatic analysis of the several documents such as audits and event logs and generate useful, novel, hidden and fascinating information from that. The information produce from the software recognize the process model as well as investigates varieties and gives clients a vastly improved picture of what a particular business process resembles, and how changes would influence the business in general. This paper presents the common framework activities of process mining in the context to all well known software. The paper also describes the open source process mining software with their operational characteristics. Finally, paper represents the role of process mining software for various famous industries.

Keywords : Process Mining, Event Log, Process Discovery, Framework Activities

I. INTRODUCTION

Business Process Management [12] is the collaborative discipline of information technology and management science in order to improve business processes. Process Mining is the developing concept of information technology which can assist business associations with extracting profitable process related data from a several event logs [17,18]. Process Mining follows the directed graph structure. The nodes of the graph represent the events and conditions of business organization, whereas arcs represent pre and post conditions for the event to occur. Most of business organizations use various kinds of software which store the event information with time stamp. For example, ERP software [8] log all transactions, CRM software[1,16] log transactions of customers, Work flow management software[20] log start and end time of events etc. Only storing the data and events will not help the businesses more so the continuous monitoring and generating some useful insights are very necessary in the context to any business organizations.

The main objective of the process mining[15,21] is automatically discover the valid business process form the behavior stored in several event logs. Over the several years, many software tools and techniques for process mining have been developed[7,13,21]. However , many organizations are not aware which tools and techniques of process mining are appropriate for them. The main intention of this paper is to provide appropriate information related to software tools of process mining. The Section II will describe the common framework activities of process mining related software. The Section III will discuss about open source software for process mining. The Section IV will describe the role of process mining software for the major industries.

II. FRAMEWORK FOR PROCESS MINING SOFTWARE

Every Process Mining software contains common framework activities. The most widely recognized activities of process mining framework for software are portrayed in following figure.



(Figure 1: Common Framework Activities for Process Mining based Software)

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The process mining software collects the data in various event logs. Event logs are extracted from databases, audit trails, transaction logs, etc. There are several common standard formats use in software are eXtensible Event Stream(XES)[14], Mining eXtensible Markup Language(MXML) and Comma Separated Values(CSV).

Event log data cannot be utilized directly without filtering. Process Mining software do different levels of filtering to remove errors, to reflect real transaction data or to avoid malfunction.

In Process Discovery phase, some model is built in based on event log data. The primary model creates to support number of criteria : Process Structure, ideal view of paths, redundancy of tasks, frequent paths etc.

Process controlling is carried by distinguishing desirable and undesirable deviations in the actual execution of transactions.

Clustering operation empowers to split unstructured processes into homogeneous subsets and for each subset, a process model is created. It also finds the connections between resources.

Machine Learning Algorithms give insights into a process model. Machine Learning Algorithms derive hidden,valid,useful pattens from process model.

Process Mining software generate several statistics based on the event log data that are very useful for certain actions in the organization.

The best feature of process mining software is visualization. The software represent the data I in various forms.

Process Mining Software apply deviation rules and methods in order to analyze the deviations in results.

Delta Analysis is the key of the process mining. It compares the model with some reference model to answer the problems related to business alignments.

OPEN SOURCE PROCESS MINING SOFTWARE

Business Organization needs software for process mining with a specific end goal to find the business processes automatically. There are two fundamental alternatives for business associations: commercial software or open source software. Open Source software are for the most part free or has a lower cost authorizing alternative so they are the most appropriate for the Business Community. The vast majority of Business Organizations don't have the introduction of the open source based process mining programming projects. Here, we will discuss the most popular open source based process mining software tools.

- (1) **Apromore** : It is the most intense open source software for process mining. You can get to it from the cloud or download it in your personal PC. There are two conveyances of it : One Click and Full-fledged. One Click is the light weight version and does not support the PQL plugin and by default is supports H2 database.Full-fledge version supports all plug ins and provide selection between H2 or MySQL database. It is structured over three layers : Presentation, Logic and Data. The data layer hosts process model and event logs. Logic layer is responsible for manager services. It is responsible for importing,storing, creating folders and renaming models. The presentation Layer hosts the portal and editor. The four main technologies are used in Apromore : Spring,

ZK,OSGi and Eclipse Virgo. Apromore provides various functionalities to business organizations such as :Confirmance Checking[9] Model Querying [2], Performance Mining [3],Predictive Monitoring[6], Variant Mining [4], Model Similarity[10], Model Merging[11] etc.

- (2) **ProM** : It is a framework that supports various process mining techniques. The latest version is ProM 6.7. It is available in three flavors: With 64 bits JRE7, With 32 bits JRE7 and Without JRE7. Light weight version of ProM is also available for the end users. ProM Lite contains only typical packages. ProM can also be connected with the most famous tool of data mining i.e Rapid Miner. In Rapid Miner,we can execute algorithms of ProM, discover the process and provide conformance of the process. Due to integration of ProM with Rapid Miner , we are able to perform repetitive process mining tasks automatically and process experiments become easy and efficient.
- (3) **bupaR**: bupaR is an open-source suite for the handling and analysis of business process data in R.bupaR creates event log file from .csv file, xes file or any database file. After generating the event log, bupaR is responsible for exploratory and descriptive analysis of events, Generating Process Maps, Process Visualalization and Process Dashboards.
- (4) **PMLAB**: It is a Python based scripting environment for process mining. It uses iPython. PMLAB supports the variety of files such as XES,MXML and CSV. The tool is very helpful for the Process Model Discovery. Several wellknown tools can be invoked from PMLAB such as Dbminer,Rbminer etc.
- (5) **OpyenXes**: It is an open source python based library for the most famous event based standard, XES. The package is created with a command-line utility that creates projects from Python package projects or jQuery plugin projects. To install it just run the pip command at terminal. Pip must be installed prior to run this command. Pip is a package management system requires to install a package development in python.

III. ROLE OF PROCESS MINING SOFTWARE FOR INDUSTRIES

Process Mining software becoming one of the most valuable assets for almost all categories of industry. Following Table-1 describes the role of process mining in several well-known industries.

(Table-1 Role of Process Mining in industries)

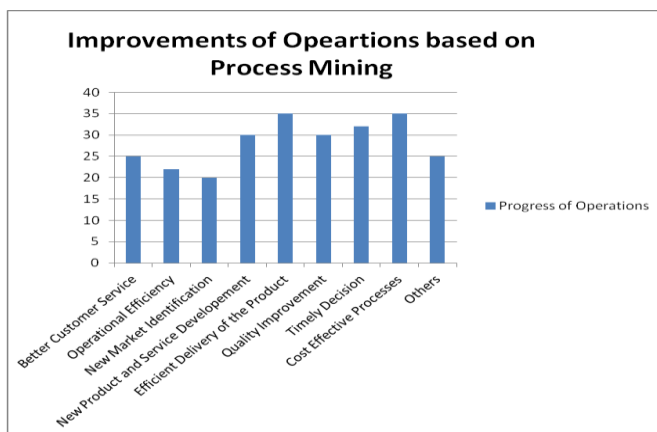
Sr.No	Industry	Role of Process Mining
11	Manufacturing	<ul style="list-style-type: none"> • Shorter Lead time • Lower Capital Cost • Increased quality of delivery • Efficient Logistic
2	Healthcare	<ul style="list-style-type: none"> • Improving patient care • Reduce Process Expense



		<ul style="list-style-type: none"> Variance Analysis
3	Insurance	<ul style="list-style-type: none"> High quality delivery service Minimize the processing time Control flow discovery
44	Telecommunication	<ul style="list-style-type: none"> Better Customer Satisfaction Minimize time and cost of the product Efficient, timely decision
5	Education	<ul style="list-style-type: none"> Better understanding of learner's habits Visual representation of complete educational process Students achievement predictions Efficient feedback to teacher Detection of undesirable behavior of students
6	Information Technology	<ul style="list-style-type: none"> Enhanced IT service management Efficient Order Processes Better Quality Assurance
7	Public Sector	<ul style="list-style-type: none"> Efficient finance controlling Better Procurement Processes Enhanced Human Resourcing
8	Retail	<ul style="list-style-type: none"> Effective Merchandise Management Better Stock Management Improve Quality Management

IV. RESULT ANALYSIS

Process Mining plays a vital role in the growth of several organizations. The following Figure-2 indicates the operational improvements based on process mining techniques. The data are collected from various organizations based on their feedback about process mining. The results show that minimum 20% improvement is done in all leading services due to process mining. Near about 35% improvement in product delivery due to process mining in the era of online service. We have considered all standard services while generating the results of the efficiency of process mining approach in various organizations.



(Figure-2 Process Mining and Business Operations)

The average improvement of the services due to process mining is 28.22% that is very significant for the growth of

any organization. We can improve this figure by applying efficient process mining methodologies at service level.

V. CONCLUSIONS

Process Mining assumes an imperative part in the development of any industry. Process Mining can be utilized viably in the ventures if the administration knows about framework activities and software. The paper presented several common framework activities of process mining related software, so the management can understand which data can be utilized, from where it can be retrieved, which operations can be performed and which insights can be achieved. The paper also provided the list of famous open source software used extensively in many industries. The paper gave brief about each and every software, so the industry personnel can select the best software according to their requirements. Finally, the paper described the roles of process mining in the context to several popular industries. The paper also demonstrated the current progress of process mining in several common operations of majority of industries.

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