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A Survey on Conformance Checking of Event Logs and Process Models in Business Organization

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Abstract:

Process Mining is a developing technology. It is used in the field of Administration. It deals with Process Discovery (PD), Conformance Checking (CC) and Process Enhancement (PE) based on Logs and Models. In Conformance Checking (CC), takes current Process Model as input and compares with the Event Logs of the actual execution of the Business Process and the resulting model by capturing the predictable performance of the given process. CC can be used to check whether the process model as recorded in the event log conforms to the process model and vice versa. It is challenging to determine the optimal alignment for each of the event log and the process model because of its similarity with the event log. The main objective of this study is to provide an overall knowledge about the CC in context with of the event logs and process model. A series of metrics based on prior work are introduced to perform Conformance Checking. The proposed metrics include Fitness, Precision, Generalization and Simplicity.

Keywords*: Process Mining (PM), Conformance Checking, Process Decomposition, Event Logs, Process Model, Business Process Management (BPM)*

I. Introduction:

Businesses drive to continually improve their Business Process. A Business Process is an activity or set of activities that will accomplish a specific various leveled objective. Business Process Management (BPM) is an intentional method to manage upgrading the Process. If an affiliation can't play out certain Business Process inside due to cost or resources, the association may utilize Business Process re-appropriating. All Business Process are dependent upon the Conformance Checking so as to refine the present Business Notation models. [1] [6] Process

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Mining (PM) is characterized as a social occasion of occasions or assignments that have comparative conditions of one another. The motivation behind PM is to extricate business Process Model. Every action of business procedure can be related to robotized occasions. The significance of PM is constantly becoming because of the expanding requirements for the mechanized extraction. The gaining from Occasion logs that recorded by an information structure. This Learning, as Business Process Model can be isolated by the PM calculations. The technique mining frameworks are used to discover Process Models from Occasion Logs, find log and model deviations. It analyzes execution characteristics of Process. The illustrative tendency Process Model accept a basic part in process mining. The Conformance Checking is a gathering of Process Mining procedures to differentiate a Process Model and an Event Log. Conformance Checking is used to check if the authentic execution of a business procedure, as recorded Event Log, agrees to the model and the opposite way around.**1.1 Event Log:**

Event Log is used to find, monitor and improve the business processes based on how the required users are to be notified. An entry will be created for each of the activity performed by the business process. An example of Event Log is given below:

Table1.1 Event Logs

Case ID	Task Name	Event Type	Originator	Timestamp	Extra Data
1	File Fine	Completed	Anne	20-07-2004 14:00:00	...
2	File Fine	Completed	Anne	20-07-2004 15:00:00	...
1	Send Bill	Completed	system	20-07-2004 15:05:00	...
2	Send Bill	Completed	system	20-07-2004 15:07:00	...
3	File Fine	Completed	Anne	21-07-2004 10:00:00	...
3	Send Bill	Completed	system	21-07-2004 14:00:00	...
4	File Fine	Completed	Anne	22-07-2004 11:00:00	...
4	Send Bill	Completed	system	22-07-2004 11:10:00	...
1	Process Payment	Completed	system	24-07-2004 15:05:00	...
1	Close Case	Completed	system	24-07-2004 15:06:00	...
2	Send Reminder	Completed	Mary	20-08-2004 10:00:00	...
3	Send Reminder	Completed	John	21-08-2004 10:00:00	...
2	Process Payment	Completed	system	22-08-2004 09:05:00	...
2	Close case	Completed	system	22-08-2004 09:06:00	...
4	Send Reminder	Completed	John	22-08-2004 15:10:00	...
4	Send Reminder	Completed	Mary	22-08-2004 17:10:00	...
4	Process Payment	Completed	system	29-08-2004 14:01:00	...
4	Close Case	Completed	system	29-08-2004 17:30:00	...
3	Send Reminder	Completed	John	21-09-2004 10:00:00	...
3	Send Reminder	Completed	John	21-10-2004 10:00:00	...
3	Process Payment	Completed	system	25-10-2004 14:00:00	...
3	Close Case	Completed	system	25-10-2004 14:01:00	...

Table 1.1 shows the various events performed for each of the each task. Further, the table shows the originator of the task. Each row corresponds to an event Case ID (1, 2), Task Name (File Fine, Send Bill, Process Payment, Close Case and Send Reminder), Event Type (Completed), Originator (Anne, System, Mary and John), Timestamp (20-07-2004 14:00:00….) and Extra Data(….).

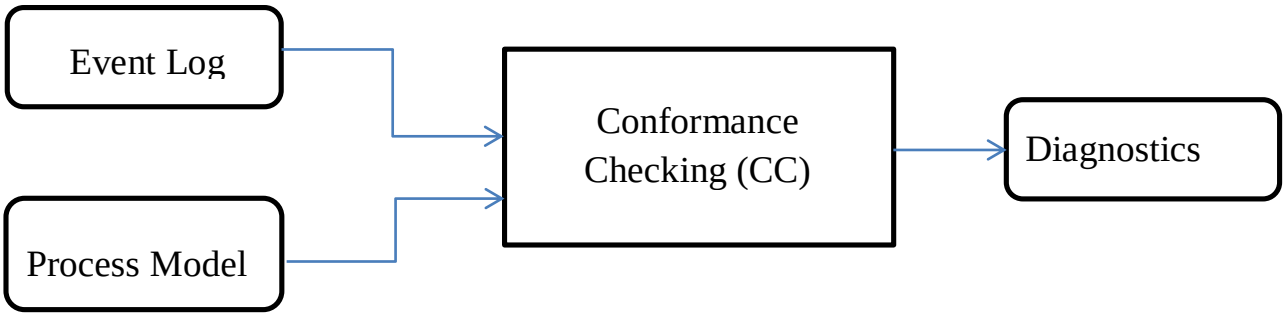
Procedure Mining is one of the methodologies in the field of Business process Building that support the assessment of Business Process taking into account the Event Log. The Process Mining procedures are related to Business Process Designing stages and assignments. Procedure Mining takes after the options developed in Business Process. Procedure Mining goes for the modified advancement of models explaining the lead found in the Event log. For example, taking into account some event log, one can fabricate a Process Model imparted the extent that a Petri

net. Further, the decisions are loosened up by offering analysis to Business Process Demonstrating so as to empower subsequent activities like:

- Conformance Checking (CC)
- Process Enhancement (PE)
- Process Discovery (PD)

1.2 Conformance Checking (CC) :

In order to make a decision between the Process Model and Event Log by Conformance Checking, it is necessary to monitor the deviations of Business Process. The Process Models rather than the observed events are driven from various techniques. Conformance Checking takes as input the Event Log and Process Model of a similar Process. It broadens or enhances the present Process Model utilizing the Data Framework genuine recorded in a portion of the Event Logs. CC measures the arrangement between Process Model with the truth of Event Log.

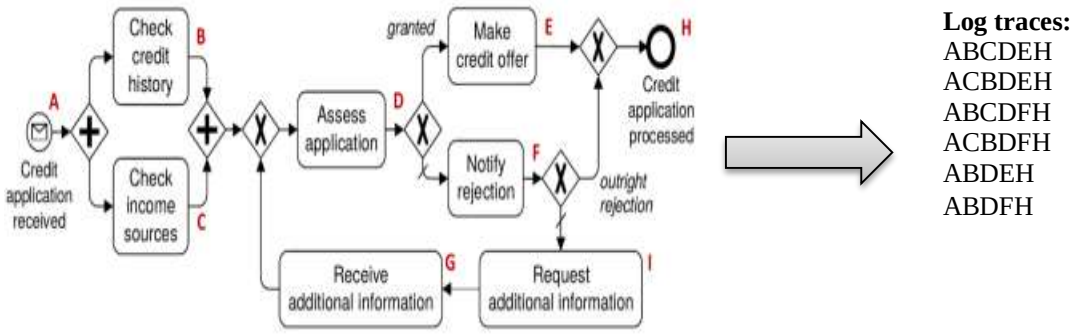


Process of Conformance Checking Figure 1.1

Example of Conformance Checking:

The Figure 1.2 shows a Credit Card Application Process. In this figure, the Log trace A(Credit Application Received), B (Check Credit history), C (Check Income Sources), D(Assess Application), E(Make Credit Offer), F(Notify rejection), I (Request additional Information), G (Receive Additional Information), H (Credit Application Processed) are depicted.

- The first statement ABCDEH characterizes the behavior observed in the log but not in the model.
- The second statement ACBDEH characterizes the behavior observed in the model but not in the log.
- Trace alignment would produce two optimal alignments that shows in figure 1.2



Credit Card Applications Process Figure: 1.2

- One task is between ABDEH of the Event log and ABCDHE of the Process model. The other task is between ABDFH of the Event log and ABCDFH of the Process model. From this, one can infer that task C is optional in the log (move on log only).
- However, the number of misaligned traces is often very large, rendering this inference quite hard in practice.
- Moreover, trace alignment would detect that there is escaping behavior starting with "Request addition information" at a trace prefix finishing with "Notify rejection", but it will not identify that the extra behavior includes tasks IG and that IGDF is behavior that can be repeated in the model but not in the log. For example, task "Assess application" can be repeated in the model but not in the log.[12]

II. Related Work:

2.1. Alignment between Process Model and Event Logs:

Huge amount of records containing Process Model and Event Logs are put away together in the data arrangement of Business Process Management (BPM) [1]. BPM is a system that applies separation and-Conquer procedure to quantify the presentation measurements - Fitness and Precision. The creator has accomplished the Single-Pass Property of confinement by utilizing the Divide and Conquer procedure. In the trial, the creator began another example of structure utilizing the form ProM 6.5.1a. In this paper, Linear Time Backtracking Algorithm Advanced requesting and Pruning frameworks are created to also upgrade the recovery viability. The Parameters utilized are Accuracy, Time Performance and Recovery Distance.

2.2. Efficient Selection of Conformance Checking:

Understanding complex occasion advancement is a difficult errand for the genuine Event Logs. Jorge Munoz-Gama et al [2] acquainted another strategy with relate various leveled Conformance checking dependent on the particular calculations. The determined procedure was as Structured Process Models and Event Logs. The method utilized is Single-Entry and a Single-Exit hub. This hub is to be confined a Sub-Process inside the given

Process Model. At that point the unstructured model is registered on direct time on organized diagram portrayal The usage must be finished by ProM apparatus system. The Parameters utilized are Similarity score, Accuracy and Size.

2.3. Merging Event Logs and Process Model:

The Rule Based calculation was utilized to discover the time expended between the given Event Logs and the executed of Process Model. The info and yield is created in the Prom module structure ProM is an extensible framework that support a wide collection of procedure mining techniques as Plug-ins. ProM is without stage as it is executed in Java. The assessment measurements utilized in this paper [3] were real proficiency, time PC time client and the Actual adequacy. The strategy and the calculation are applied in two counterfeit and three genuine datasets. The outcome acclimates their viability and effectiveness.

2.4 Business Process Model and Event Logs uses:

Procedure Mining utilizes verifiable information in the Information System so as to improve the Process examination coming as Event Logs. The paper proposed the movement sequencing for breaking down business process utilizing Event Log by means of recurrence grids. The Business Process assessment and the resulting matrices are utilized as the clarification behind structure probabilistic business Process Models as Bayesian Belief Networks for Causality examination. It permits productive action arrangement to examination the Process [6].

2.5 Incomplete Log and Declarative Process Model:

Procedure Mining places the current enormous volumes of records in the structure of Organization. Logs may be deficient, since logs contain just model lead. The picked Process Mining framework is to oversee inadequacy in the Event Log data [7]. The revelatory Process Model has a capacity to help multi-viewpoint outline. It likewise underpins different points of view, for example, information and time. The creators have introduced an approach for conformance checking by multi-point of view demonstrating language. The multi-viewpoint demonstrating language is announced utilizing a Disco device [9]..

III. Process Mining Algorithms:

The improvement of computing power and the speed of data transaction with the semi-structured processes are addressed as the new challenges.

The Different algorithms used in the Process Mining are given below:

1. Heuristic Miner
2. Genetic Miner
3. Fuzzy Miner

3.1. Heuristic Miner:

The algorithm [5] [10] can manage clamor information and can be communicated with commotion. The modules was to control the progression of viewpoint Process Models and Event Logs that thinking about the recurrence of successive follows. Heuristics Miner is a realistic fitting mining calculation that can oversee uproar, and

can be used to communicate the essential direct that isn't all unobtrusive components and uncommon cases, enrolled in an Event log. This framework expands alpha calculation by contemplating the repeat of follows in the log. The Heuristics Miner Plug-in mines the control stream perspective of a Process Model

3.2 Genetic Miner:

The algorithm manages clamor and the inadequacy of Process Model and Event Logs in the data framework [10]. It is utilized to remove the data about the actives their easygoing relations and Event Logs happens at a widespread hunt level. The explanation is that the quality or wellness of candidate Process Model is figured by associating the model Show with the progressive follow. The execution of such neighborhood mining are weak when the necessary records are not locally available considering the way that wrong result can thoroughly mess up the derivation right model. It can peruse Event Log and fabricate the underlying populace. The constraint of Genetic digger is the decrease of the neighborhood and nonlocal ideal undertaking.

3.3 Fuzzy Miner:

The data framework separates the information on Process Models from the execution logs. The Process Model is changed over into less organized model. [13] The fluffy digger is suitable for mining less sorted out procedure which shows a great deal of unstructured and conflicting conduct. The Fuzzy Miner expels the insignificance edges, connected hubs and bunch separated hubs. The impediment Fuzzy digger is end of unimportant subtleties, improvement of compressibility and decrease of multifaceted nature.

IV. Analysis and Discussion:

Table 1.2 shows the analysis based on the various Process Mining Algorithms used in the literature works. The Paper [1] has utilized the Heuristic Miner Algorithm. The Paper [2] has used the Alpha Miner Algorithm, [3] has utilized the Rule suggestion Algorithm, [4] has used Linear Time Backtracking Algorithm, [5] has used Linear Time Algorithm, [6 has utilized Linear Time Algorithm, [8] has used Fuzzy miner Algorithm, [9] have been utilized a++ Algorithm.

Table1.2. Analysis based on the Various Algorithms

SI. No	Method	Pros	Cons
1	Heuristic Algorithm	A framework that applied divide-and-Conquer strategy[1]	Single-Pass property of Directly-Follows Graphs

2	α algorithm	Decompose the model- log and log-model is Refined Process Structure Tree (RPST) [2]	It has been Single-Entry and a Single-Exit node
3	Rule suggestion Algorithm	Consuming the time and prone of subjective decision making [3]	It generated only in Prom plugin framework.
4	Linear Time Backtracking Algorithm	Improve the Recovery Efficiency developed by using advanced indexing & pruning techniques. [4]	Accuracy, Time Performance& Recovery Distance
5	Linear Time Algorithm	In view of trace replaying to make the base recovery of a deficient events succession from a qualified sub-process with no choices [5]	Event missing rate & Number of sequences
6	Frequency matrixes	To permit effective action arrangement investigation [6]	Number of occurrences
7	Prom-plugin	The implementation has by using the SQL-based Process Discovery approach [7]	MP-Existence, MP-Response
8	Fuzzy miner algorithm	Disco tool based on the framework is used [8]	New reservation, Check In, Bill Payment
9	Integer Linear programming approach	Declarative Process Model has an ability to support multi-perspective blueprint [9]	The modeling language is declared using only in a mining tool
10	a ++ algorithm	Easy to understand and simple [10]	The algorithm can only work with petri- net and not Event Log.

Discussion:

This paper enumerates the list of the Process Mining algorithms and the Conformance checking based on the performance metrics. The performance metrics and the methods were evaluated in on Conformance checking to get an effective output. The execution pick up utilizing Wellness strategy takes into consideration the large portion of the conduct behavior in the Event Log. A Process Model has a perfect fitness if every single consecutive trace in the Event Log. It can be replayed in the Process Demonstrate from the beginning to end of Process Model.

- Generalization is the issue that is particular to a model and is produced though clearly the Event Log and the Process Model to maintain a strategic distance from over fitting.
- Precision is to avoid under fitting. So it is called prefix automaton. It is built to see whether the Process Models consider more conduct than actually observed in the Event Log and the Process Model.

V. Conclusion:

In this paper, a survey of Conformance Checking in based on the Business process in different algorithms and techniques have been studied. In addition, we have studied various techniques of Conformance Checking and mining algorithms used by various researches. We have discussed in detail how they were implemented by using Process Mining tools. Our paper highlights how the Conformance Checking has thrown open the research issues of Process Mining. The future work is to focus on new algorithm trends that come into the existence.

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