ROZARIO Mary - M2 MCI EUR

Anomaly detection in business processes using process mining and fuzzy association rule learning

Source : Google scholar : https://link.springer.com/article/10.1186/s40537-019-0277-1

KEY WORDS :
ARL and Fuzzy ARL methods, control flow analysis, learning fuzzy association

The article presents the different types of fraud that can occur in business processes. The paper highlights the use of enterprise resource planning (ERP) software to detect anomalies and fraud in the massive logs generated by ERP systems.

The paper proposes a fraud detection approach using four types of processors:

- Control flow analysis: which is crucial for detecting fraud in the form of omitted activity or an erroneous model.For this, it is preferable to use Fuzzy Miner, an algorithm that measures the equality and difference between event logs resulting from an ongoing process and a standard business process model.
- Role resource analysis is the role allocation step: each event in a running process can be compared with the roles present in the POS (point of sale) to obtain the probability of fraud occurrence in terms of resources.
- Throughput time analysis: measures the time interval between activities.
- Decision point analysis: discover the existence of a specific case resulting from a decision taken in a business process.

Different types of fraud are possible:

- Skipped activity : activities that are poorly executed or skipped.
- Wrong throughput time : activity not conforming to the model
- Wrong resources: activity performed by an unauthorized actor
- Wrong tasks: several activities carried out simultaneously by one actor.
- Wrong models: activity not conforming to the model
- Wrong decisions: anomaly data resulting from a wrong decision.

Once anomalies have been identified, they are processed using fuzzy association rules, which consist of **4 steps.**

A case study of the bank's credit application process explains these main stages, with **compliance checking, fuzzy multi-attribute decision making and learning fuzzy association** rules to detect and prevent fraud.

Step 1: **compliance**
Step 2: **Fuzzy multi-attribute** decision making is used to determine anomaly rates in a process by combining fuzzification and multi-attribute decision making (MADM).
The data required for this are as follows:

- Expert assessment of the importance of attributes and anomaly occurrences resulting from the compliance check, converted into fuzzy numbers.
- The probability of anomalies is measured for each attribute.
- The rate of occurrence of the attribute is calculated using the value of the compliance result.
- The importance-adjusted severity.

Step 3: use the previous assessments to create **fuzzy association rules** between abnormal attributes, which provide the information used to establish the degree to which each abnormal attribute belongs to predefined categories (low, medium, high), then implement fraud prevention strategies in operational processes.

Step 4: Fuzzy association is the association of anomalies with the association rules obtained. If a case contains an association rule not marked as fraud, it is categorized as non-fraudulent. On the other hand, if a case contains a fraud association, it is categorized as fraudulent. Method example: **ARL and Fuzzy ARL methods.**

Following on from the case study result: We can say that the integration of Process Mining with ARL (Association Rule Learning) and Fuzzy ARL methods is effective in detecting fraud, with the Fuzzy ARL method showing better accuracy and a reduction in false positives compared with previous research.