Process Mining

More and more information about processes is recorded in the form of event logs. Equipment ranging from embedded systems to enterprise information systems are logging the behaviors that take place. This data explosion allows for the analysis of reality and the construction of models that reflect what actually happened. This can be used to diagnose and improve processes in a variety of domains.

ProM

The process mining framework ProM provides a versatile and extendible environment for process mining. It provides plug-ins to extract different types of models from event logs, e.g., the construction of a process and organizational models. Moreover, it supports the conversion and analysis of models. Using conformance checking techniques models can also be compared with reality and existing models can be enhanced with additional information, e.g., indicating bottlenecks in a process.

Business Intelligence

Many vendors claim to offer support for Business Intelligence (BI). Unfortunately, these BI tools are not intelligent at all. Moreover, these tools require input data of a particular type and a predefined model. Process mining overcomes these limitations and makes it possible to extract new knowledge from information systems in a truly intelligent way.
Process mining spectrum

Process mining addresses the problem that most organizations have very limited information about what is actually happening in their organization. In practice, there is often a significant gap between what is prescribed or supposed to happen, and what actually happens. Only a concise assessment of the organizational reality, which process mining strives to deliver, can help in verifying process models, and ultimately be used in a process redesign effort.

The idea of process mining is to discover, monitor and improve real processes (i.e., not assumed processes) by extracting knowledge from event logs.

With ProM we support three types of process mining.

• **Discovery:** There is no a-priori model, i.e., based on an event log some model is constructed. For example, using the audit trails of an ERP system organizational models describing the transfer of work between people and departments are discovered. Another example would be to discover care processes based on information about patients in a hospital's information system.

• **Conformance:** There is an a-priori model. This model is used to check if reality, as recorded in the log, conforms to the model and vice versa. For example, there may be a process model indicating that purchase orders of more than one million Euro require two checks. Another example is the checking of the four-eyes principle. Conformance checking may be used to detect deviations, to locate and explain these deviations, and to measure the severity of these deviations.

• **Extension:** There is an a-priori model. This model is extended with a new aspect or perspective, i.e., the goal is not to check conformance but to enrich the model. An example is the extension of a process model with performance data, i.e., some a-priori process model is used on which bottlenecks are projected.
Applications
Process mining can be applied in a wide variety of application domains. Today many systems are recording events in one way or another. This enables new types of analysis that can be used to diagnose and improve software systems and the processes they support.

- For many years hospitals have been working towards a comprehensive Electronic Patient Record (EPR), i.e., information about the health history of a patient, including all past and present health conditions, illnesses and treatments. For example, by law most hospitals need to record the diagnosis and treatment steps at the level of individual patients in order to receive payment. This forces hospitals to record all kinds of events. Using process mining this information can be used to discover, monitor, analyze, and improve careflows.

- Today, many organizations are moving towards a Service-Oriented Architecture (SOA). A SOA is essentially a collection of services that communicate with each other. Here technologies and standards such as SOAP, WSDL, and BPEL are used. It is relatively easy to listen in on the message exchange between services. This results in massive amounts of relevant information that can be recorded. As a result the actual use of services and their interconnections can be analyzed.

- Increasingly, professional high-tech systems such as high-end copiers, complex medical equipment, lithography systems, automated production systems, etc. record events which allow for the monitoring of these systems. These raw event logs can be distributed via the internet allowing for both real-time and off-line analysis. This information is valuable for (preventive) maintenance, reliability analysis, monitoring user adoption, etc.

- Classical administrative systems of large organizations using e.g. WFM, BPM, ERP, CRM, SCM, and PDM software are recording massive amounts of event data. Consider for example processes in banks, insurance companies, local governments, etc. Here most activities are recorded in some form. In these environments, process mining can be used to measure conformance and alignment. Moreover, the actual workflows in the organizations can be uncovered.
About ProM
ProM is an open-source process mining framework. It provides a plug-able architecture. It's current plug-ins cover the whole process mining spectrum.

Process mining at TU/e
TU/e is leading in process mining. More than 25 researchers are developing new process mining techniques and are applying these techniques in a variety of application domains. The research is sponsored by organizations such as NWO, STW, EIT, EU, and IOP and we are working with many organizations including AMC, Pallas Athena, Futura Technology, IBM, ASML, Philips Medical Systems, IDS Scheer, Philips Lifestyle, Océ, SAP, ING, LaQuSo, and IBIS.

More information
For more information about process mining visit www.processmining.org (for process mining) or prom.sf.net (for the open source tool ProM).