

# Process Mining

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Prof. Dr. Thomas Seidl

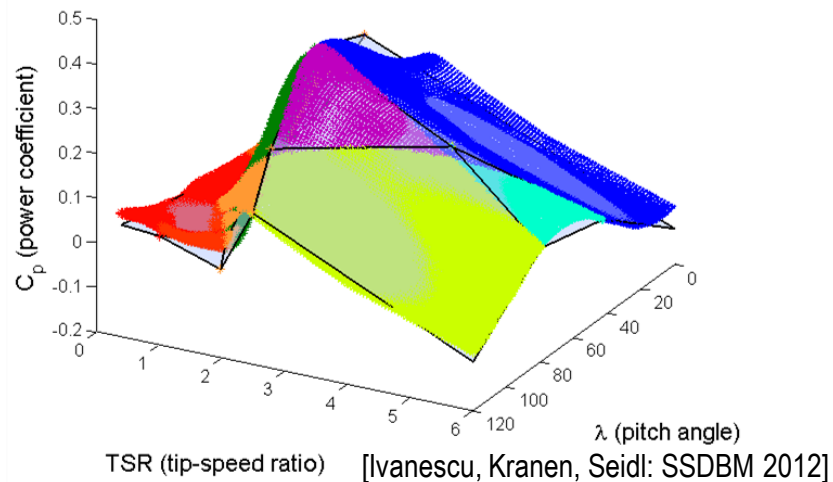
LMU Munich, Chair of Database Systems and Data Mining



# Kontinuierliche Prozesse und ereignisbasierte Prozesse

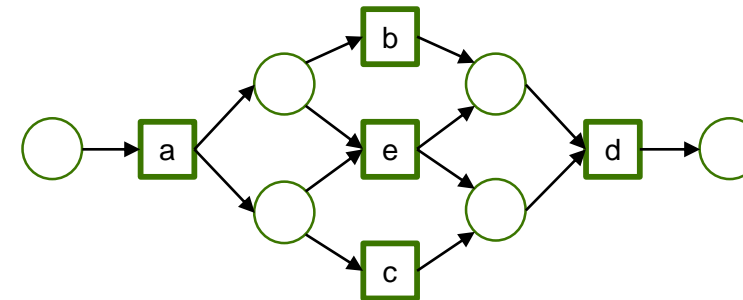
- Kontinuierliche Prozesse

- Beispiele: Verbrennungsmotor, Verfahrenstechnik, ...
- Basis: Differentialgleichungen
- Modelle: (nicht-)lineare Funktionen
- Beispiel: verbundene Hyperebenen

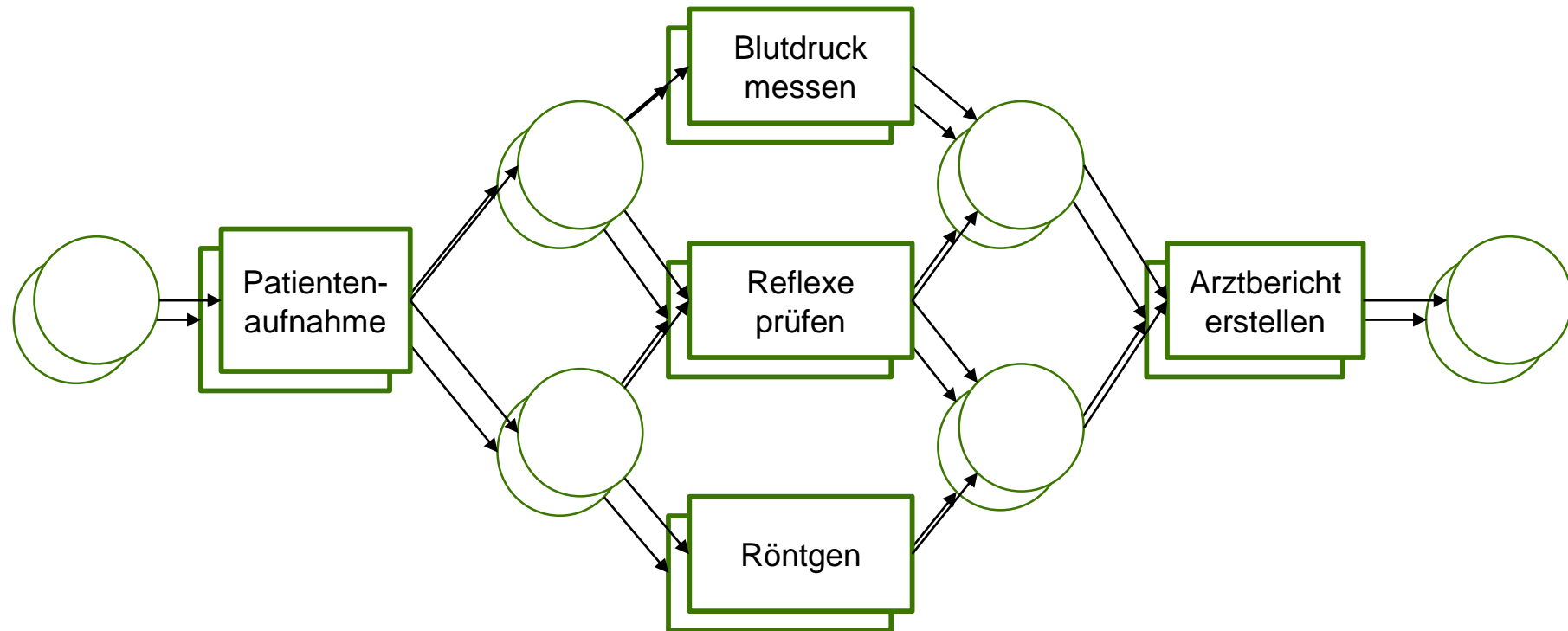


- Ereignisbasierte Prozesse

- Beispiele: Notaufnahme, Produktion, Antragsbearbeitung, Logistik, ...
- Basis: Fälle und Ereignisse
- Modelle: Zustandsübergangssysteme
- Beispiel: Petrinetz



# Prozessmodelle

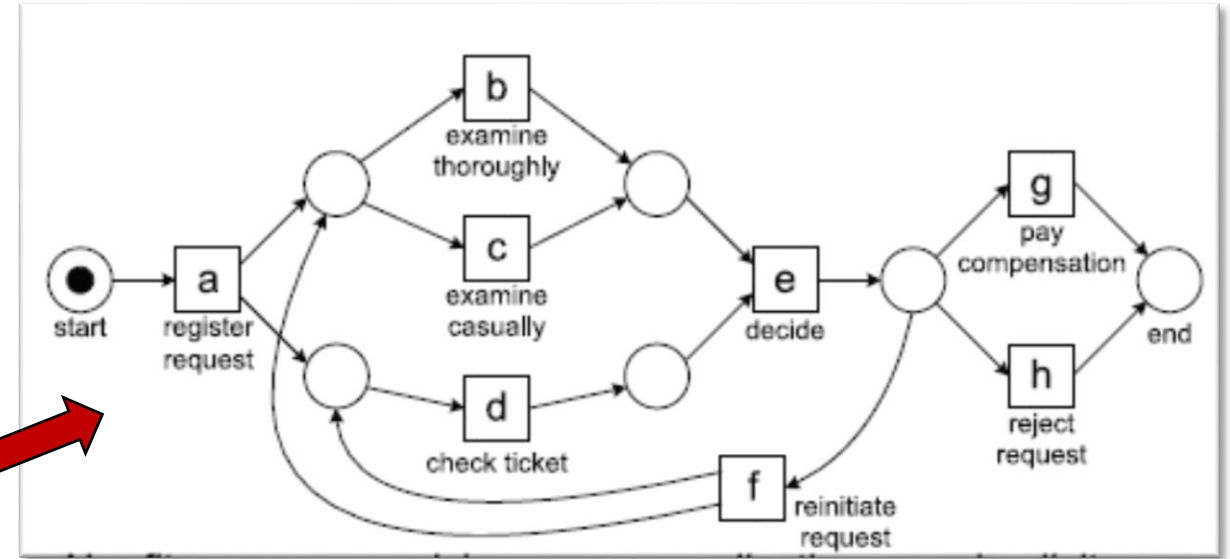


# Process Mining



time	case	event
2018-6-6-6:29	732	a
2018-6-6-6:32	744	a
2018-6-6-6:33	732	b
2018-6-6-6:34	728	a
2018-6-6-6:35	732	d
2018-6-6-6:37	744	b
2018-6-6-6:38	728	c
2018-6-6-6:39	751	a
2018-6-6-6:42	744	d
2018-6-6-6:43	732	d
2018-6-6-6:44	744	e
2018-6-6-6:45	751	c
2018-6-6-6:47	732	e
2018-6-6-6:48	744	g
2018-6-6-6:59	751	d
2018-6-6-7:02	751	e
2018-6-6-7:03	728	e
2018-6-6-7:04	768	a
2018-6-6-7:05	751	h
2018-6-6-7:07	768	c
2018-6-6-7:08	728	h
2018-6-6-7:09	732	g
2018-6-6-7:12	768	d
2018-6-6-7:13	779	a
2018-6-6-7:14	768	e
2018-6-6-7:15	779	b
2018-6-6-7:17	768	h
2018-6-6-7:18	779	d

#	trace
455	acdeh
191	abdeg
177	adceh
144	abdeh
111	acdeg
82	adceg
56	adbeh
47	acdefdbeh
38	adbeg
33	acdefbdeh
14	acdefbdeg
11	acdefdbeg
9	adcefcdeh
8	adcefdbeh
5	adcefbdeg
3	acdefbdefdbeg
2	adcefdbeg
2	adcefbdefdbeg
1	adcefdbefbdeh
1	adbefbdefdbeg
1	adcefdbefcdefdbeg
1391	

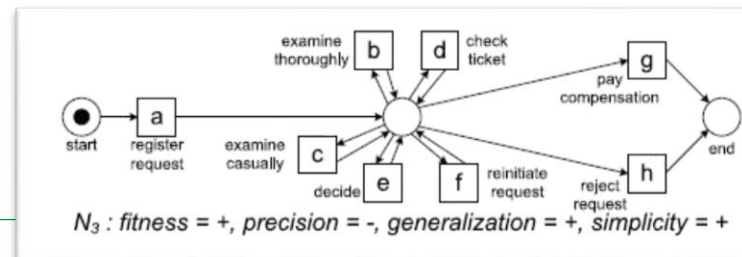
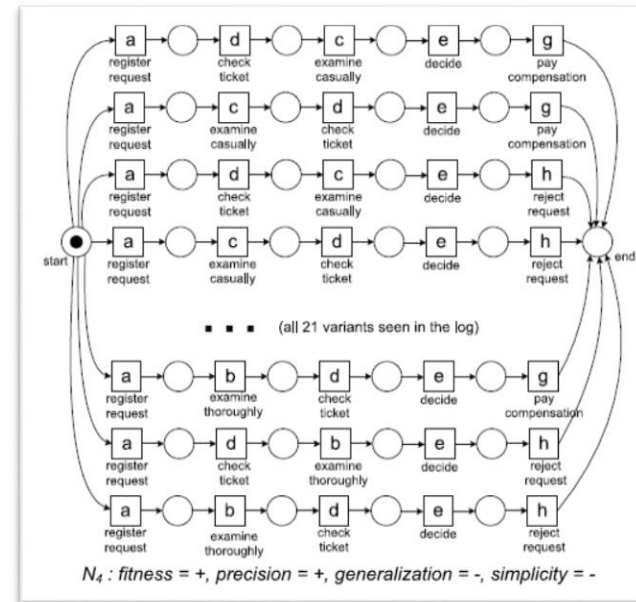
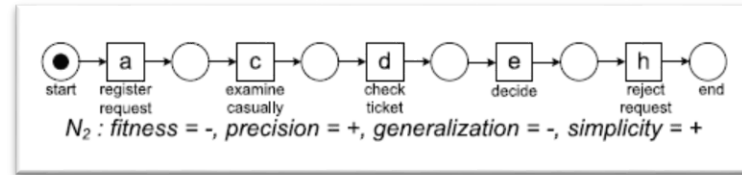
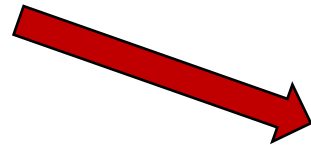
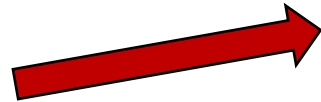


- Task: Extract process model from log entries which
  - ... is able to replay the log ⇒ *Fitness*
  - ... simplifies as far as possible ⇒ *Simplicity*
  - ... does not overfit the log ⇒ *Generalization*
  - ... does not underfit the log ⇒ *Precision*

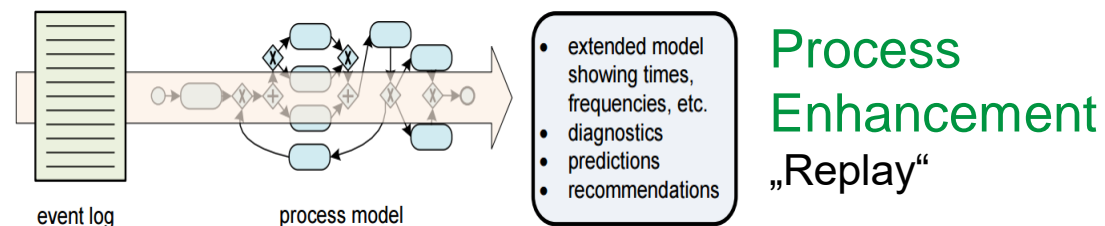
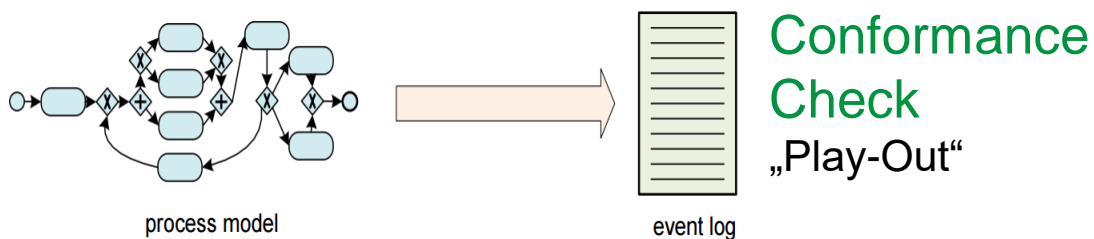
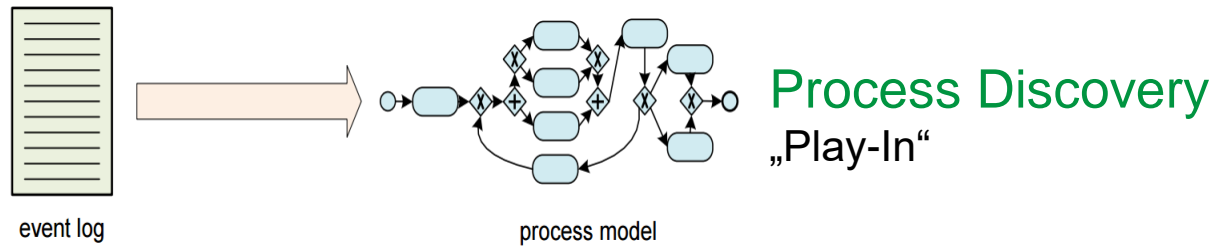


# Process Discovery: Tune Generalization Granularity

#	trace
455	acdeh
191	abdeg
177	adceh
144	abdeh
111	acdeg
82	adceg
56	adbeh
47	acdefdbeh
38	adbeg
33	acdefdbeg
14	acdefbdeg
11	acdefdbeg
9	adcefcdeh
8	adcefdbeh
5	adcefbdeg
3	acdefbdefdbeg
2	adcefbdeg
2	adcefbdefdbeg
1	adcefdbefdbeg
1	adbefbdefdbeg
1	adcefdbefcdefdbeg
1391	



# Process Mining: Towards Holistic Analytics in Industry 4.0 Environments



## Applications

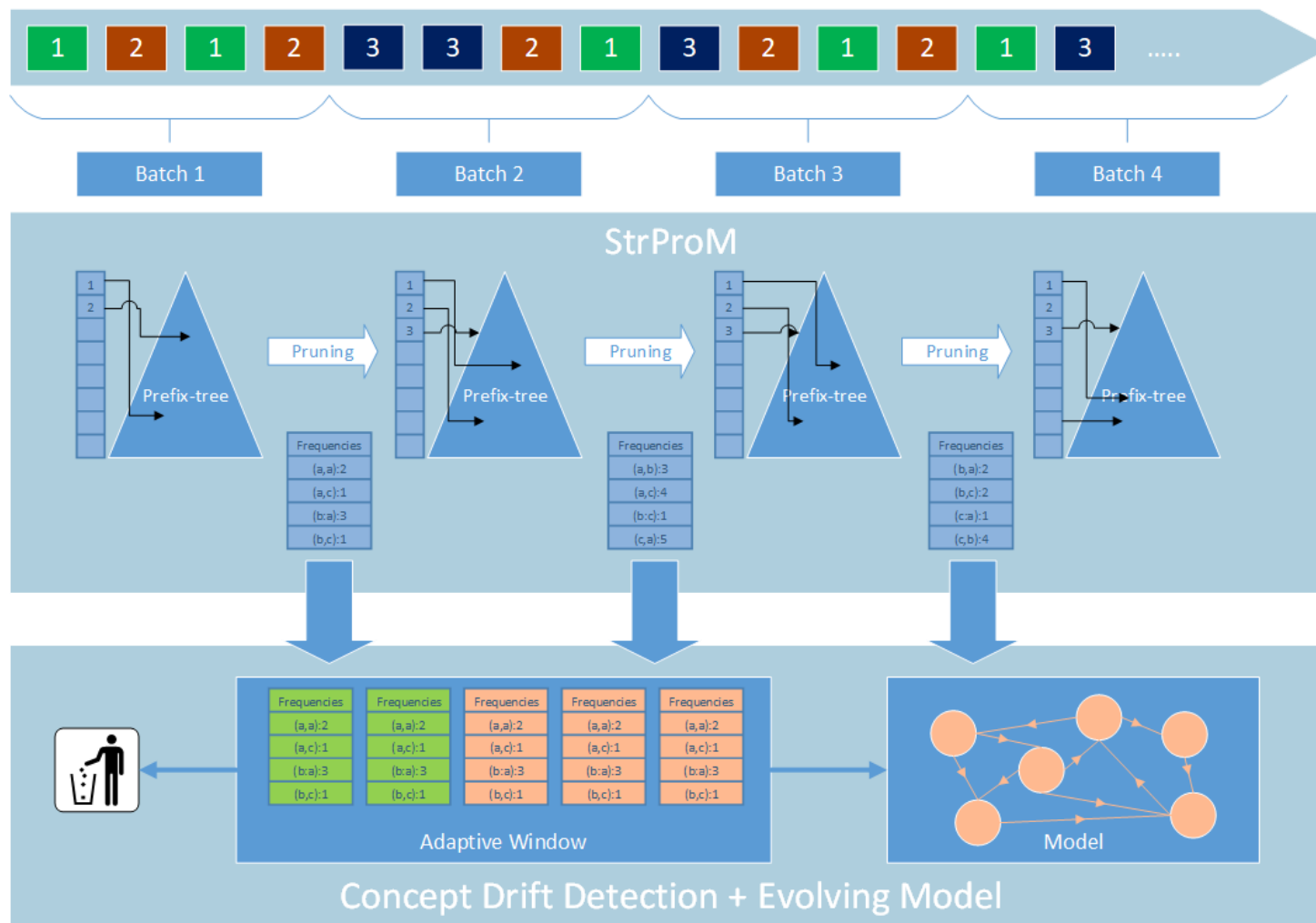
- Fleet management
- Monitoring of train schedules
- Predictive maintenance for mechanical parts in use
- Monitoring of production processes

## Challenges for Process Mining on Complex Events and Cases

- Multi-source data descriptions
- Multimodal and heterogeneous data
- Spatio-temporal contexts
- Uncertainty in object representations
- Evolution of models over time



# Stream Process Mining



**Event Stream**

**Batched Approach**

**Prefix-Trees**

**Irregular Updates**

**Decaying**

[Hassani, Siccha, Richter, Seidl: IEEE CI 2015]

