

MDL Principle in Process Models Evaluation

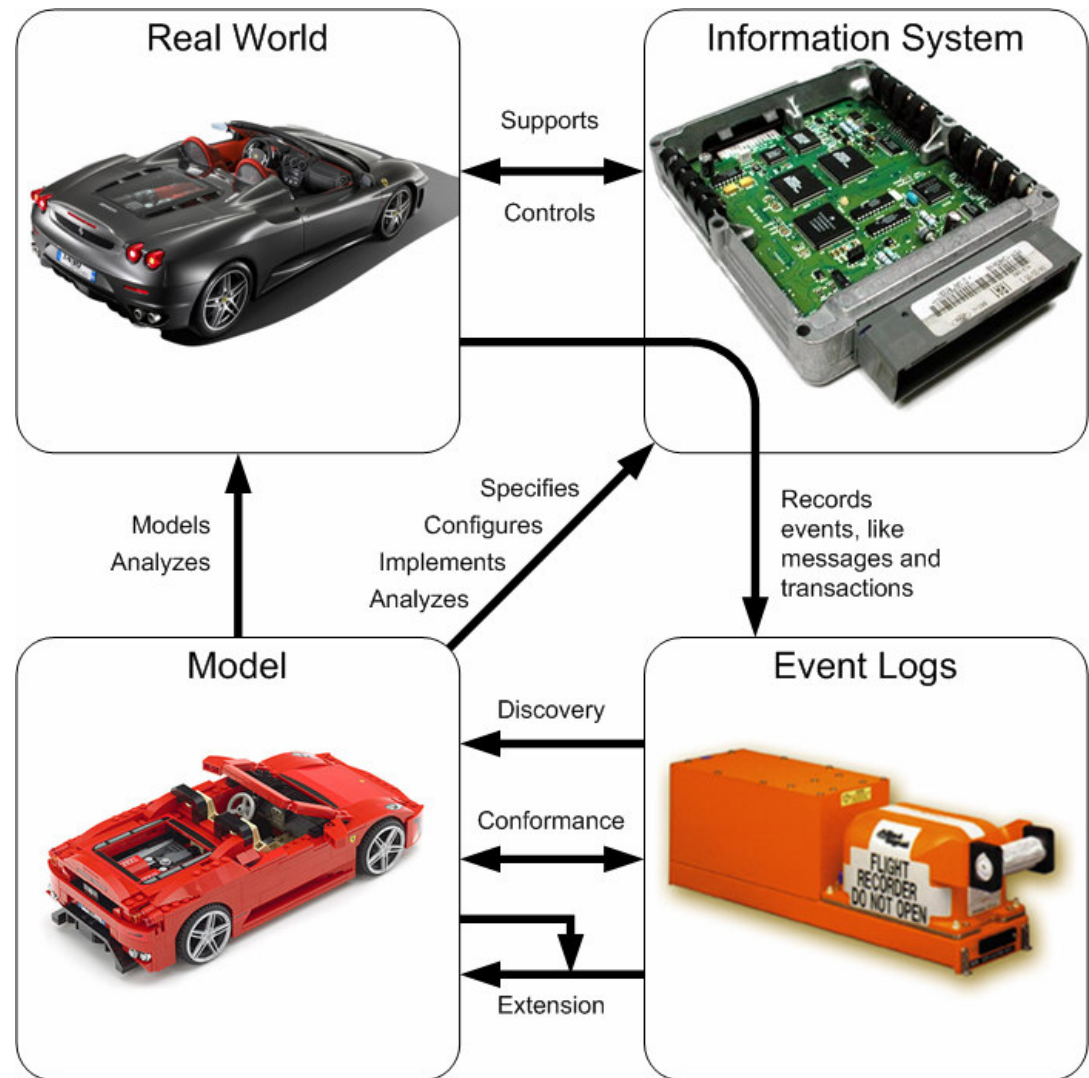
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- Process mining
 - Tasks, techniques, challenges
- Evaluation of process models
 - Commonly used measures and their limitations
- MDL-based measure of process model quality
 - Compression-based DM and MDL principle
 - Applicability to process mining
 - Model complexity/log compression ratio trade-off
- Ongoing and Future work
 - Evaluation
 - MDL principle for guiding process mining

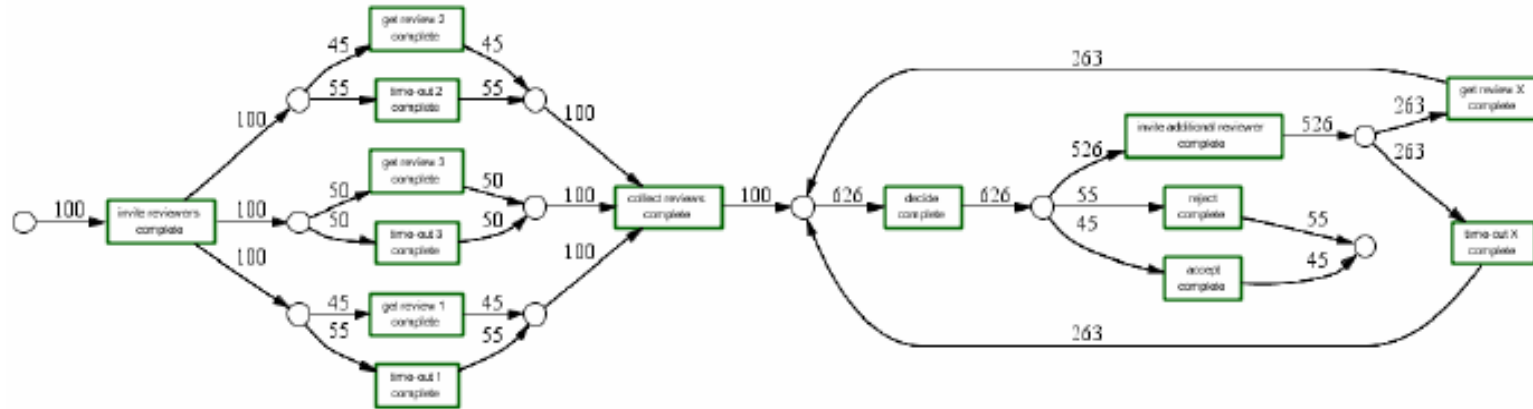
- Extracts process models from event logs
 - Discovery;
 - Conformance; Extension
- Different model classes exist
 - Petri-nets
 - EPC, YAWL, BPEL;
 - Markov models, ...
- Several process mining techniques exist
 - Alpha miner;
 - Heuristic miner;
 - Genetic miner, ...



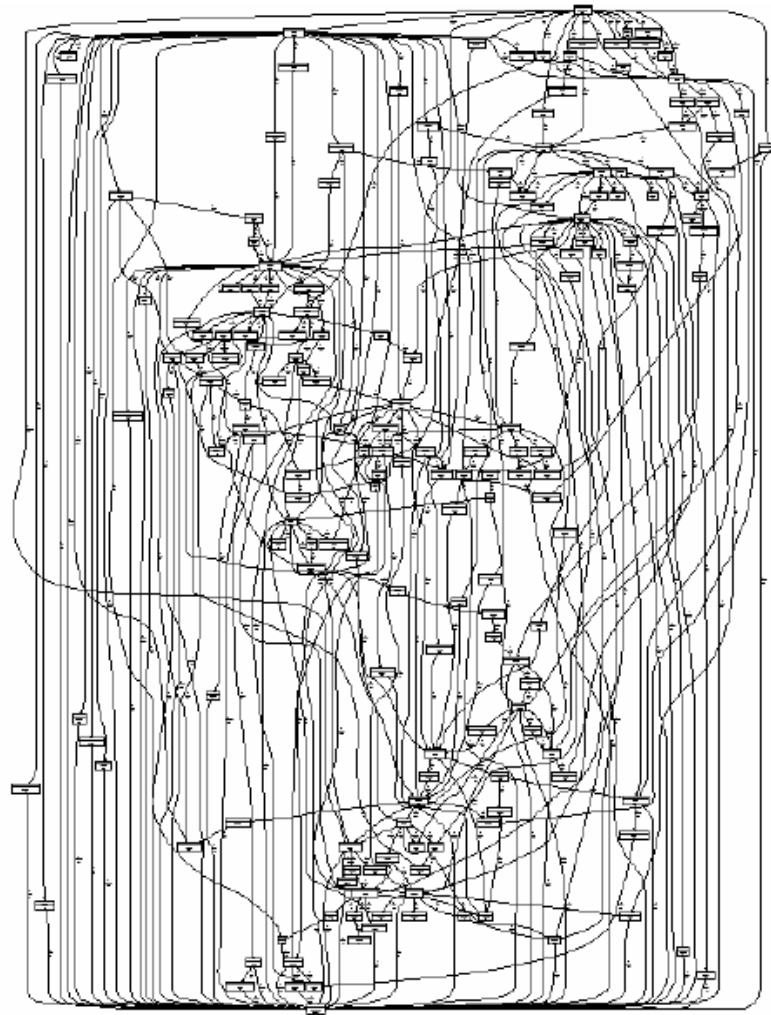
Examples:



- structured, easy to understand process models
 - just like this one



- but ...



- A few measures are popular
 - accuracy/fitness related
 - structural (number of places, transitions etc)
- These measure have certain limitations
 - are model-dependent,
 - assume that the model that generated the log is known
 - need negative examples of event sequences
- Our focus here:
 - MDL-base process model(s) quality measure

□ MDL principle

- Minimizing the total encoding costs equal to $\text{EncodingCost}(\text{EventLog} \mid \text{Model}) + \text{EncodingCost}(\text{Model})$

□ Rationale:

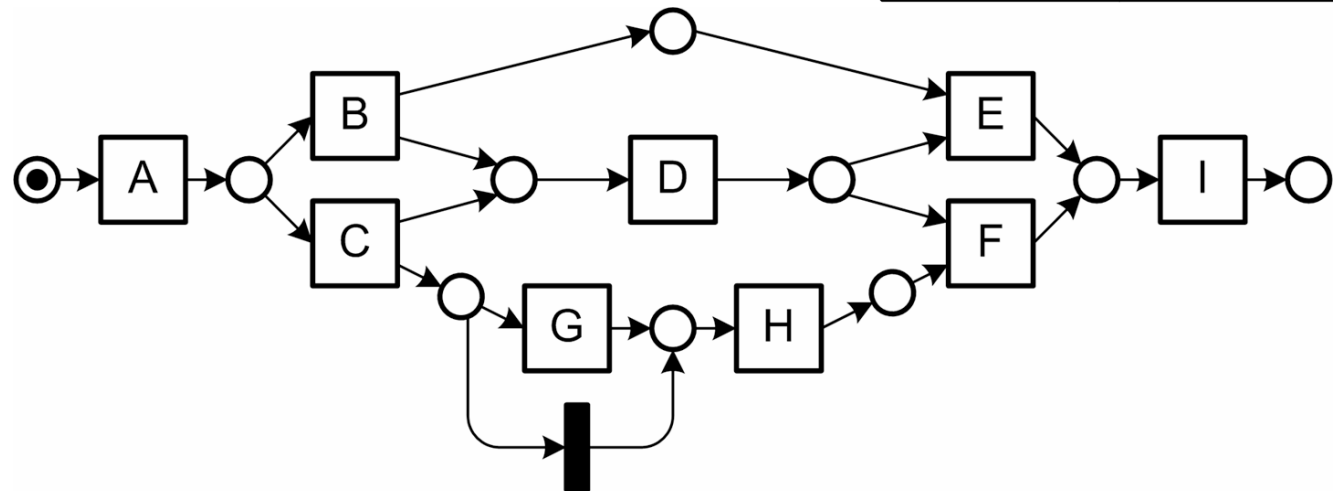
- the more accurate a model fits the reality, the better,
- i.e., more succinct, it will be able to describe the event log and vice versa.

□ Need to define how

- to encode a Petri-net
- to encode traces from an event log given a Petri-net
- both is possible ;-) (the manuscript is available upon your request)

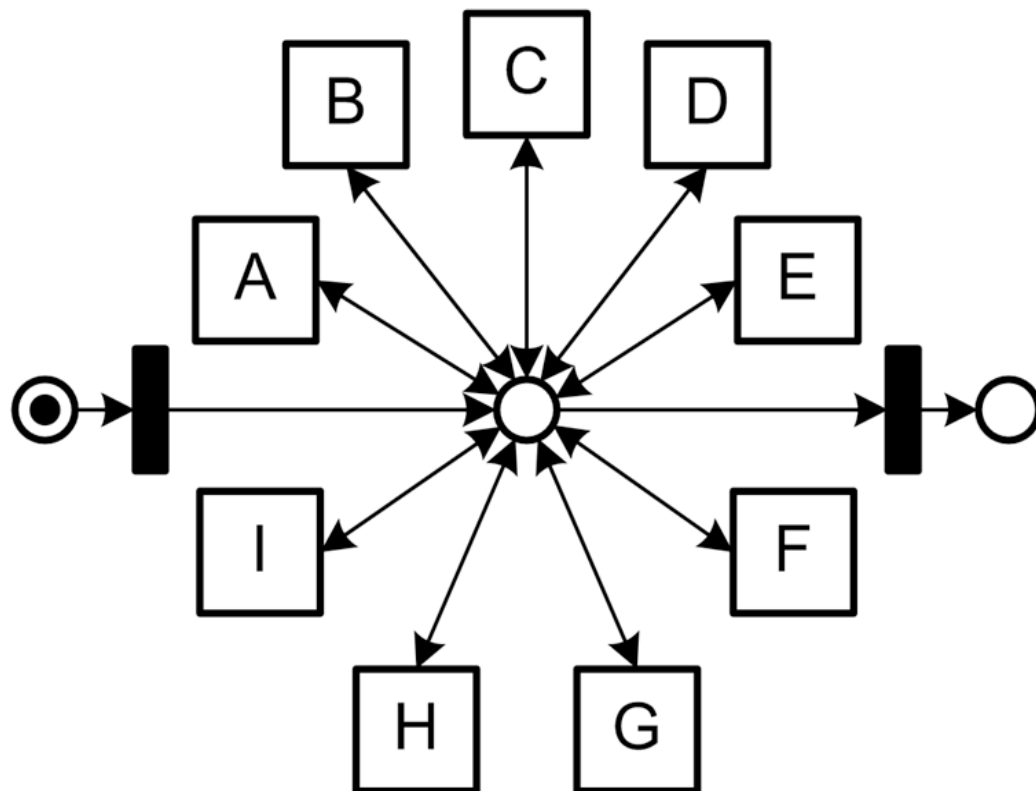
- ❑ M: Number of places, transitions, incoming/outgoing links
- ❑ L: Explicit encoding with violating transitions EEVT
 - enabled transitions in a replay have a much shorter encoding than faulty transitions,
 - no need to trigger an error recovery mechanism in the encoding.

No. of Instances	Log Traces
1207	ABDEI
145	ACDGHFI
56	ACGDHFI
23	ACHDFI
28	ACDHFI



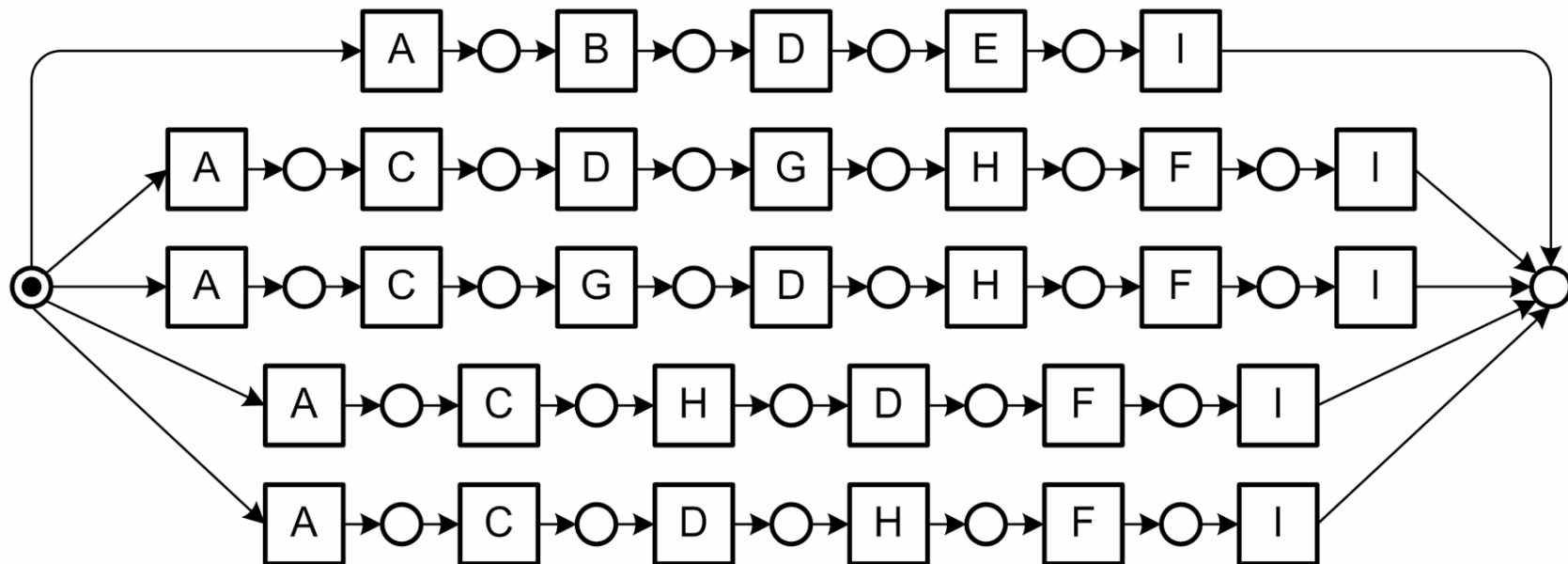
Running Petri-net example from:

Rozinat et al. 2007 Towards an Evaluation Framework for Process Mining Algorithms. BPM Center Report, BPMcenter.org

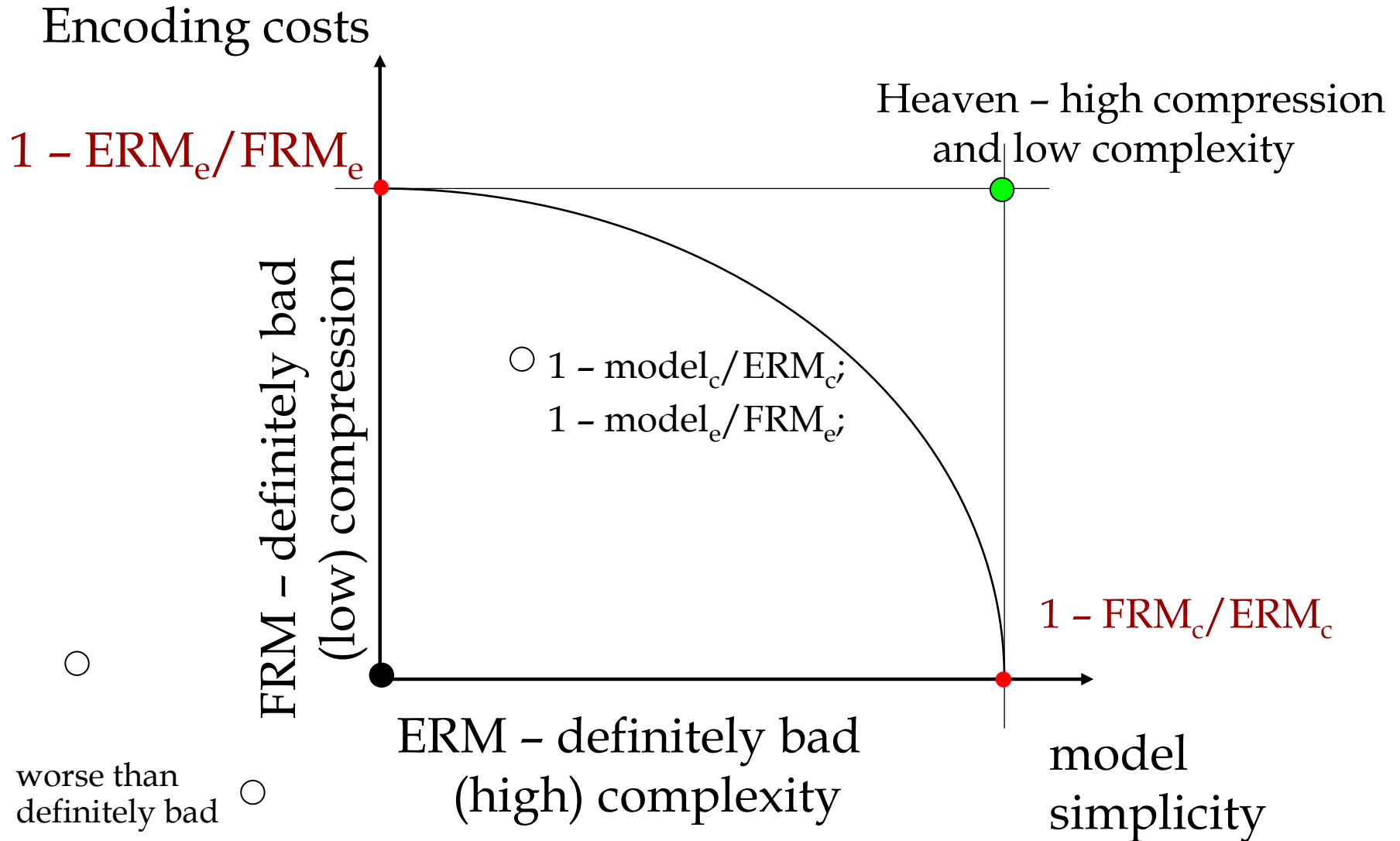


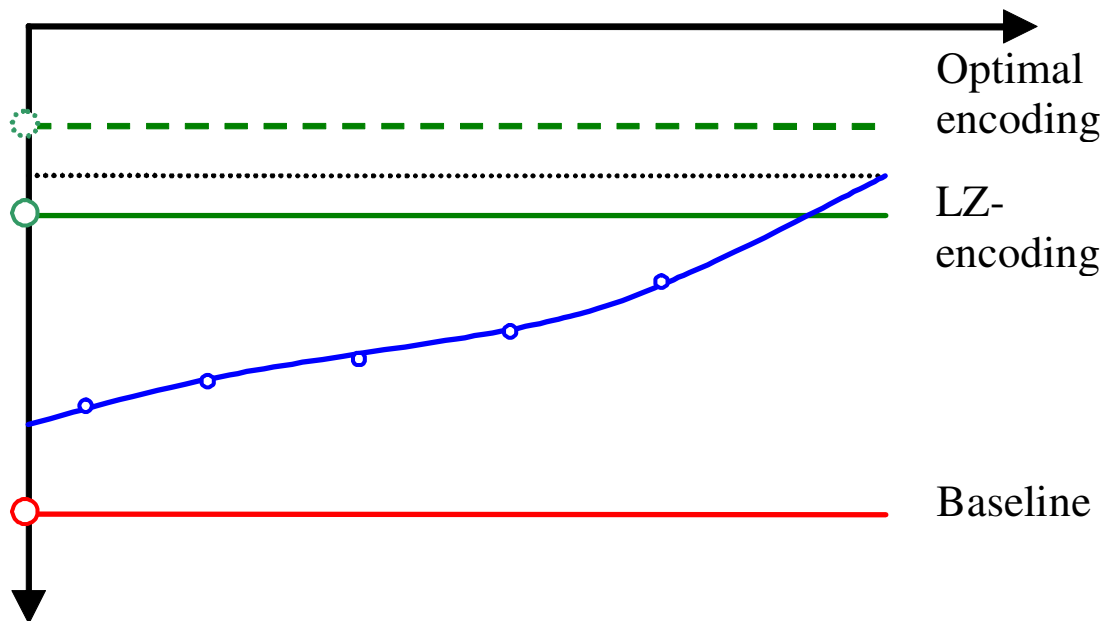
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TU/e Log compression – model complexity trade-off





Optimal: Kolmogorov (undecidable)

Close to optimal: LZip or similar

Baseline: min (FRM, ERM)

□ Short run

- Extensive experimental studies
- Evaluation of trace clustering
- MDL principle for guiding process mining
 - $I = \alpha * Model_e + (1 - \alpha) * Model_c$

□ Long run

- Some success stories exist, but
 - to a large extent the state-of-the art techniques still have problems with scalability and robustness
- Adaptation of sequence mining, graph mining and other data mining approaches for
 - development of the new robust and scalable process mining techniques



Questions

Suggestions

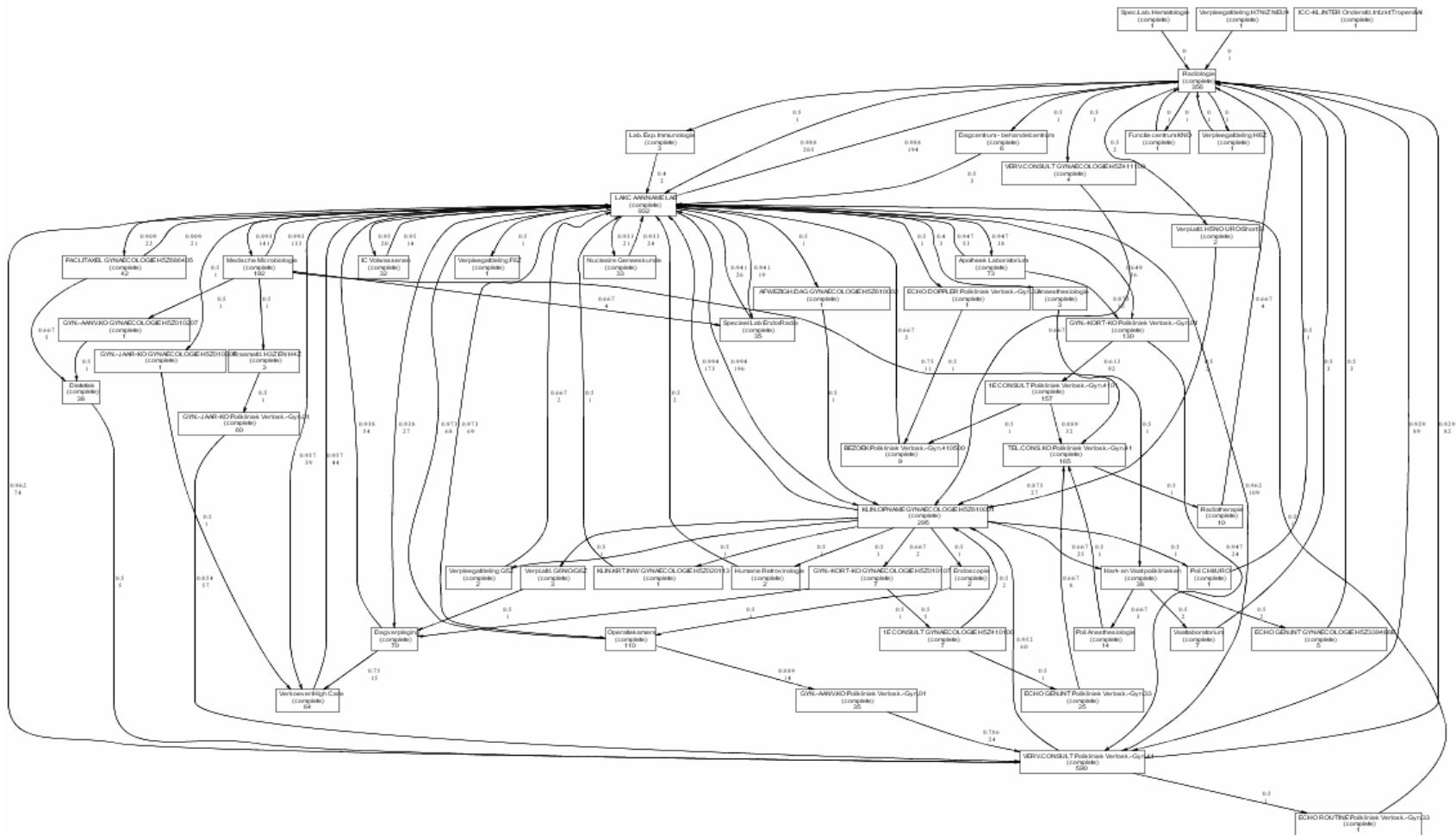
Collaboration

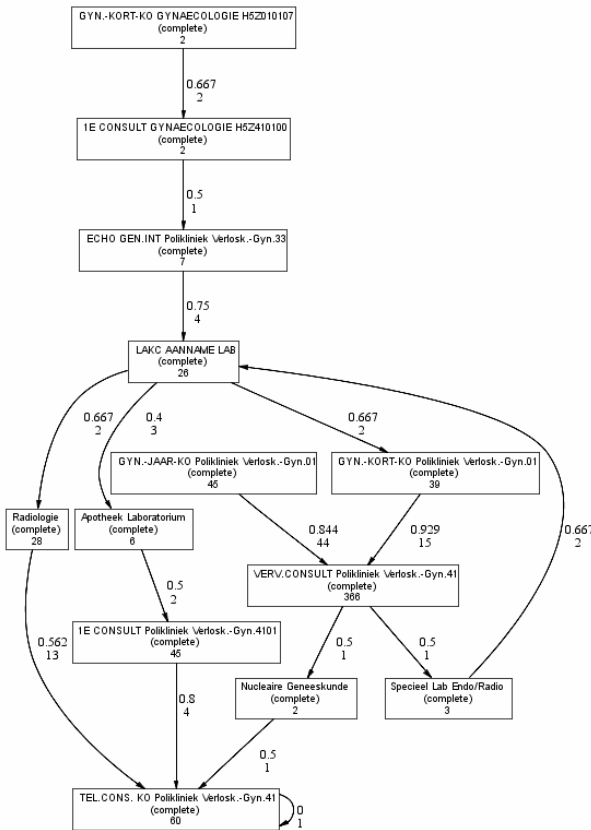
all warmly welcome

Please consider submitting your work and attending
*ECML/PKDD Workshop on
Discovery of Process Models*

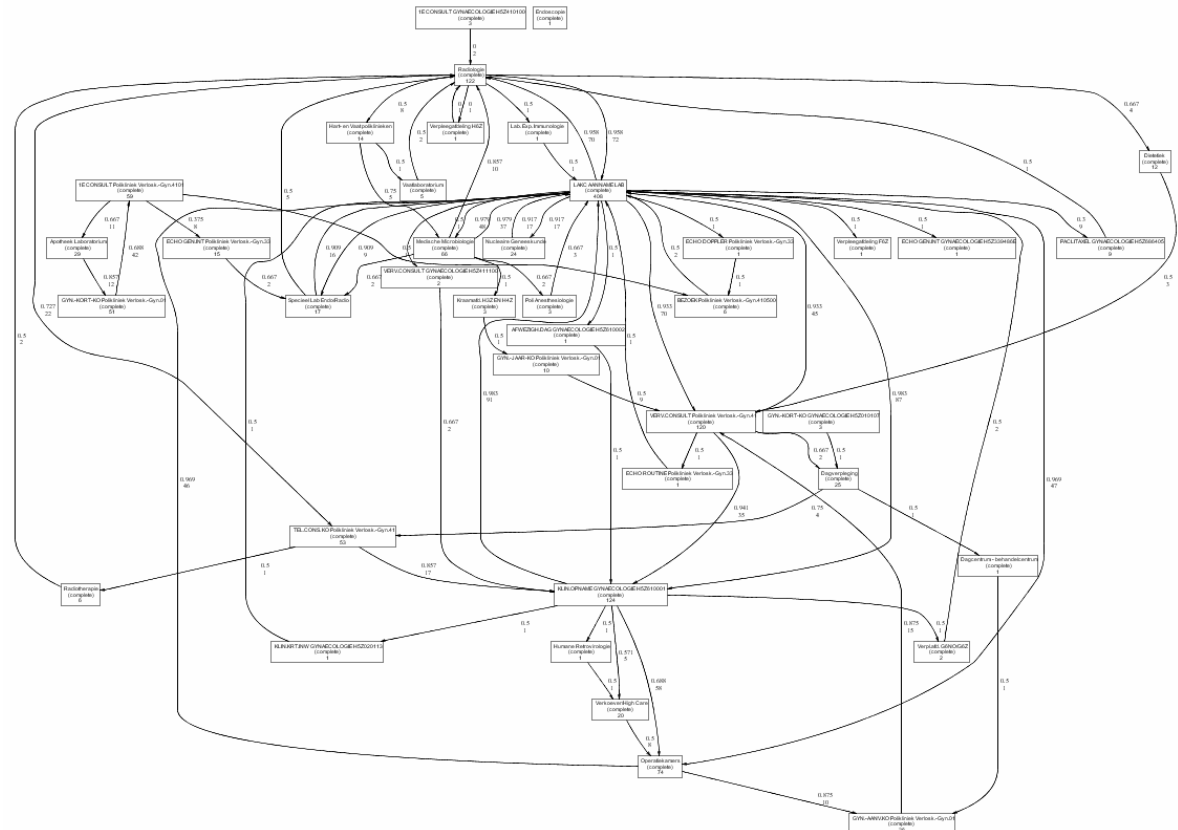


- Given the whole log, process mining techniques find spaghetti-type of process models
- The hope is that if traces are clustered into homogeneous partitions, process mining techniques can do better
 - i.e. instead of one global spaghetti model there will be *several* local more intuitive to the user models
- How many clusters?
 - Current approaches
 - minimization of MAE etc, plus
 - maximization of the (weighted) fitness of the local models
 - => if #cluster = #traces then we can get same number of perfectly precise models
 - some penalization is needed ...
 - but MDL-based measure does this without any extra effort





Diagnosis process



Treatment process