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The Concept of the Knockout Analysis Approach

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The overview of the proposed approach

Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Definitions and Prerequisites

A knock-out check is…

- an activity that classifies a case into“accepted” or “rejected”, such that if the case is accepted it proceeds forward, while if rejected, all other checks are considered unnecessary and the case is either terminated or moved to a later stage in the process (Verenich et al 2016).

Event log should have:

- data on when the case is accepted and rejected - manually input by the analyst before the start of the analysis
- case attributes (case type, client, etc.)

Running Example

A mortgage application process that has 5 knock-out checks:

- A Check salary of mortgagee: is the income sufficient to pay off the debt in a reasonable period?
- B Check current debts: does the mortgagee have serious debts?
- C Check mortgage history: does the mortgagee have a history of non-payment?
- D Check collateral: is the value of the real estate as indicated by the mortgagee?
- E Check insurance: is there a reason why the mortgagee will not be able to get a life insurance?

Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Input: Event log

Goal: Identify knock-outs from the event log

Steps: *Lino's and Manuel's proposition*

Output: Discovered knock-outs

Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Input: Discovered knock-outs

Goal: Identify knock-outs' behaviour

Steps:

1. Identify knock-out probabilities (rejection rate).
2. Identify knock-out efforts (average processing time of the knock-out check activity).
3. Identify knock-out rules:
   a. Cluster up cases in two groups: accepted and rejected.
   b. Identify the correlation of case attributes between the two clusters.
   c. Formulate the knock-out rules.

Identify knock-out rules (example)

1. 1 000 cases: 400 cases accepted, 600 rejected
2. All values of "accepted" cases satisfy the knock-out rules. One or several values of "rejected" cases does not satisfy the knock-out rules.

   E.g., take Mortgage Amount, eur
   Accepted: (30,000; 50,000; 55,000; 60,000, …; 500,000)
   Rejected: (10, 35,000; 50,000; …; 80,000)

Accepted

Case Attribute	Value
Property Type	House
Mortgage Amount, eur	250,000
Mortgage Period, years	25
Collateral Value, eur	250,000
Mortgagee Salary, eur	5,000
Mortgagee Debts, eur	0
Mortgagee Non-payments, binary	0

Rejected

Case Attribute	Value
Property Type	Apartment
Mortgage Amount, eur	800,000
Mortgage Period, years	25
Collateral Value, eur	200,000
Mortgagee Salary, eur	2,000
Mortgagee Debts, eur	50,000
Mortgagee Non-payments, binary	1

Discovered Potential Rules

Case Attribute	Reject if…
Property Type	-
Mortgage Amount, eur	<=30,000 ^ >= 800,000
Mortgage Period, years	<= 0,5 ^ >= 45
Collateral Value, eur	<= 10,100
Mortgagee Salary, eur	<= 620
Mortgagee Debts, eur	>= 15,000
Mortgagee Non-payments, binary	= 1

Identify knock-out rules (example)

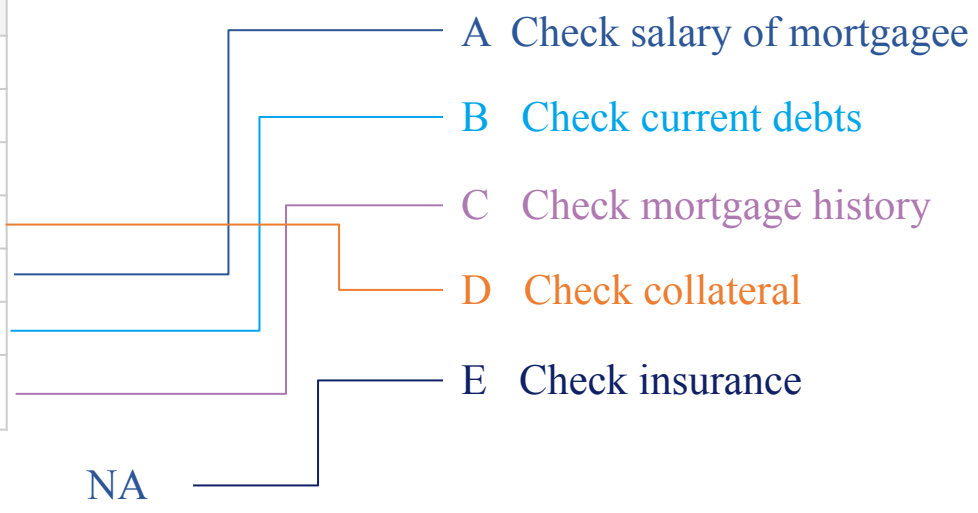
3. Associate discovered potential rules with the identified knock-out checks.

Currently, I'm not sure how to do it. I'll be working on it. But you're also welcome to suggest a solution. :)

Discovered Potential Rules

Case Attribute	Reject if…
Property Type	-
Mortgage Amount, eur	<=30,000 ^ >= 800,000
Mortgage Period, years	<= 0,5 ^ >= 45
Collateral Value, eur	<= 10,100
Mortgagee Salary, eur	<= 620
Mortgagee Debts, eur	>= 15,000
Mortgagee Non-payments, binary	= 1

Identified Knock-out Checks



Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Input: Discovered knock-outs

Goal: Identify knock-outs' behaviour

Steps:

1. Identify knock-out probabilities.
2. Identify knock-out efforts (mean processing time of the knock-out check).
3. Identify knock-out rules:
   a. Cluster up cases in two groups: accepted and rejected.
   b. Identify the correlation of case attributes between the two clusters.
   c. Formulate the knock-out rules.
4. Calculate the knock-out score as Rejection rate / Average PT. The higher the knock-out score, the earlier it should be placed w.r.t. other knock-outs.

Knock-out check	Total frequency	Case frequency	Mean PT	Rejection rate	Rejection rule	Knock-out Score
Check Mortgage Amount	1000	100%	5 mins	60%	[Mortgage Amount, eur] <= 30,000 ^ [Mortgage Amount, eur] >= 800,000	Rejection rate / Average PT
Check salary of mortgagee						
Check smth else 2						
Check mth						
…	…		…	…	…	

Input: Discovered knock-outs with probabilities, efforts and rules

Goal: Identify knock-out impact

Steps:

1. To identify the knock-out impact, calculate several parameters FOR EACH KNOCK-OUT SEPARATELY:
   a. **total overprocessing waste** - how much time was spent on cases that were knocked out by a particular knock-out check. Calculate the total time spent on all the rejected cases by a particular knock-out (both waiting and processing time).
   b. **total processing time waste -** how much effort was spent on cases that were knocked out by a particular knock-out check. Calculate the total time spent on processing the rejected cases by a particular knock-out (only processing time).
   c. **mean waiting time waste** - how long an accepted case typically waits because of the time spent on the rejected cases.
   - not sure how to calculate it yet

   (We'll need to make these parameters as low as possible.)

Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Knock-out check	Total frequency	Case frequency	Mean PT	Rejection rate	Rejection rule	Knock-out Score	Total Overprocessing Waste	Total PT Waste	Mean WT Waste
Check Mortgage Amount	1000	100%	00:05:00	60%	[Mortgage Amount, eur] <= 30,000 ^ [Mortgage Amount, eur] >= 800,000	Rejection rate / Average PT	34:22:11	16:00:50	00:02:50
Check salary of mortgagee									
Check smth else 2									
Check mth									
…	…		…	…	…				

Knock-out Discovery -> Knock-out Analysis -> Knock-out Impact Analysis -> Knock-out Redesign

Input: Discovered knock-out overprocessing

Goal: Identify potential redesign option to reduce/eliminate overprocessing

Steps:

1. Identify the possible redesign options for the knock-out/-s:
   a. Relocate a knock-out, i.e., put a knock-out to a different place in a process:
   place the knock-out check as early in the process as the attribute value (based on which the knock-out is performed) is available.
   b. Reorder knock-outs according to the **knock-out principle**:
   checks are ordered according to the principle of "least effort to reject"– checks that require less effort and are more likely to reject the case come first. In addition, consider the knock-out rule so that the attribute value (based on which the knock-out is performed) is available at that point in the process.
   c. Change the knock-out rule:
   change the attribute value (or its range) based on which the knock-out is performed;

   d. Remove the knock-out;
   e. Add a new knock-out.

Let's wait with these two for now.

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Thank you!