EVA: Visual Analytics to Identify Fraudulent Events

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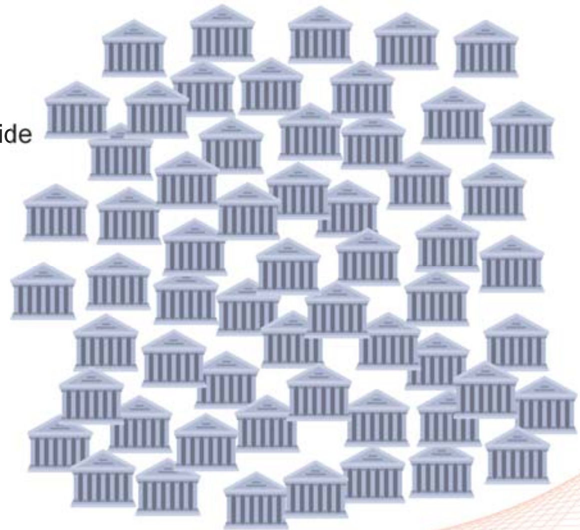
Motivation

Around 30.000 different banks world wide

- Top 10 banks alone hold around $25 tri
- Banks succeed!



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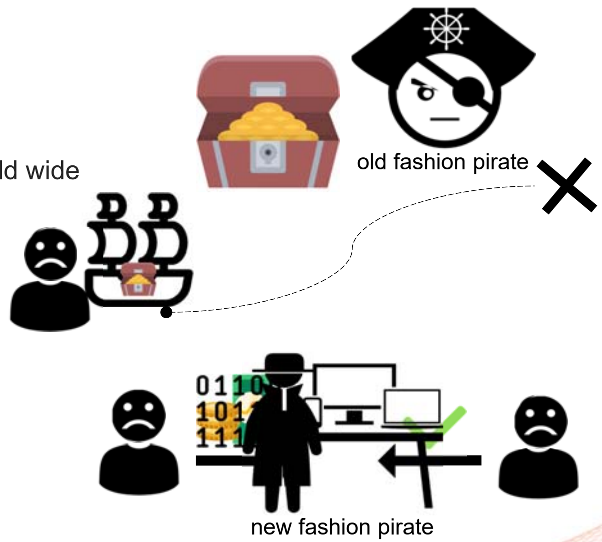
Transaction security

Financial crime fashion changes



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Motivation

Around 30.000 different banks world wide

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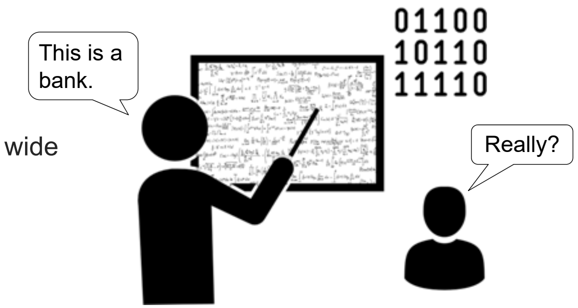
Transaction security

Financial crime fashion changes

Types of frauds

- Unauthorized Transaction
- Straw Person
- Internal Fraud
- Money Laundering
- …



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Roadmap

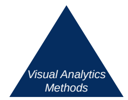
- Motivation
- Automatic Method
- Requirements
- EVA
- Evaluation
- Future Work
- Conclusion

Collaboration – The Beginning

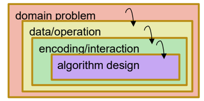
A bank approached us with a problem concerning financial fraud detection.

They had developed an Automatic Method for detecting financial frauds that had great results but could still be improved.

We decided for a **User Centered** design of a VA approach.



[S. Miksch and W. Aigner, 2014]

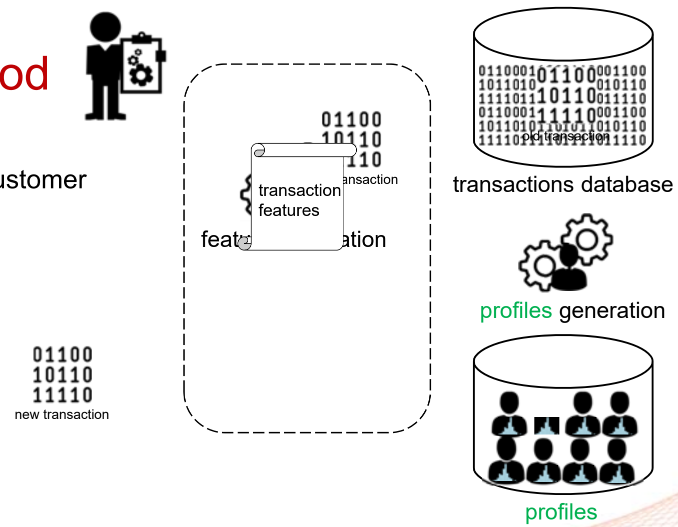


Nested Model [Tamara Munzner, 2009]

…let`s take a look at this Automatic Method

Automatic Method

Creates a profile for each customer



Automatic Method

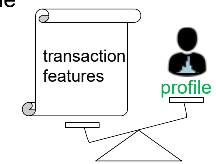
Creates a profile for each customer

Scores are generated for each new transaction

Scores represent suspiciousness

scores:

- operation time score
- location score
- amount of money score
- location and amount score
- location and time
- …
- …
- …



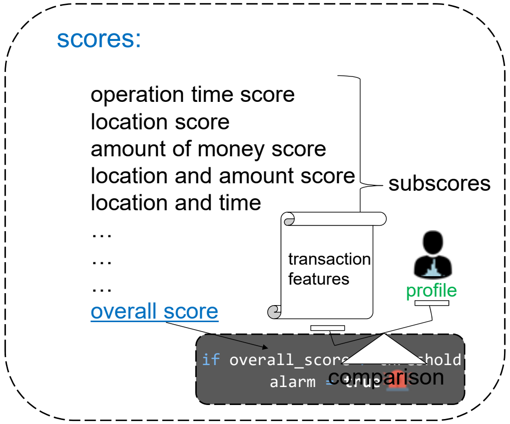
Automatic Method

Creates a profile for each customer

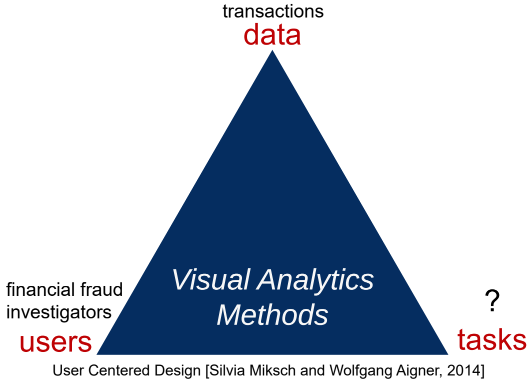
Scores are generated for each new transaction

Scores represent suspiciousness

Alarms are triggered by the overall score



Requirements



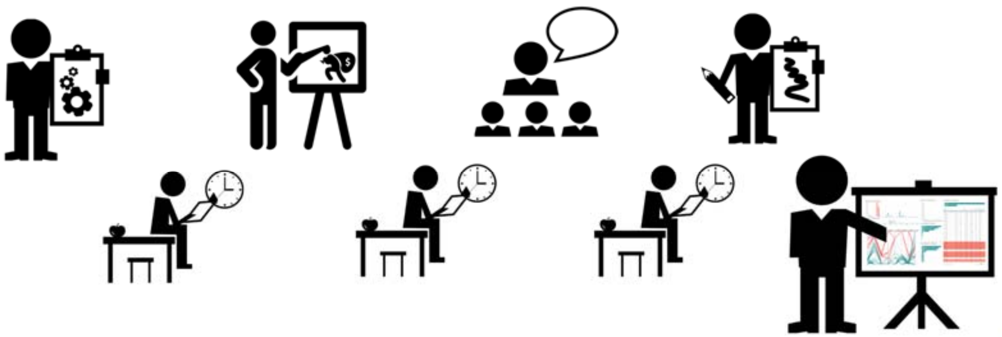
System should be constantly updated
R1 - Visual support for scoring system

Hard to compare accounts
R2 - Account comparison

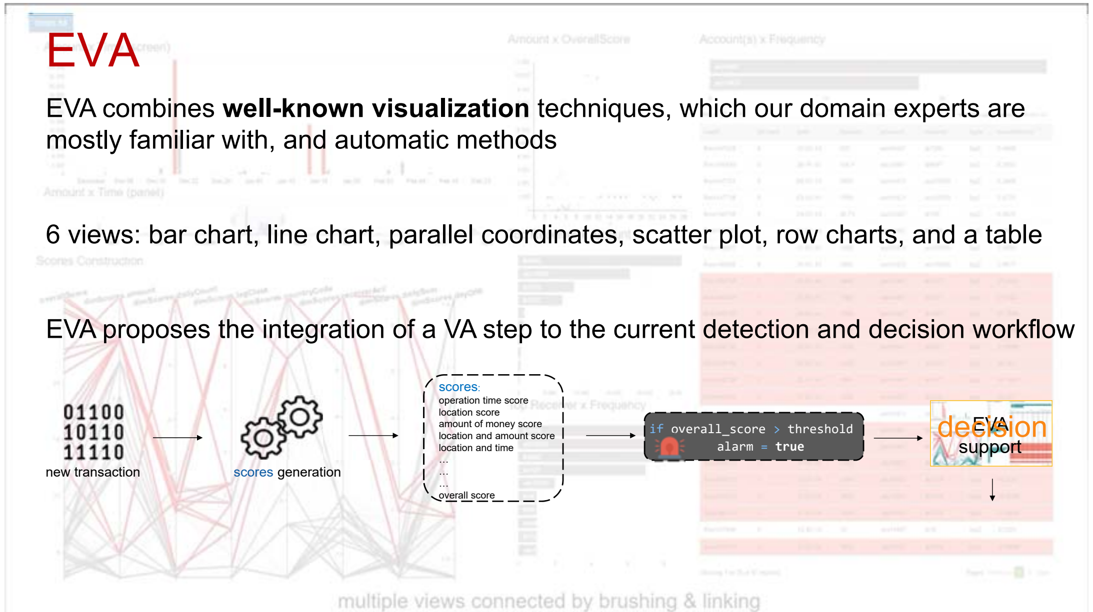
Hard to identify false-positives
R3 - Reasoning about potential frauds

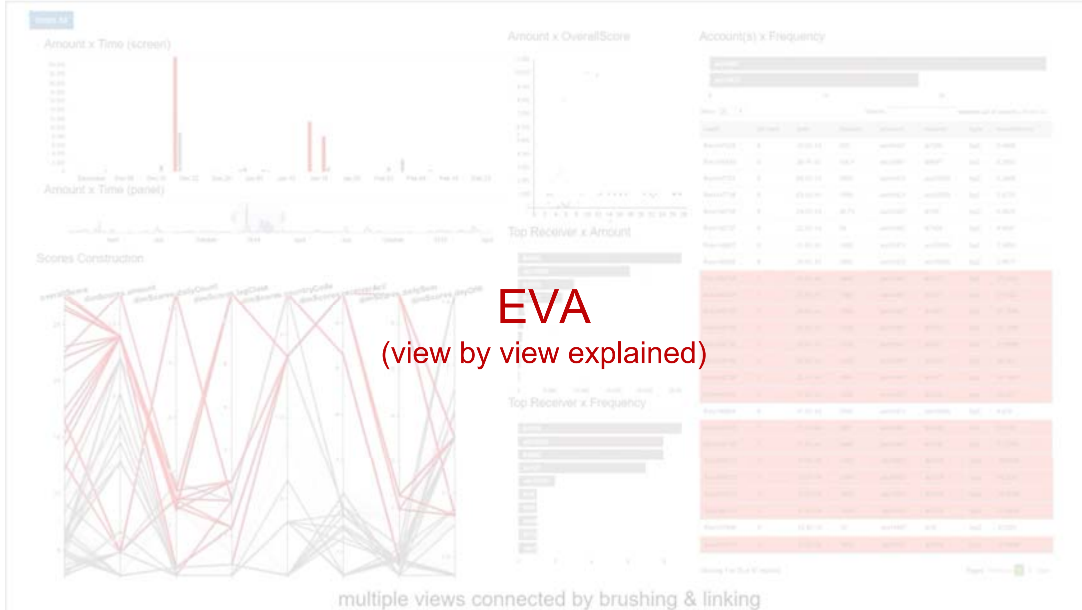
Hard to identify false-negatives
R4 - Identification of hidden frauds

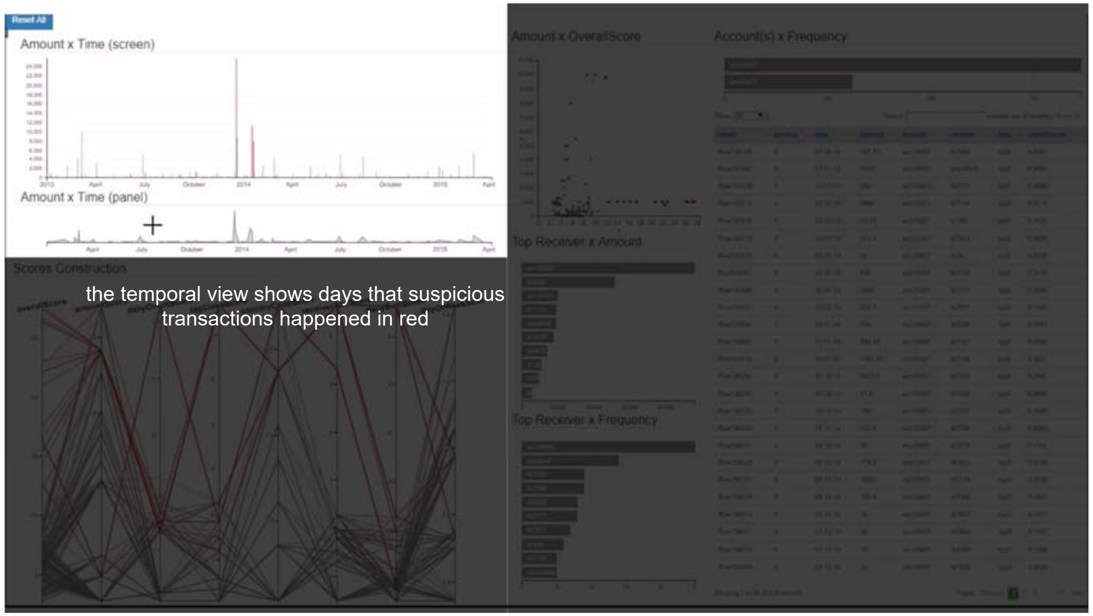
Collaboration – User Center Design



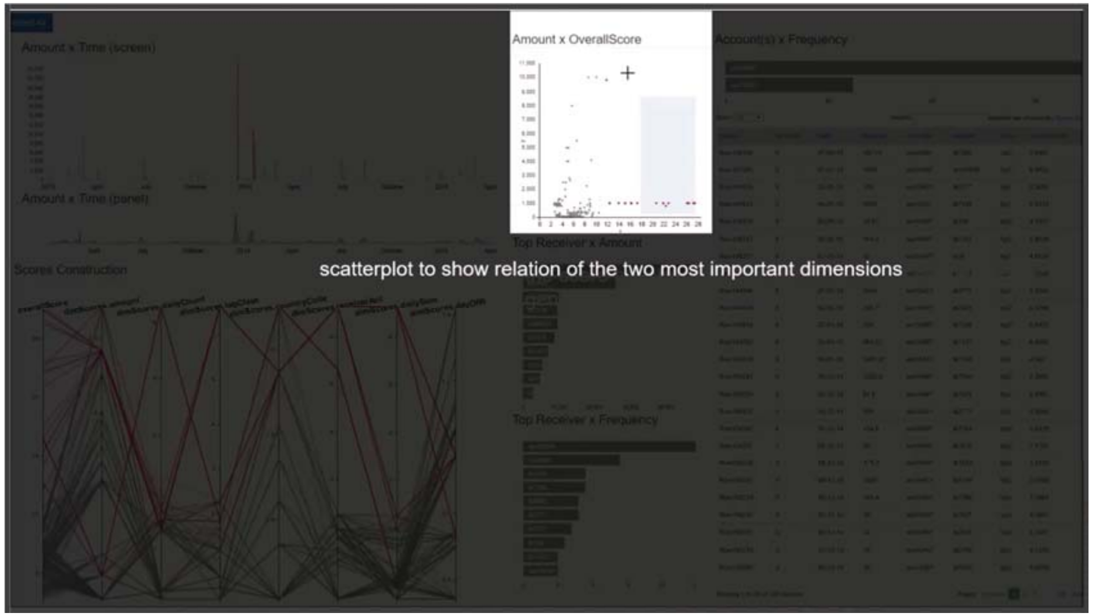
…18 months project

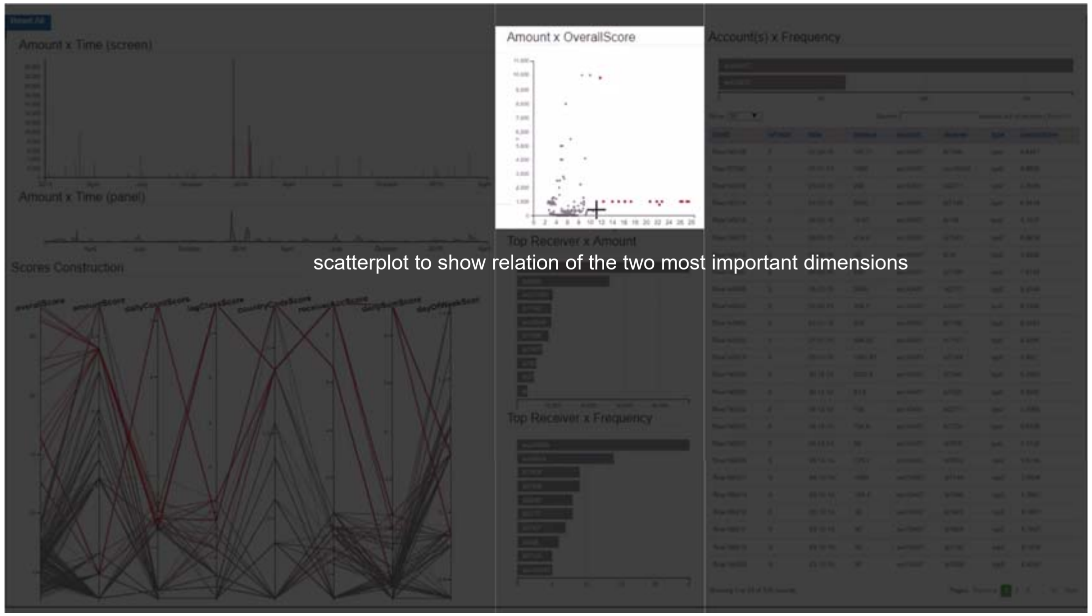

EVA
EVA combines **well-known visualization** techniques, which our domain experts are mostly familiar with, and automatic methods
6 views: bar chart, line chart, parallel coordinates, scatter plot, row charts, and a table
EVA proposes the integration of a VA step to the current detection and decision workflow
01100
10110
11110
new transaction
scores generation
scores:
operation time score
location score
amount of money score
location and amount score
location and time
...
...
overall score
if overall_score > threshold
alarm = true
decision
EVA
support
multiple views connected by brushing & linking


EVA
(view by view explained)
Amount x Time (screen)
Amount x Time (panel)
Amount x OverallScore
Account(s) x Frequency
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency
multiple views connected by brushing & linking


Reset All
Amount x Time (screen)
Amount x Time (panel)
Amount x OverallScore
Account(s) x Frequency
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency
the temporal view shows days that suspicious transactions happened in red


Reset All
Amount x Time (screen)
Amount x Time (panel)
Amount x OverallScore
Account(s) x Frequency
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency
the score construction view shows how the automatically generated score was composed for each transaction


Amount x OverallScore
Account(s) x Frequency
Amount x Time (screen)
Amount x Time (panel)
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency
scatterplot to show relation of the two most important dimensions


Amount x OverallScore
Account(s) x Frequency
Amount x Time (screen)
Amount x Time (panel)
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency
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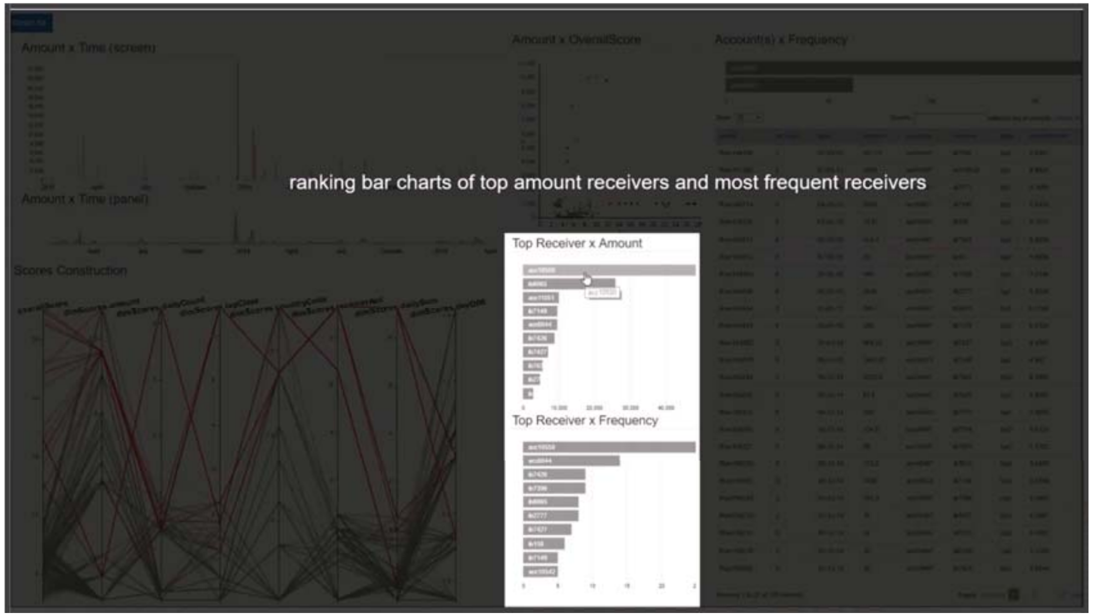
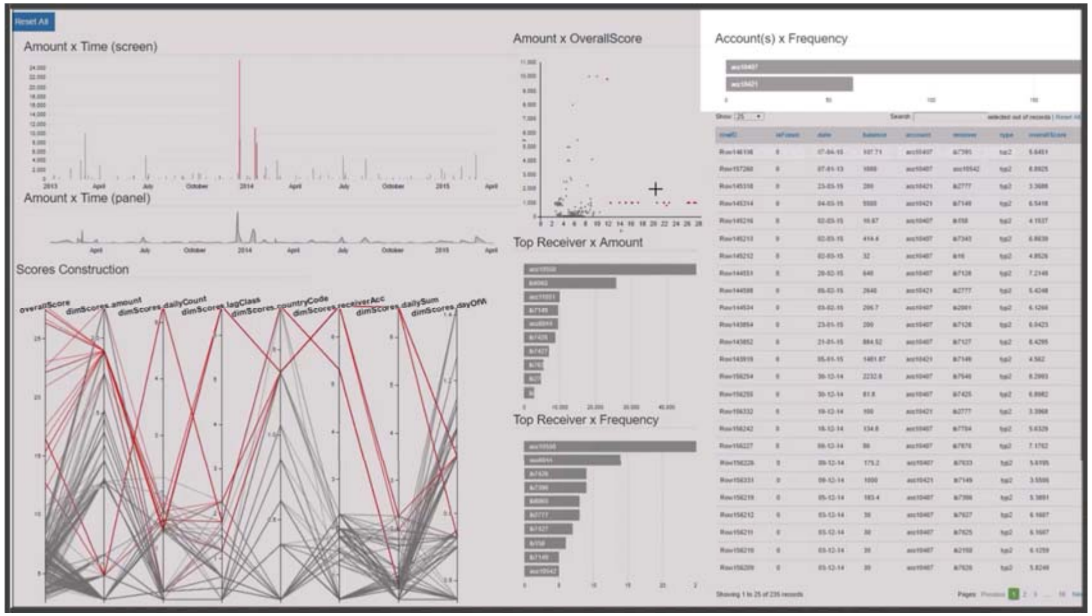
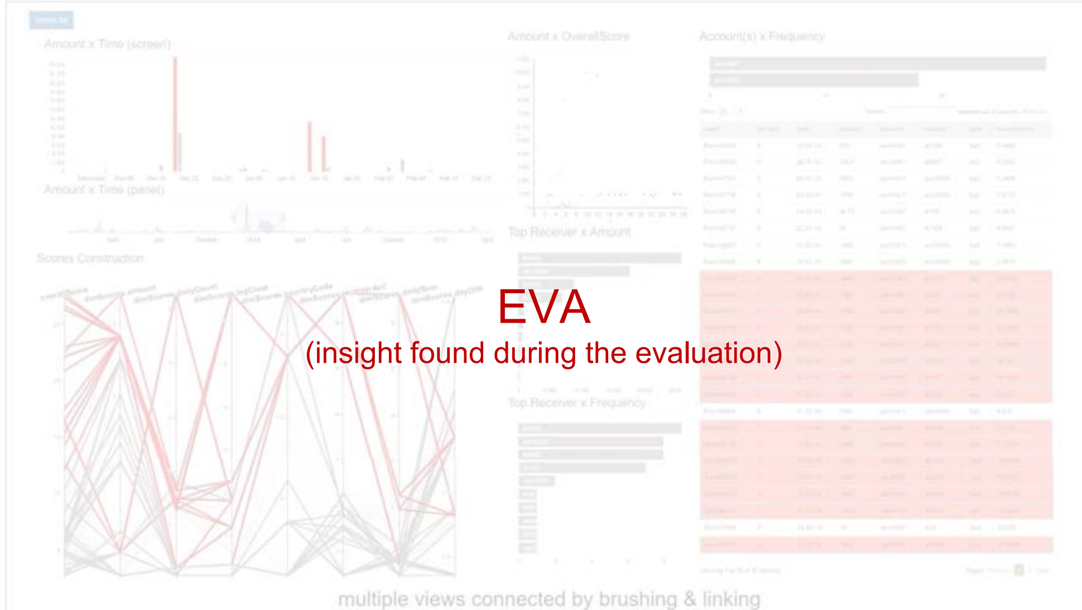
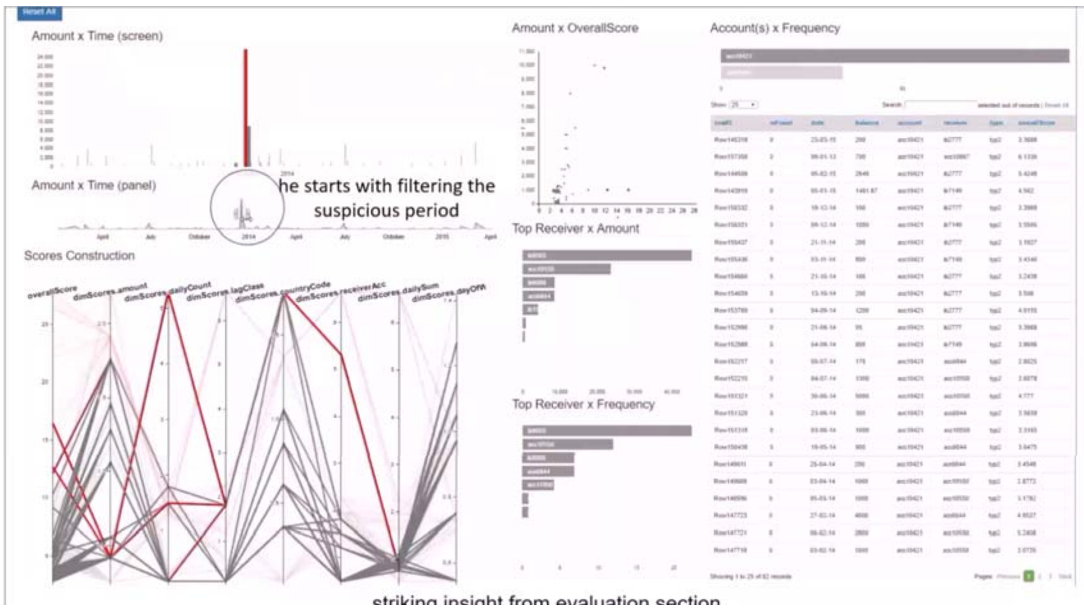
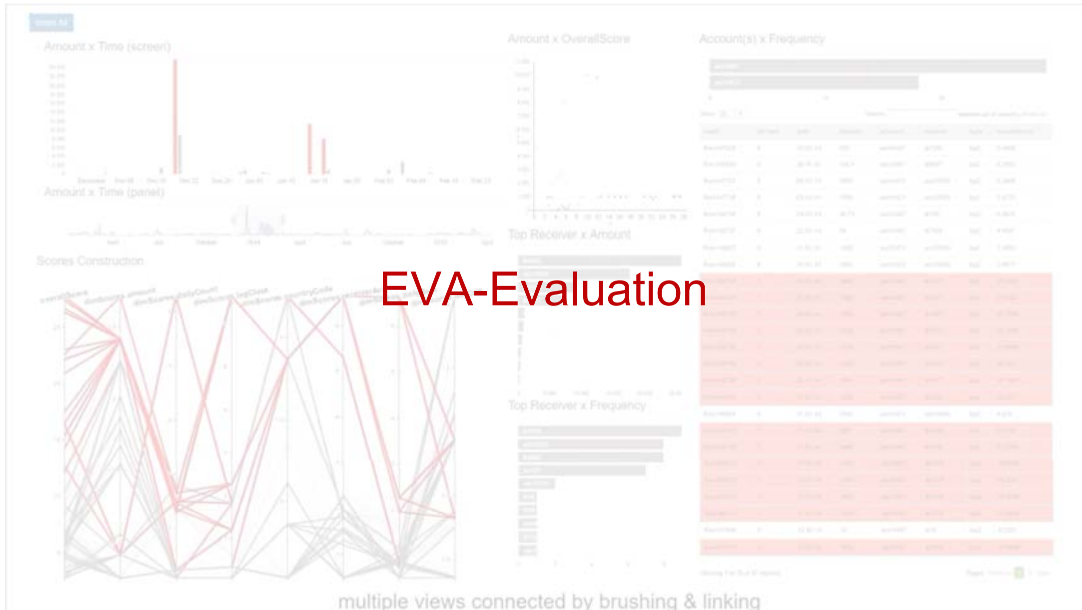

Amount x OverallScore
Account(s) x Frequency
Amount x Time (screen)
Amount x Time (panel)
Scores Construction
ranking bar charts of top amount receivers and most frequent receivers
Top Receiver x Amount
Top Receiver x Frequency


Reset All
Amount x Time (screen)
Amount x OverallScore
Account(s) x Frequency
Amount x Time (panel)
Scores Construction
Top Receiver x Amount
Top Receiver x Frequency

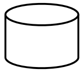

Amount x Time (screen)
Amount x Time (panel)
Scores Construction
Amount x OverallScore
Top Receiver x Amount
Top Receiver x Frequency
Account(s) x Frequency
choosing accounts to investigate

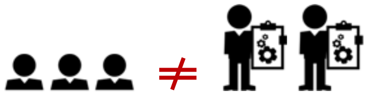

EVA
(insight found during the evaluation)
multiple views connected by brushing & linking


Amount x Time (screen)
Amount x Time (panel)
Scores Construction
Amount x OverallScore
Top Receiver x Amount
Top Receiver x Frequency
Account(s) x Frequency
he starts with filtering the suspicious period
striking insight from evaluation section


EVA-Evaluation
multiple views connected by brushing & linking

Evaluation - Sample

Anonymized real world 2 years dataset 

3 target users 

EVA introduction

Interviews

Designed 3 tasks based on the requirements

Requirements:
R1 - visual support for scoring system
R2 - account comparison
R3 - reasoning about potential frauds
R4 - identification of hidden frauds

	R1	R2	R3	R4
Task 1		•	•	
Task 2	•		•	•
Task 3		•	•	•

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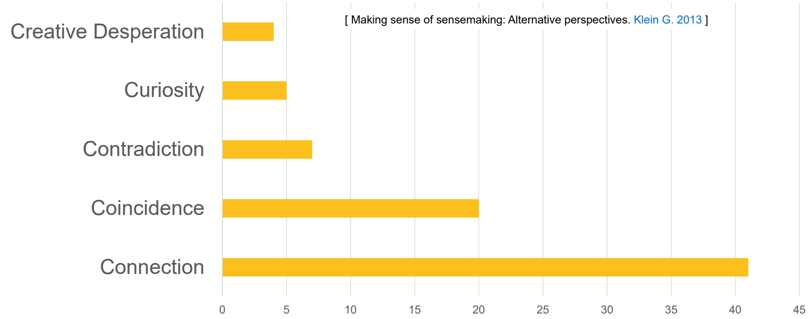
Evaluation - Results

Klein`s sensemaking model:

[Making sense of sensemaking: Alternative perspectives. Klein G. 2013]



"I liked it because it is very interactive and you can browse the data, even if you don't know what you are looking for, and find new insights"

"Here we could see what is possible and what is available [...] So we can rethink what we can offer to the bank."

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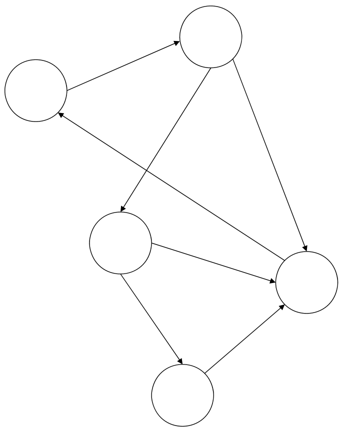
Future Work

Network analysis



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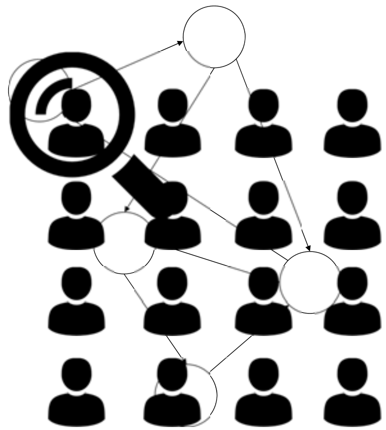
Future Work

Network analysis

Monitoring multiple customers



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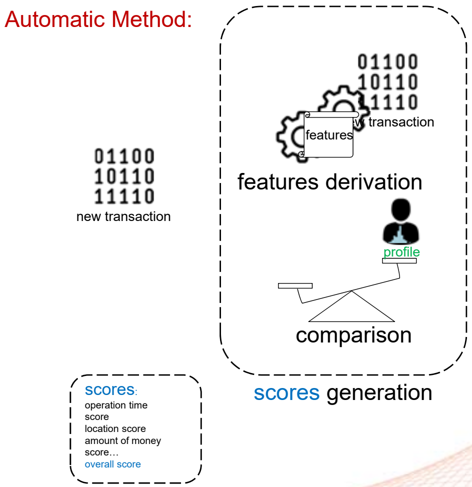
Future Work

Network analysis

Monitoring multiple customers

Fine tuning fraud detection algorithm



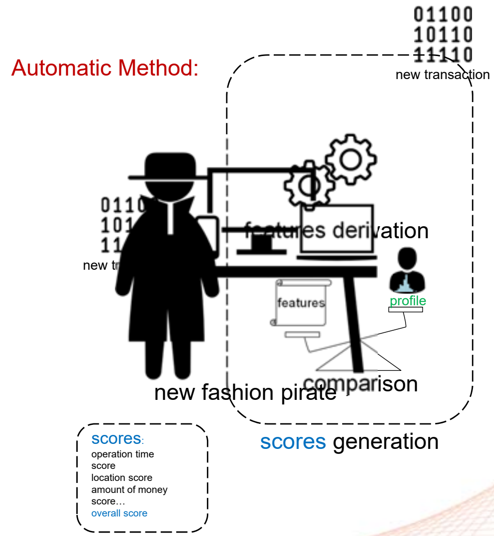
Future Work

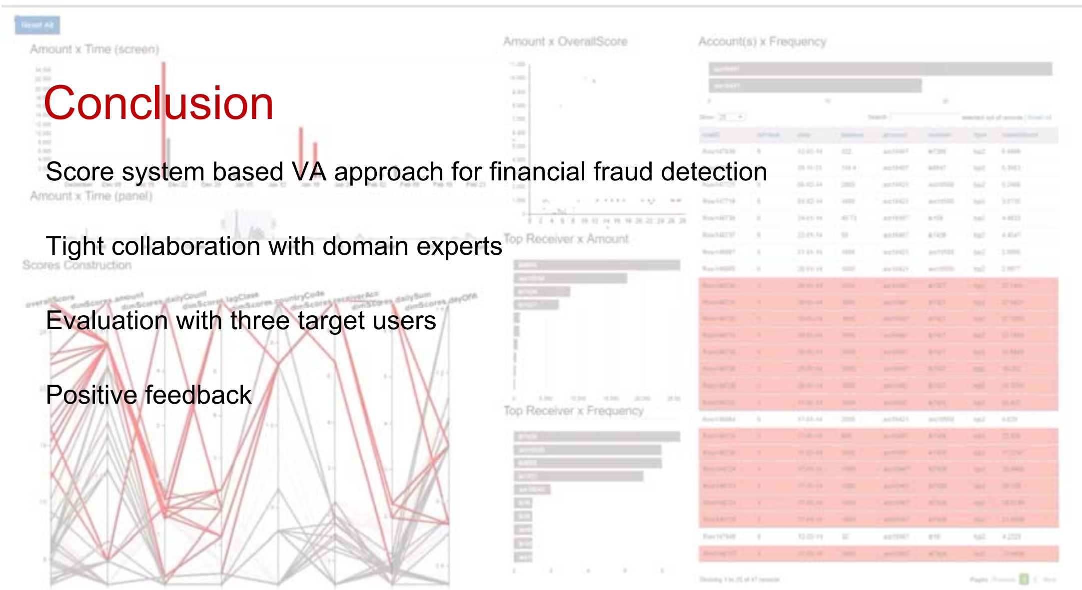
Network analysis

Monitoring multiple customers

Fine tuning fraud detection algorithm

Different types of fraud





Conclusion

Score system based VA approach for financial fraud detection

Tight collaboration with domain experts

Evaluation with three target users

Positive feedback