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Domain: E-Transaction Logs

- Millions of transactions a day (e.g. Ebay)
- Many buyers, many sellers, many products
- Analysis used to maximize profits (prevent fraud, improve advertisements)
Previous Approaches

- Aggregate into trends (e.g. sparklines)
- Automated data mining
- Automated clustering and aggregation
Problems

- Not enough focus/zooming
- One specific buyer or seller may collude
- Mostly overview, hard to drill down to details
• Juxtaposed overview + detail
• Introduces new visual encoding: Knotlines
Typical Tasks

- Identify time periods and categories of interest
- Identify interesting transactions and drill down
- Identify interesting sellers
- Examine transaction patterns of specific sellers
Overview through Saliency Map

- Probabilistic decision tree computes interest
- Encode in a dense pixel based layout
- Allow zooming and time selection
What is a PDT?

- User provides training set of interesting and non-interesting transactions.
- Machine learning algo (see paper) computes something similar to a finite state machine.
- Probability of TP is function of \( \exp TP \) and FP.
Detail View: Knotlines

- Novel visual encoding based on sheet music
- Based on three level hierarchy (grouped by seller, by time period then by item category)
- Linked with saliency overview
<table>
<thead>
<tr>
<th>Visual Encoding</th>
<th>Transaction Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>A knotline</td>
<td>Transactions from the same seller in different time (a group)</td>
</tr>
<tr>
<td>A knotbunch</td>
<td>Transactions from the same seller in a time interval (a sub-group)</td>
</tr>
<tr>
<td>The stem length</td>
<td>The total payment amount of transactions from the same seller in a time interval</td>
</tr>
<tr>
<td>A knot</td>
<td>Transactions from the same seller with the same sales category in a time interval (a section)</td>
</tr>
<tr>
<td>The knot color</td>
<td>The sales category of the knot</td>
</tr>
<tr>
<td>The knot size</td>
<td>The number of commodities in the knot</td>
</tr>
<tr>
<td>An unfilled knot</td>
<td>A transaction with abnormal seller or buyer locations</td>
</tr>
</tbody>
</table>
Knot Details on Demand

- Interaction and selection of knots provides greater detail
- Related knots shown with grey highlights
Validation of the Tool

- Informal walkthrough case study with expert analysts
- Full user study, two analysts eight novice users
- Variety of exercises simulating analyses that would happen in the real world
Results

- Experts concerned with usability, but novices had 95% accuracy rate on the exercises.
- Minor issues with glyph cultural expectations.
- Size coding caused minor selection issues.
- Analysts excited about using the tool, especially to find missing values.
Criticisms

- Saliency map assumes we a priori know what transaction patterns are interesting
- Unfilled knots draw the eye to faulty data
- Seller names and details only visible through interaction, arduous to examine several knots
- Knots on a row implies continuity, but may be from several sellers
Conclusion

- VAET Presents an approach to encoding an overview of transactions through saliency
- Introduces a novel visual encoding of knotlines for detailed time series data
- Provides an effective overview + detail view of E-Transactions
- Could be further improved and customized, but the validation is convincing