VAET: A Visual Analytics Approach for E-transactions Time-Series

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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

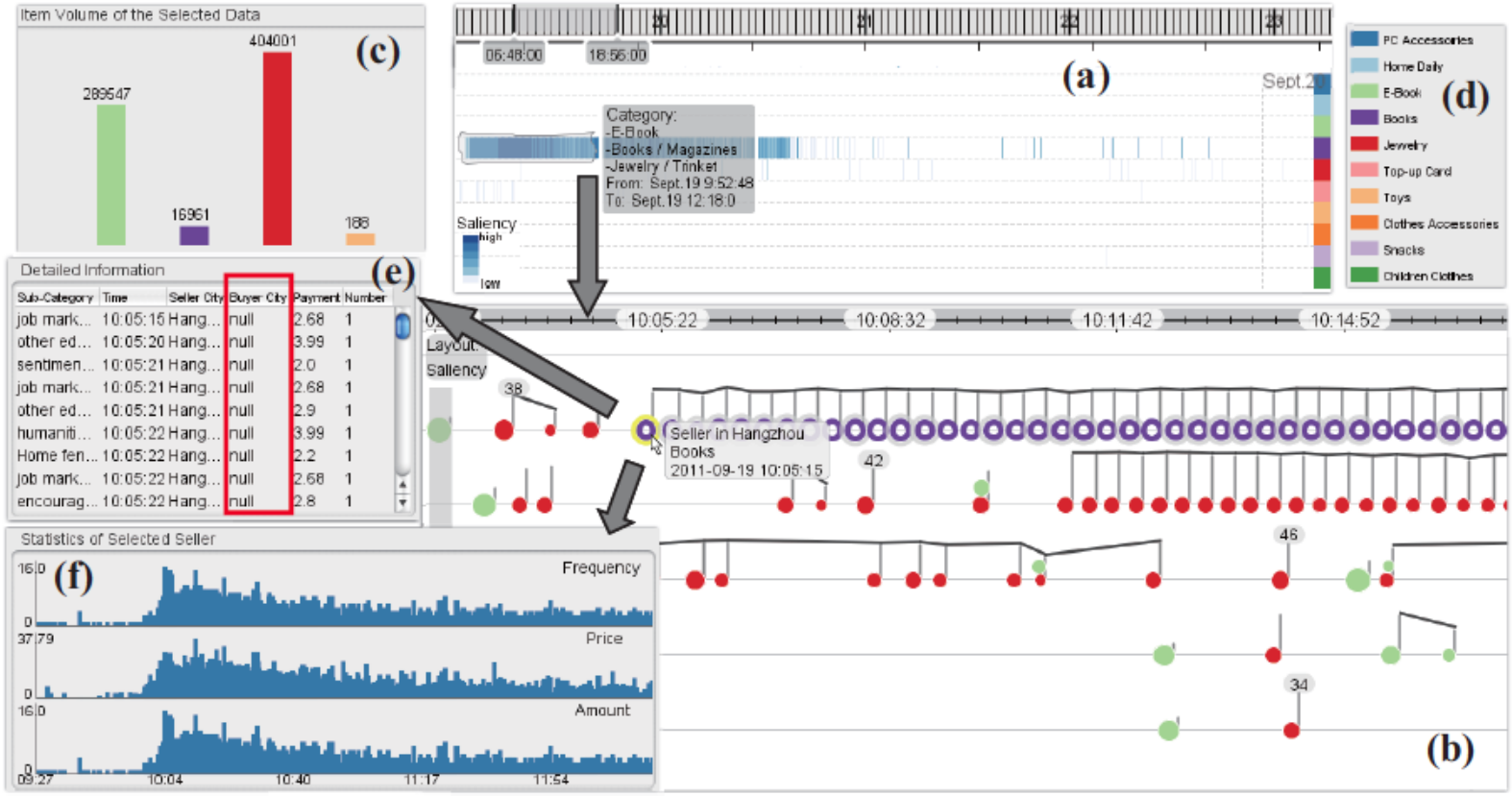
Region	Actual Sales (mn)		% to Goal	(12 Month)	Gross Profit (mn)	Profit Trend (12 Month)
Alabama	$4,916		107%		$1,172	
Alaska	$3,110		65%		$791	
Arizona	$5,198		103%		-$282	
Idaho	$5,280		101%		$410	
Illonois	$4,956		93%		-$22	
Indiana	$5,032		91%		-$516	
Ohio	$5,566		112%		$524	
Oklahoma	$4,246		85%		$787	
Oregon	$6,408		102%		-$932	
Vermonut	$4,244		73%		$1,495	
Virginia	$7,664		161%		$325	
Washington	$4,558		88%		$1,829	

Problems

- Not enough focus/zooming
- One specific buyer or seller may collude
- Mostly overview, hard to drill down to detail

VAET

- Juxtaposed overview + detail
- Introduces new visual encoding: Knotlines



Typical Tasks

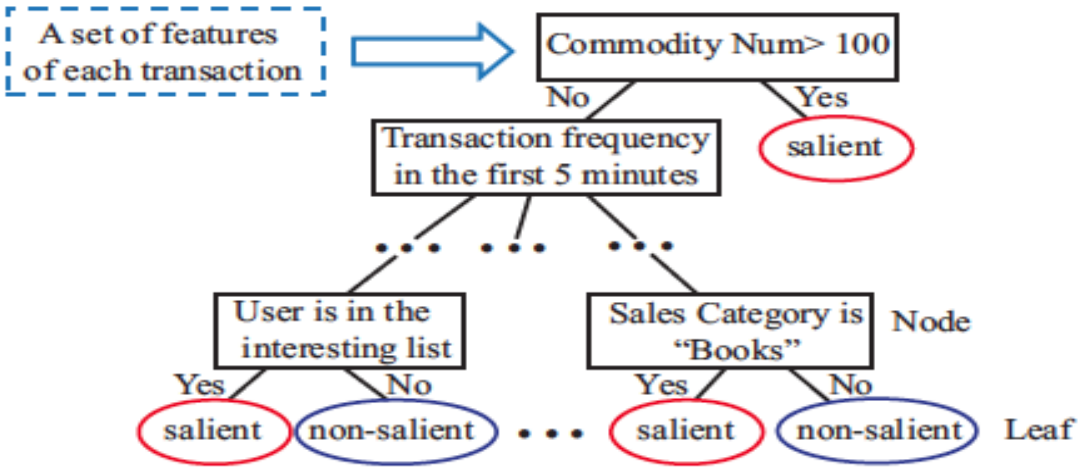
- Identify time periods and categories of inte
- Identify Interesting transactions and drill do
- Identify interesting sellers
- Examine transaction patterns of specific se

Overview through Saliency Map

- Probabilistic decision tree computes interes
- Encode in a dense pixel based layout
- Allow zooming and time selection

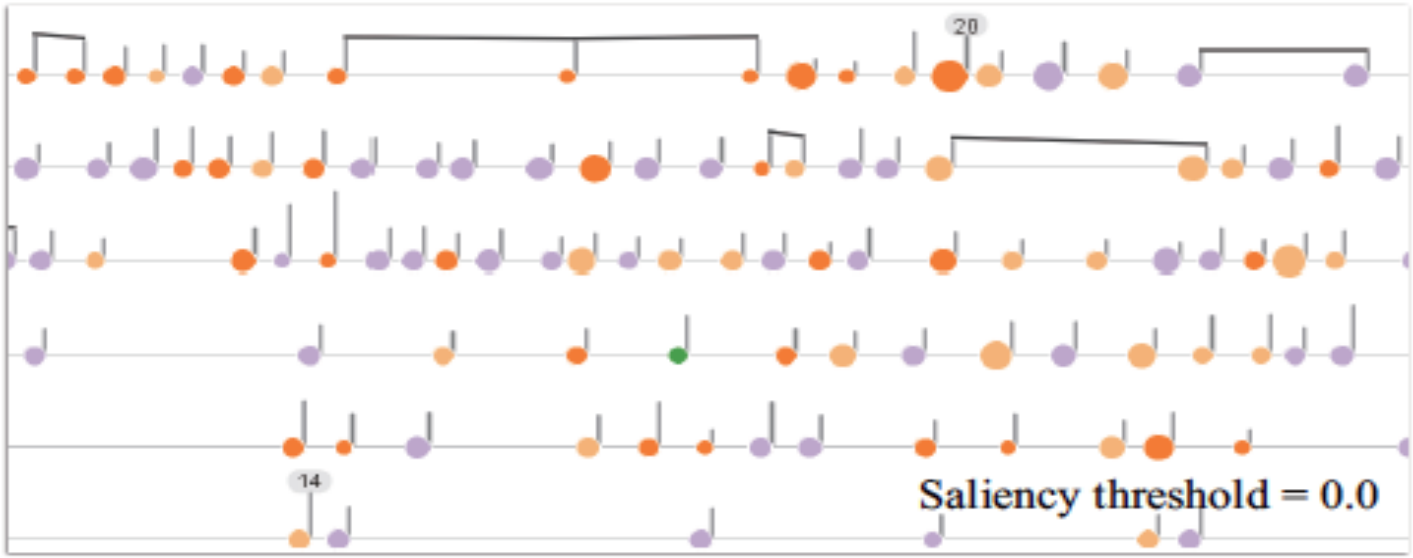
What is a PDT?

- User provides training set of interesting and non interesting transactions
- Machine learning algo (see paper) compute something similar to a finite state machine
- Probability of TP is function of exp TP and



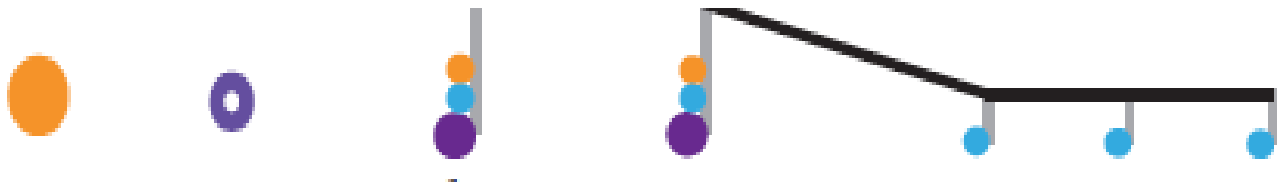
Detail View: Knotlines

- Novel visual encoding based on sheet mus
- Based on three level hierarchy (grouped by seller, by time period then by item category
- Linked with saliency overview



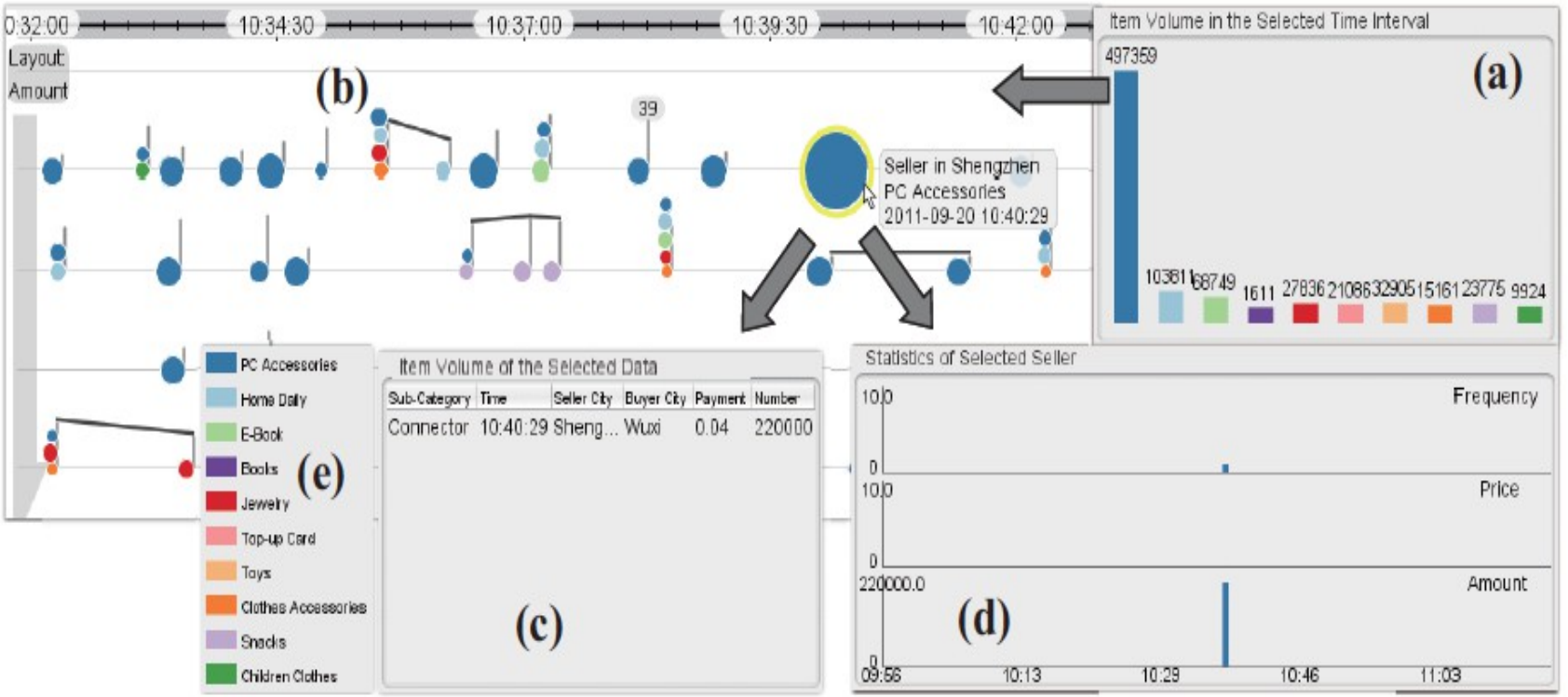
Knot Glyph Details

Visual Encoding	Transaction Data
A knotline	Transactions from the same seller in different time (a group)
A knotbunch	Transactions from the same seller in a time interval (a sub-group)
The stem length	The total payment amount of transactions from the same seller in a time interval
A knot	Transactions from the same seller with the same sales category in a time interval (a section)
The knot color	The sales category of the knot
The knot size	The number of commodities in the knot
An unfilled knot	A transaction with abnormal seller or buyer locations



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 exper analysts
- Full user study, two analysts eight novice users
- Variety of exercises simulating analyses tha would happen in the real world

Results

- Experts concerned with usability, but novice had 95% accuracy rate on the exercises
- Minor issues with glyph cultural expectation
- 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 wh transaction patterns are interesting
- Unfilled knots draw the eye to faulty data
- Seller names and details only visible throug interaction, arduous to examine several kn
- Knots on a row implies continuity, but may b 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