Better Risk and Attrition Predictions

Using Temporal Behaviour Maps

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Why Use Transaction Data?

Task: Behaviour Trend Assessment

Customer: John Smith

Methodology: Models Based on Cycle End Summary Data

This Month	One Month Ago	Conclusion
Balance $1,000	Balance $1,000	No change in risk

Transaction Details Reveals Significant Shift In Behaviour Patterns

This Month	
Balance	**$1,000**
7995 Gambling Charges	$200
6011 Cash Advance	$300
6011 Cash Advance	$150
5411 Grocery Store	$150
3370 Rent-A-Car	$100
5933 Pawn Shop	$100

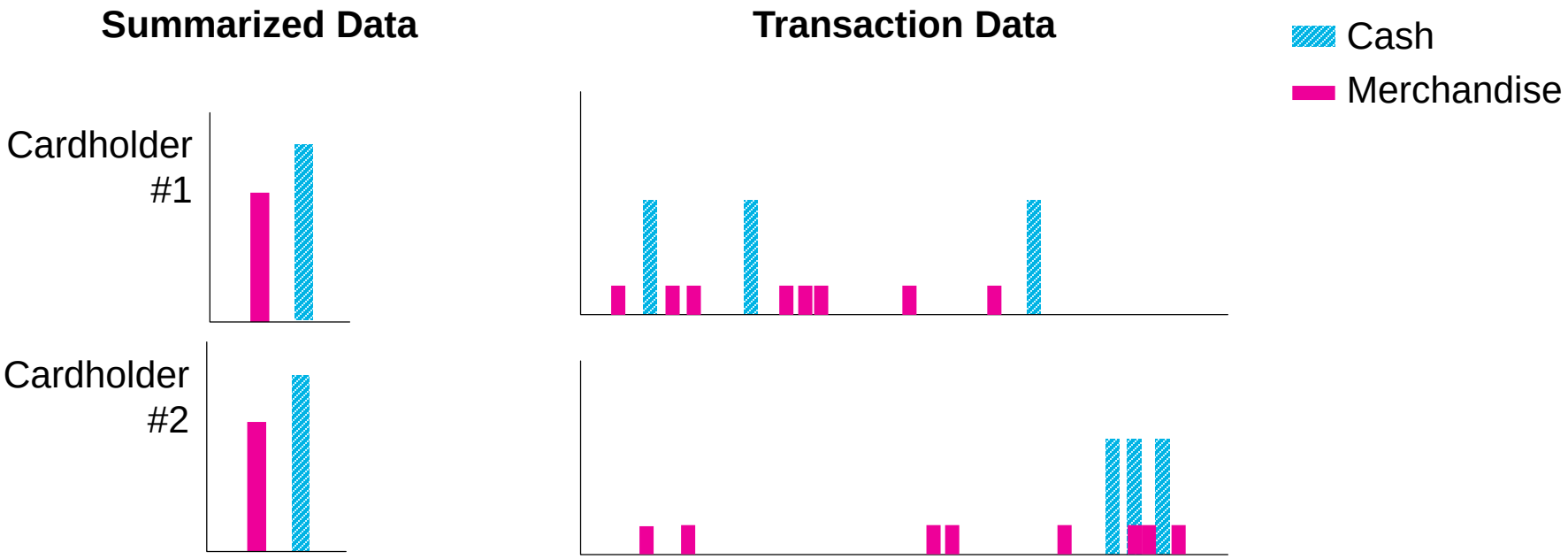
One Mo	
Balance	**$1,0**
5651 Clothing	$200
5641 Toys	$100
5812 Restaurant	$ 50
5942 Bookstore	$ 50
7999 Travel	$400
5732 Electronics	$200

John Smith's Behaviour Trend Assessment

- Big change in typical spending pattern month over month
- Big opportunity to work with customer now to reduce potential loss impact later

Transaction Data Also Informs of the Timing That Is Vital Information

Note the difference in apparent risk when transaction data are examined



Transaction Level Data Also Contains Indicators of Attrition

	Cardholder 'A'	Cardholder 'B'	Conclusion
Summary Data	Balance: $6,000 Value: High	Balance: $6,000 Value: High	No difference
Transaction-Based	4722 Vacation $1,200 5812 Restaurant $150 3357 Car Rental $150 5944 Jewelry $400	5310 Discount Stores $1,000 7841 Videotape Rental $100 5411 Supermarket $250 6011 Catalog Merchant $650	Different spending patterns reveal propensity to attrite

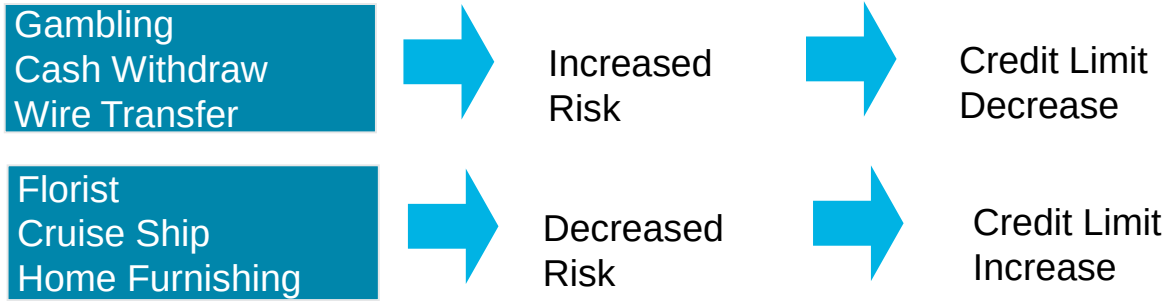
Summary
High-ticket charges
Non-repeating charges,
T&E spender

More likely to attrite

Summary
"Card of Choice"

Less likely to attrite

Credit Card Transactions Tell Us A Life's Story That Helps Decisions



- Extracting A Life's Story Is A Non Trivial Task
  - How do these charges compare to the cardholder's past transaction history?
  - Are these a seasonal type of transaction for this card holder?
  - Gambling charge was made in a casino, but could it be for food, a show or other merchandise?
  - Do the other transactions point to higher risk?
  - What is the potential profitability of this account for the card issuer?

Capturing Cardholder's Life Story from Transaction Data

Historical Transaction Data of John Smith

03/01/15	Restaurant	$ 50.00
03/01/15	Movies	$ 20.00
10/01/15	Jewelry	$ 520.00
17/01/15	Clothes	$ 120.00
24/01/15	Flight Booking	$ 630.00
03/02/15	Car Repair	$ 250.00
27/02/15	Car Rental	$ 250.00

# of fields vary from few to few dozens

$$Char = \frac{\$\ spent\ in\ last\ 30\ days}{\$\ spent\ in\ last\ 60\ days}$$

- Complex characteristic
- Captures customer behaviour change
- Allows comparison against typical change in behaviour in the portfolio

Computed on 01/03/2015

- Need to iterate through the same subset of transactions for both numerator and denominator
- Different periods require different iterations

Challenges in Using Transaction Data in Characteristic Discovery

1000s of transaction characteristics possible	• A combinatorial nightmare • Need large characteristic libraries
Characteristics computation is expensive	• Need to process every transaction
Characteristics selection is difficult	• Too many • Often correlated

Addressing the Challenges of Working with Transaction Data

By Using A Reusable Transaction Variable Library

Efficient

- Computationally cheap and low latency

Accurate

- Palatable values can be used across use cases

Scalable

- Consumes new data feeds and data elements
- Easy to add new characteristic computation

Multiple Data Sources

- Supports retail, credit card, banking transaction data
- Supports click stream data

FICO™ proprietary Patent Pending Technology

Application # 14/102,374 (USA); Publication # US-2015-0161623-A1

Key Idea: Reuse Previous Computations

Temporal Behaviour Maps

03/01/15	Restaurant	$ 50.00
03/01/15	Movies	$ 20.00
10/01/15	Jewelry	$ 520.00
17/01/15	Clothes	$ 120.00
24/01/15	Flight Booking	$ 630.00
03/02/15	Car Repair	$ 250.00
27/02/15	Cash Withdrawal	$ 100.00
27/02/15	Car Rental	$ 250.00

- Step 1: Discretize time

Period

- Step 2: Store pre-computed summary of the transactions

3	$ 70
10	$ 520
17	$ 120
24	$ 630
34	$ 250
58	$ 350

Base-map

Aggregation step

Computing Characteristics Using Base-maps

$$Char = \frac{\$\ spent\ in\ last\ 30\ days}{\$\ spent\ in\ last\ 60\ days}$$

03/01/15	Restaurant	$ 50.00	3
03/01/15	Movies	$ 20.00	3
10/01/15	Jewelry	$ 520.00	10
17/01/15	Clothes	$ 120.00	17
24/01/15	Flight Booking	$ 630.00	24
03/02/15	Car Repair	$ 250.00	34
27/02/15	Cash Withdrawal	$ 100.00	58
27/02/15	Car Rental	$ 250.00	58

- Spend Base-map

  [3:$70, 10:$520, 17: $120, 24:$630, 34: $250, 58: $350]

On 03/01/2015

$$Char = \frac{\$\ spent\ from\ period\ 31\ to\ 60}{\$\ spent\ from\ period\ 1\ to\ 60}$$

$$= \frac{\$\ 250 + \$\ 350}{\$\ 70 + \$520 + \$\ 120 + \$630 + \$\ 250 + \$\ 350}$$

$$= 0.309$$

Defining Temporal Behavior Maps

Domain specific

01/03/15	Restaurant	$	50.00
01/03/15	Movies	$	20.00
01/10/15	Jewelry	$	520.00
01/17/15	Clothes	$	120.00
01/24/15	Flight Booking	$	630.00
02/03/15	Car Repair	$	250.00
02/27/15	Cash Withdrawal	$	100.00
02/27/15	Car Rental	$	250.00

A collection of base-maps

Price Base-map

[3:$70, 10:$520, 17: $120, 24:$630, 34: $250, 58: $250]

Cash Base-map

[58: $100]

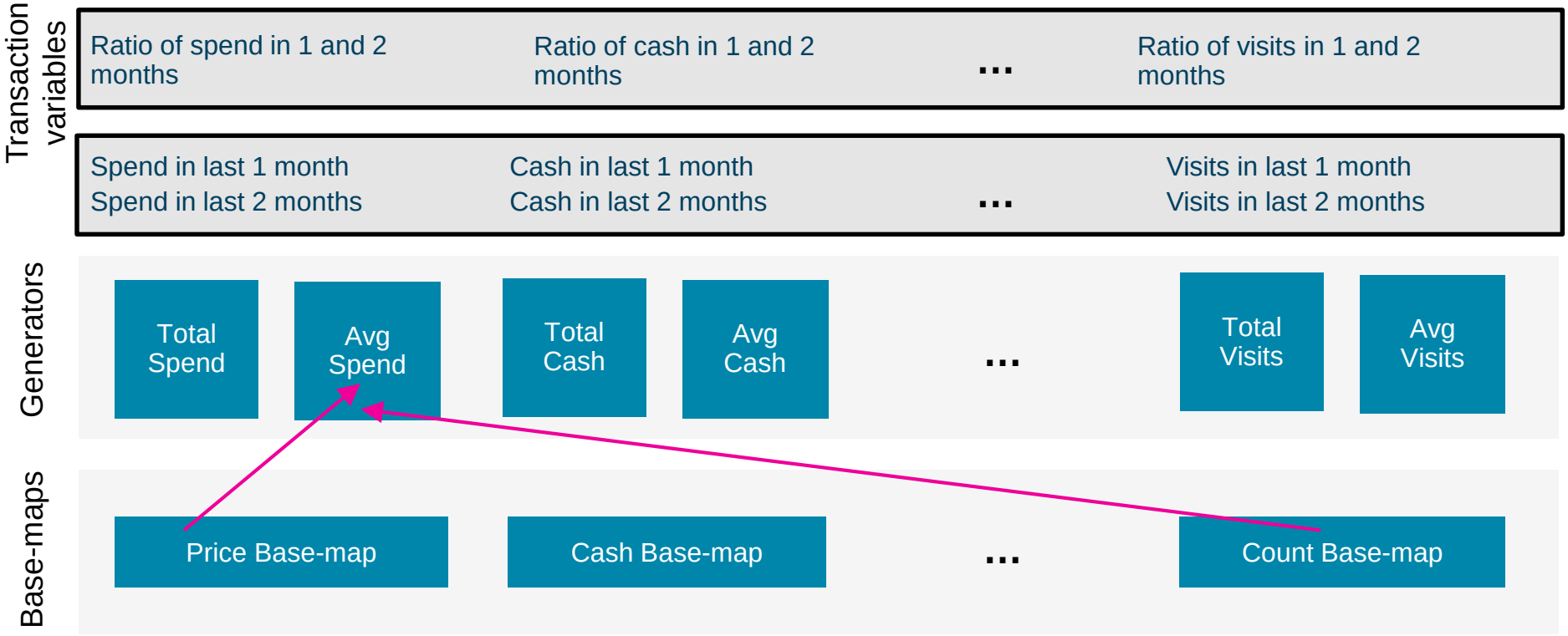
Count Base-map

[3:2, 10:1, 17: 1, 24:1, 34: 1, 58: 2]

“Aggregator” function creates and updates the base-maps

Modular Structure

A Schematic Representation



Accounting for New Transactions

Only need to use the new transactions

03/01/15	Restaurant	$ 50.00	3
03/01/15	Movies	$ 20.00	3
10/01/15	Jewelry	$ 520.00	10
17/01/15	Clothes	$ 120.00	17
24/01/15	Flight Booking	$ 630.00	24
03/02/15	Car Repair	$ 250.00	34
27/02/15	Cash Withdrawal	$ 100.00	58
27/02/15	Car Rental	$ 250.00	58

07/03/15	Hotel Expense	$ 780.00	66
07/03//15	Taxi	$ 40.00	66

- Retrieve Old Base-map
- Update the Base-map

3	$ 70
10	$ 520
17	$ 120
24	$ 630
34	$ 250
58	$ 350

3	$ 70
10	$ 520
17	$ 120
24	$ 630
34	$ 250
58	$ 350
66	$ 820

Aggregation step

Updating Characteristics

Accounting for new transactions

$$Char = \frac{\$\ spent\ in\ last\ 30\ days}{\$\ spent\ in\ last\ 60\ days}$$

01/03/15	Restaurant	$ 50.00
01/03/15	Movies	$ 20.00
01/10/15	Jewelry	$ 520.00
01/17/15	Clothes	$ 120.00
01/24/15	Flight Booking	$ 630.00
02/03/15	Car Repair	$ 250.00
02/27/15	Cash Withdrawal	$ 100.00
02/27/15	Car Rental	$ 250.00

07/03/15	Hotel Expense	$ 780.00
07/03/15	Taxi	$ 40.00

- Updated Spend Base-map

  [3:$70, 10:$520, 17: $120, 24:$630, 34: $250, 58: $350, 66:$820]

On 07/03/2015

$$Char = \frac{\$\ spent\ from\ period\ 37\ to\ 66}{\$\ spent\ from\ period\ 7\ to\ 66}$$

$$= \frac{\$\ 350 + \$\ 820}{\$520 + \$\ 120 + \$630 + \$\ 250 + \ \$\ 350 + \$\ 820}$$

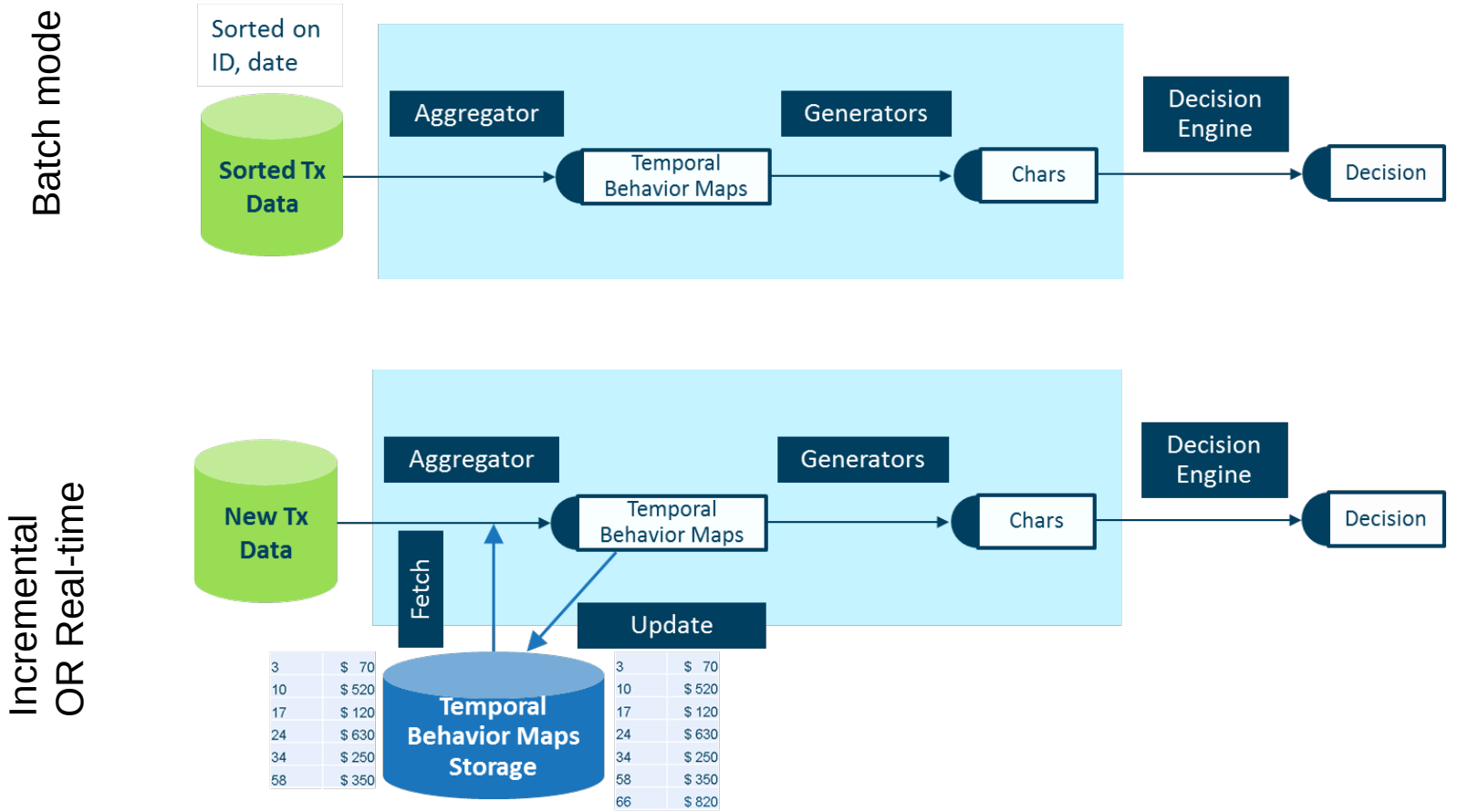
$$= 0.435$$

Deploying Transaction Analytics in Production Environment

By Using A Reusable Transaction Variable Library

Efficient	• Computationally cheap and low latency
Accurate	• Palatable values can be used across use cases
Scalable	• Consumes new data feeds and data elements • Easy to add new characteristic computation
Multiple Data Sources	• Supports retail, credit card, banking transaction data • Supports click stream data
Portable	• Use same library in modeling and production
Multiple modes	• Supports batch, incremental and real-time mode • Supports discovery mode

Working in Multiple Modes



Rolling up Multiple Cards to Account Level Through Fusion

Card #1, Account #1

01/03/15	Restaurant	$ 50.00	3
01/03/15	Taxi	$ 20.00	3
01/24/15	Flight Booking	$ 630.00	24
02/03/15	Car Repair	$ 250.00	34
02/07/15	Cash Withdrawal	$ 100.00	38
02/07/15	Car Rental	$ 250.00	38

Card #2, Account #1

01/10/15	Jewelry	$ 520.00	10
01/17/15	Clothes	$ 120.00	17
01/30/15	Restaurant	$ 150.00	30
01/30/15	Clothes	$ 175.00	30
02/07/15	Restaurant	$ 160.00	38
02/07/15	Movies	$ 40.00	38

- Spend Base-map (Card #1)
  [3:$70, 24:$630, 34: $250, 38: $350]
- Spend Base-map (Card #2)
  [10:$520, 17: $120, 30: $325, 38: $200]

Fusion (on-demand)

- Spend Base-map (Account #1)
  [3:$70, 10:$520, 17: $120, 24:$630, 30: $325, 34: $250 , 38: $550]

Housekeeping Functions For Base-maps

For Real-Time or Incremental Modes

Maturation	• Use historical Tx data to instantiate base-maps
Trimming	• Discard earliest irrelevant periods as base-maps grow with time
Append	• Introduce a new base-map in existing TBM store

Predicting Risk Using Behaviour and Transaction Data

	Build Predictive Model with Transaction Data	Deploy Model	Begin Usage for Decisions (Total time to value)
Traditional Transaction Approach	5 months	7 months	12 months
Temporal Behavior Maps	3 months	2 months	5 months

Benefits of Transaction Analytics

More information	• Provides greater insight into cardholder behaviour • Cardholder life stage, life events
Early detection of changes	• Score returned after every transaction • Take actions on accounts upon change in behaviour
Earlier life-cycle accuracy	• Fewer scoring exclusions • Sooner and more accurate
More accurate prediction	• Lift over traditional approaches • Better KS, divergence, recall and precision

Thank You

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