



Artificial Intelligence

Presented by:

Robin D. Hoag, CPA, CMC, CGMA

Practice Leader, Financial Institutions Group, Doeren Mayhew

MindBridge Analytics Inc.™

 **DoerenMayhew**
CPAs AND ADVISORS

Michigan ● Texas ● Florida ● North Carolina

Insight. Oversight. Foresight.™

“AI can enable humans to focus on parts of their role that add the most value”

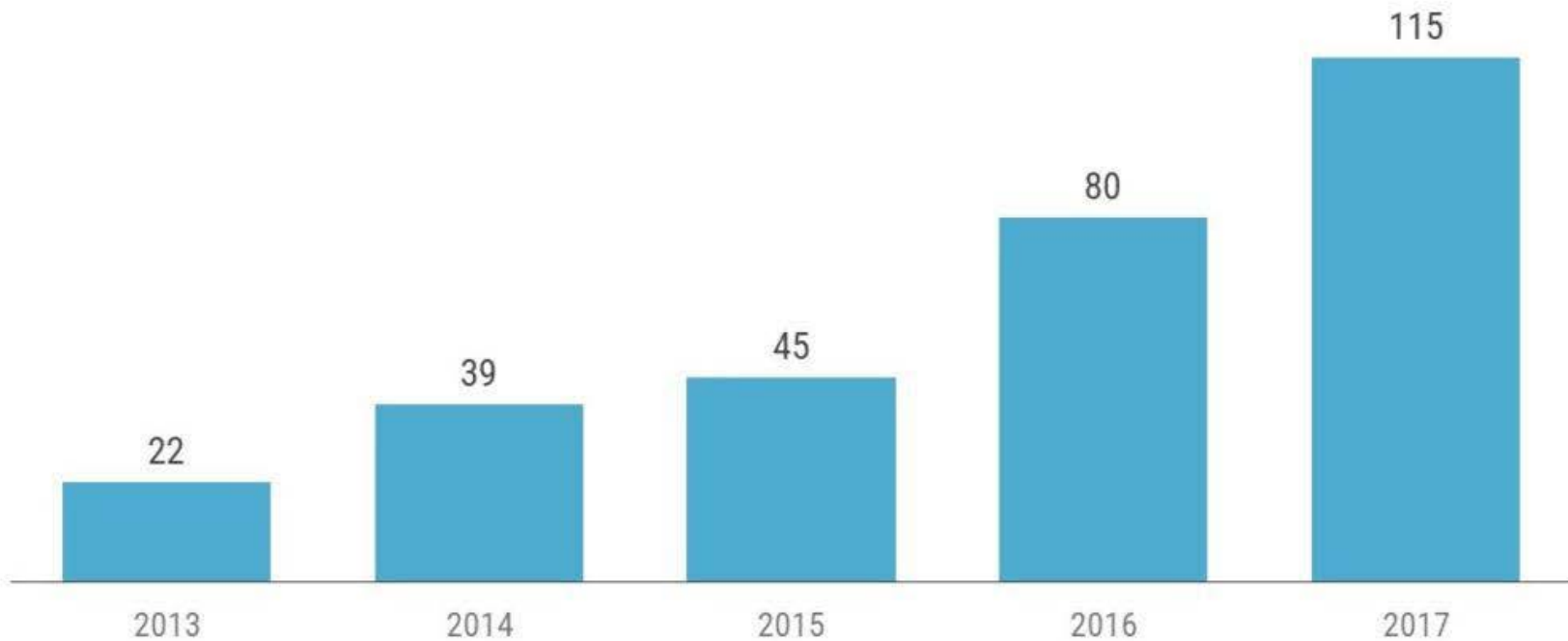


“The field of artificial intelligence is pushing new boundaries.”
Judy Woodruff

Artificial intelligence is a tool, not a threat.
Rodney Brooks

AI startup acquisitions up 44% in 2017

M&A by year (1st exits only)



Source: cbinsights.com

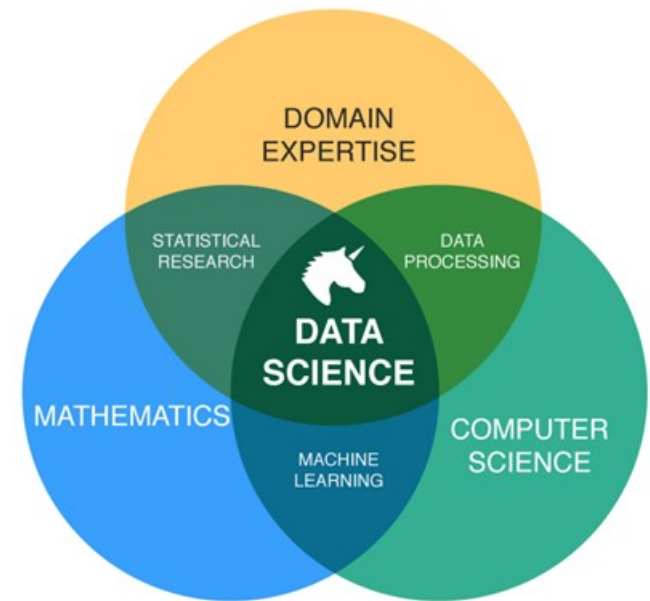
 CBINSIGHTS



Data science is in demand

3x as many job openings
as people to fill them...

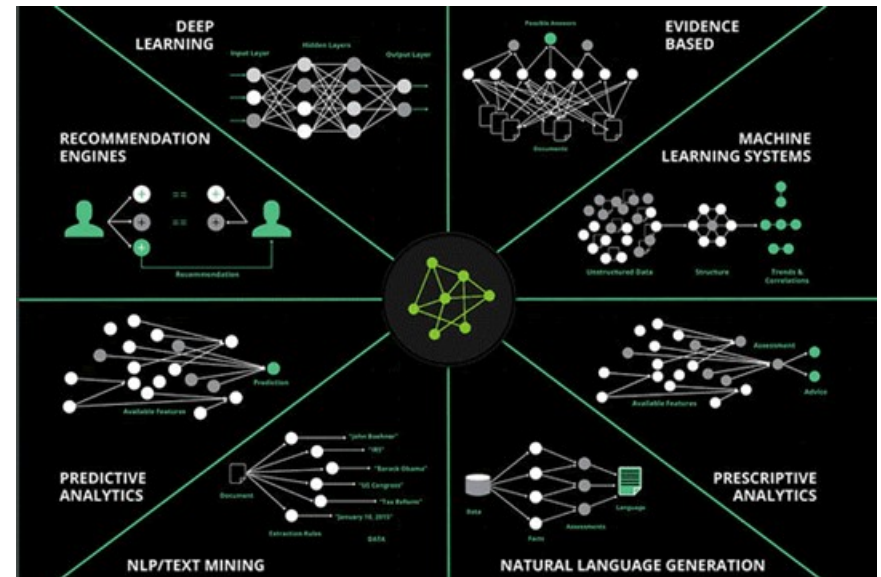
83% say they are struggling
to find Data Scientists



Human capital is in short supply...

<https://www.datanami.com/2016/03/25/tracking-data-science-talent-gap/>

- Value proposition to credit union
- Value to risk management process
- Control risk
- Inherent risk
- Substantive testing
- Integration of AI to Audit





- Distribution of year-end work load concentration
- Deliver forensic research tool that is extremely efficient
- Controls override identification
- Manage rising cost of services
- Transaction substantive testing
- Sampling expansion and coverage

Value to Audit Process

- Why credit unions would invest in Ai:
 - Control risk - minimization or elimination
 - Sampling: increase 1-5% population samples, extension to 100%
 - Thought leadership in credit union industry
 - Challenge audit professionals & recruiting
 - Innovation for teams to continue learning
 - Data science is the new frontier of risk monitoring
 - Audit failure risk reduction



- Help credit unions manage risk of fraud (detection) and erroneous financial reporting
- Services (new toolkit) specifically designed to detect anomalies
- Higher confidence level
 - Supervisory Committee
 - Internal audit
 - Board of Directors
 - Regulators
 - Financial Auditors



Audit Risk Implications

- Significant audit areas
 - Risk of material misstatement (RMM)
 - Control testing in larger complex credit unions
 - Inherent risk x Control risk = RMM
- Assertions in financial statements
 - **Existence or occurrence** (E/O)
 - **Completeness** (C)
 - **Rights & obligations** (R/O)
 - **Accuracy or classification** (A/CL)
 - **Valuation or allocation** (V)
 - **Cutoff** (CO)

Building a CU Competitive Advantage / Controlling Costs

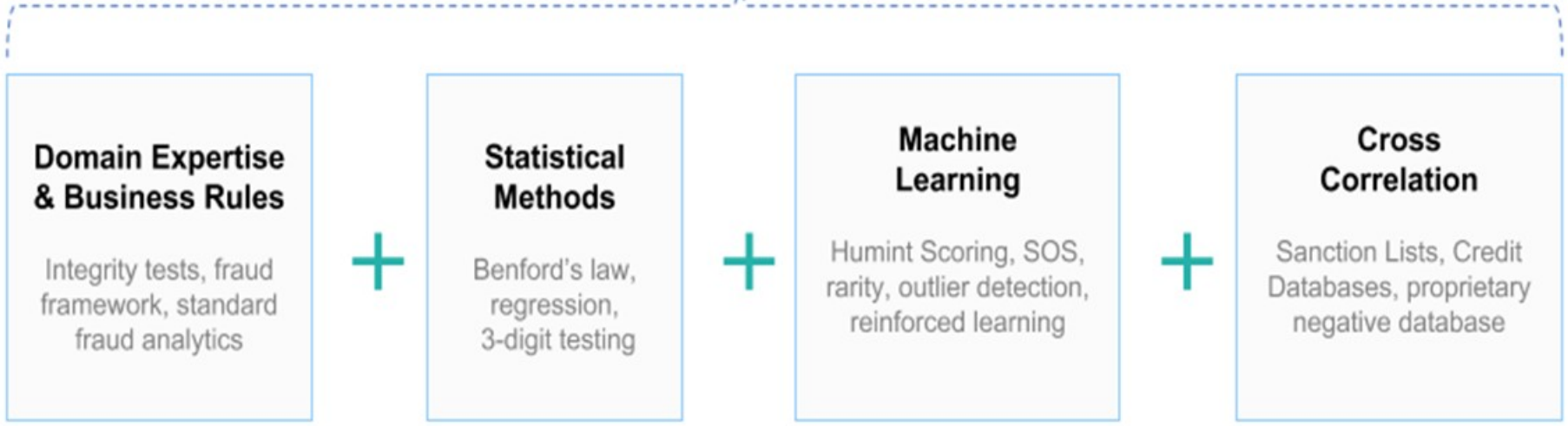


- Artificial Intelligence
 - Purpose-built platform for detecting anomalies on financial data with analysis on 100% of the dataset(s)
 - Leverages Machine Learning/AI, along with business rules & statistical methodologies
 - Enables audit professionals to move up the value chain & become or continue advisors
- Create leading AI applications



- Analyze financial anomalies by using the latest technology advancements in data science and machine learning artificial intelligence (AI).
- Enhance the auditor's capacity to ingest, process and analyze financial data empowering risk professionals with faster results and deeper insights to identify and perform an audit with a greater level of assurance.

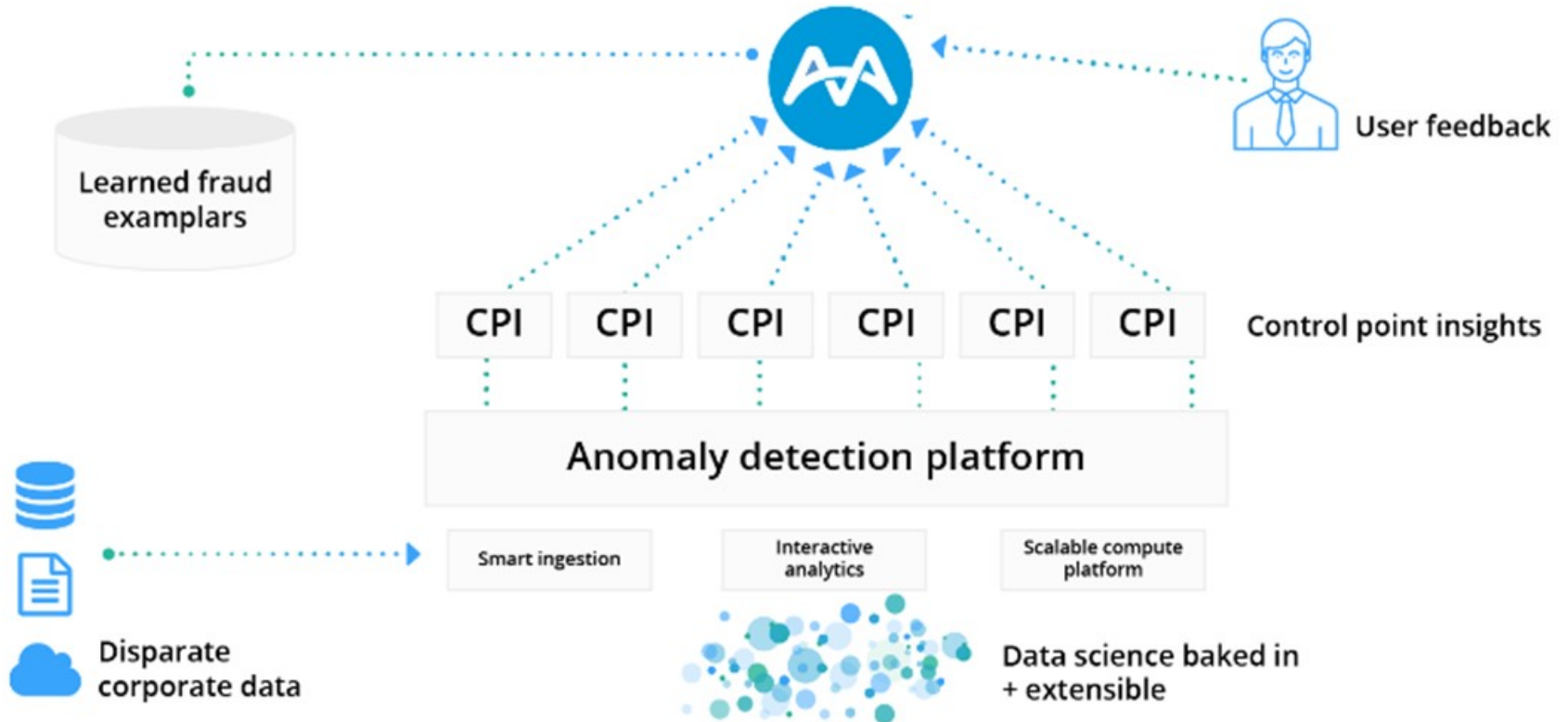
Uncovering Errors in Financial Data Using a Hybrid Approach



AI Solution Interated to Financial Audit



Ai Uses the Extensible Platform to Solve Targeted Problems





- Risk reduction
 - Every transaction is reviewed and scored, not just a sample
- Efficiency
 - Smart data ingestion significantly reduces time required to massage and input data
- Grow the scale of audit scope
 - Increase the capacity of an audit team to handle more due to efficiency enhancements



Delivers:

- Automated data ingestion
- Complete data analysis with AI
- Improved detection effectiveness
- High assurance



- Large credit union datasets: Evaluate for anomalies
 - Check sequences
 - Journal entries and reversals
 - Payroll modifications
 - Accounts payable and expenses
- Fraud and forensic projects
- Internal audit applications in credit unions
 - Loan file for originations (consumer, real estate, commercial)
- Financial audit loan originations

Objectives of AI within Credit Unions



- Learn and innovate to reduce audit risk
- New internal audit support services with AI tool
- Long-term cost control
- Assurance on population results
- Identify micro-patterns
- Increase audit efficiency in the internal audit
 - Identify internal control circumvention

Objectives of AI within Credit Unions

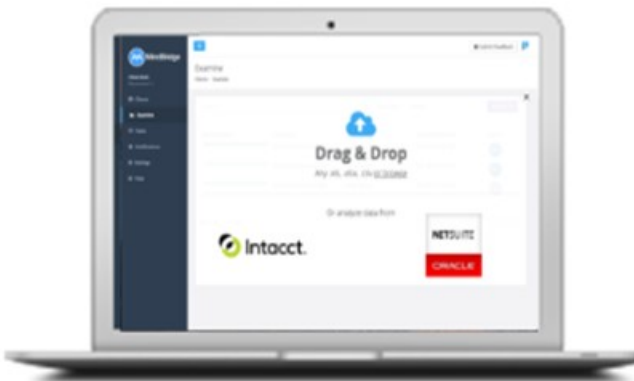


- Access to data engineers and expert data analysts
- Leverage software solutions through SaaS
- Increase reliability of audit results and conclusions
- Ferret out complex transaction schemes

Experience: \$500 million dollar complex Credit Union



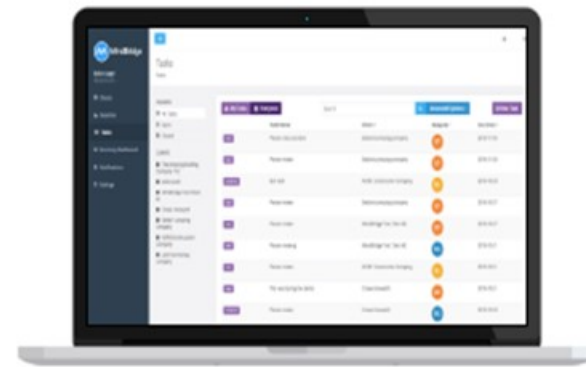
- General ledger transaction evaluation



Step 1: Load Data
- Automated ingestion



Step 2: Review results
- Risk score generated for ALL transactions



Step 3: Call to Action
- Reinforced learning

Control Point Indicators & Rationale



Weighting Rationale

- The weightings behind the transaction overall score were chosen based on a combination of user input and examination of results on real-world data sets.
- The two standard weightings for a control point are 5% and 10%.
- For most CPIs, we assessed a number of factors, such as importance to auditors, likelihood of false positives, and correlation between these CPIs and known misstatements, and assigned them either low or high weighting (5% or 10%, respectively).

Transaction Overall Score

- The transaction overall score control point aggregates all control point information for a transaction into a single score.
- Transactions with higher overall scores are more likely to be of interest during audit scenarios.
- The overall score is a weighted average of all active control point scores for a transaction.
- The following control points are used for calculating the overall score, along with their default weights.

Transaction Overall Score

Control Point	Default Weight
2-digit Benford	5%
Domain expert score	10%
Duplicate transaction	5%
High dollar value	10%
Last 3 digits	5%
Manual entry	10%
Material entry	--%
Rare monetary flows	10%
Reversal	5%
Reversed	5%

Control Point	Default Weight
Sequence gap	1%
Stochastic outlier selection anomaly score	5%
Suspicious keyword	5%
Transaction flow analysis score	--%
Unbalanced debits and credits	5%
Weekend entry	5%
Zero dollar entry	5%

- Last 3 digits
- Weekend post
- Duplicate transaction
- Zero-dollar entry
- Suspicious keyword
- Unbalanced debits and credits
- High dollar value
- Manual entry
- Material value
- Reversal
- Reversed
- Sequence gap



- Flags dollar values in the ledger which end in either 0.00 or 9.99.
 - These dollar values are more likely to be entered manually than other dollar values/



- Flags transactions entered into the ledger on a weekend.



Duplicate Transaction



- Flags transactions occurring more than once in a ledger.



- Flags journal entries whose credit and debit values are both \$0.

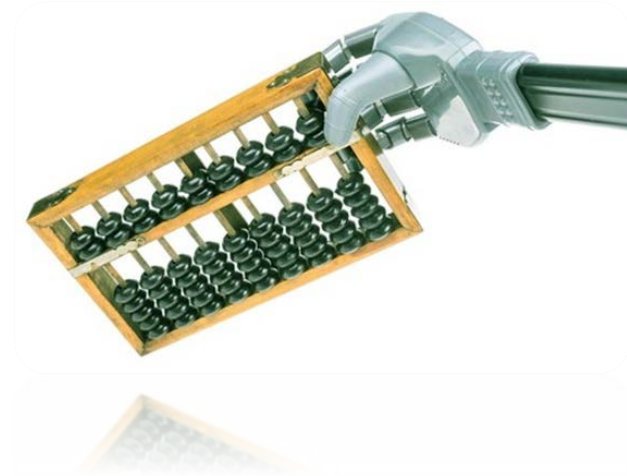




- Flags entries whose memo field contains keywords that are indicative of a ledger entry being outside normal business processes.
- This control searches for complete, exact word matches between a keyword list and words within the memo field of a ledger. By default, the following keywords cause a transaction to become flagged:

Accrual, adjust, adjusting, adjustment, alter, requested, audit, bonus, bury, cancel, capital, ceo, classif, confidential, corr, correction, coverup, director, ebit, err, error, estimate, fix, fraud, gift, incentive, kite, kiting, lease, leases, mis, mistake, per, plug, problem, reclass, rectify, reduce, remove, reverse, reversing, screen, switch, temporary, test, transfer

- Flags transactions containing debit or credit values that are in the top x% of all debit or credit values in the ledger.





- Flags transactions entered manually into the general ledger.
 - Ledger columns indicating manual transactions should be entered below.
 - If all entries were entered manually, this control point's weight can be safely set to zero.
- By default, this control point searches any column named source for the character strings aj, m, and gl.
 - Inclusion and exclusion terms, for this and other fields within the ledger, can be adjusted on a per-client basis.

- Flags transactions containing dollar values above the auditor's or credit unions material threshold.
 - The threshold must be provided on a per-credit union basis, and this control point must be activated manually in order for it to contribute to the overall scores of transactions.





- Flags transactions that are reversals of previously occurring entries in the ledger.
- For the purpose of this control point, a transaction is a reversal if all accounts debited in the transaction are credited by the same amount in another previous transaction, and all accounts credited in this transaction are debited by the same amount in the same previous transaction.
- When two reversing transactions appear on the same date, both are flagged as being potentially reversed by a reversal of the other transaction.



- Flags transactions reversed by future entries in the ledger.
- For the purpose of this control point, a transaction is reversed if all accounts debited in this transaction are credited by the same amount in a future transaction, and all accounts credited in this transaction are debited by the same amount in the future transaction.
- When two reversing transactions appear on the same date, both are flagged as being potentially reversed by a reversal of the other transaction.



- Flags transactions next to missing transaction IDs, based on the ledger's normal sequence of transaction IDs.
 - E.g., if journal entries J150 and J151 were deleted from a ledger, the journal entries J149 and J152 will be flagged as sequence gap indicators.
- This control point is turned on with a low weighting by default, as transactions that are next to sequence gaps may not be transactions of interest to auditors, but the existence of transaction sequence gaps is surfaced through these indicators.

Analytic and Machine Learning-Based Transaction-Level Control Points



- 2-Digit Benford
- Domain expert score
- Stochastic outlier selection anomaly score
- Rare monetary flows
- Transaction flow analysis score



2-Digit Benford

- The Benford Law of First Digits describes the number of times you would expect to see numbers starting with specific digits in a naturally-occurring set of dollar values.
- This control point flags entries whose first two digits occur more or less than expected in the ledger, which would be a sign of unnatural or tampered data.
- Entries having the same first two digits will all have the same score (%).
 - 0% means this and other entries with the same first two digits conform to Benford's Law (within a threshold).
 - Entries with the highest score (%) deviate the furthest from expected norm. These could imply that one or all of the entries have been tampered with.



- Identifies monetary flows between account categories identified by domain experts as being of importance to audits.
- The flows either involve high-importance account or are not a part of common business processes.

Stochastic Outlier Selection Anomaly Score



- Flags monetary flows which are mathematically anomalous, based on the accounts, date, and amount of the transaction.
- The anomaly control point score displayed for a transaction is the maximum anomaly control point score among all transaction flows within the transaction.



- Flags transactions where matching debits and credits occur between accounts that do not usually interact, based on the usual business processes within the ledger.



- Combines the three monetary flow scores: anomaly, rare monetary, and domain expert scores.
- Based on preliminary testing, a combination of these three scores is a strong indicator of transactions that are outside of normal business practices.





Risks Found (in \$ of total population)



High Entry Control Points

⊘ Cash expenditures This transaction contains 3 credits to cash or cash-equivalent accounts	High Complex structure Transaction complexity is high and transaction should be examined	⊘ High monetary value This transaction contains 4 entries above the top 2% of monetary values within the ledger	⊘ Last 3 digits This transaction contains 3 entries with value ending in 0.00 or 9.99
High Outlier anomaly Amounts within this transaction are unusual for this ledger, according to machine learning-based anomaly detection	⊘ Reversal This transaction appears to be a reversal of one or more transactions: 36582	⊘ Reversed This transaction appears to be reversed by one or more subsequent transactions: 36582	⊘ Suspicious keyword This transaction contains 2 entries that have suspicious keywords in the memo field: 'ADJUST'
⊘ Weekend post This transaction has 12 entries posted on a weekend	High Rare flows This transaction contains monetary flows which are unusual for this ledger	High Flow analysis Monetary flows for accounts in this transaction are unusual	High Unusual amount This transaction contains amounts which are unusual for the accounts in which they appear



High Entry Control Triggers (over total population)

# of Occurrences	Control Trigger
1,564	Empty text field
1,918	2 Digit Benford
2,344	High monetary value
2,815	Suspicious keyword
3,078	Outlier anomaly
3,159	Duplicate
3,872	Last 3 digits
5,415	Cash expenditures
7,048	Rare flows

Dashboard Examples: Credit Union



ARTIFICIAL INTELLIGENCE

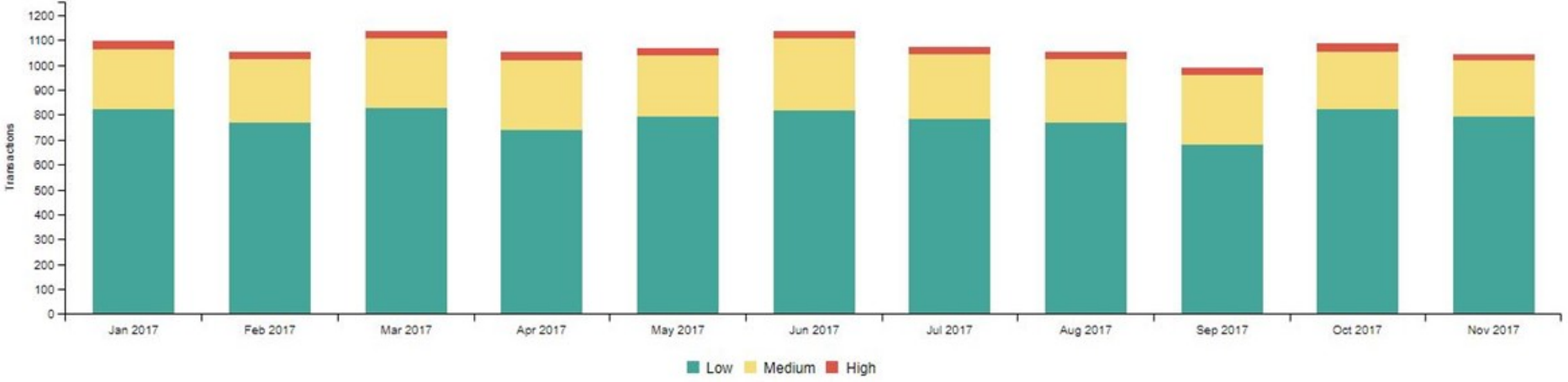
High Entry Example

☐ ^ 36585 59% Jun 17, 2017 \$1,081,122.22 12

Account ▶	Account Name	Posted Date ▶	Memo	Debit ▶	Credit ▶
1-745003000	ALLOYA HI YIELD: MAIN	Jun 17, 2017	ATM FUNDS SURCHARGE	\$0.00	\$190.25
4-136006000	FOREIGN CARDS @ CFCU ATMS: MAIN	Jun 17, 2017	ATM FUNDS SURCHARGE	\$190.25	\$0.00
1-745003000	ALLOYA HI YIELD: MAIN	Jun 17, 2017	ATM AUTOMATED FUNDS	\$693,128.27	\$0.00
1-729004000	ATM DEPOSIT ADJUSTMENT: MAIN	Jun 17, 2017	ATM DEP ADJUSTMENTS	\$0.00	\$1,000.00
1-729004000	ATM DEPOSIT ADJUSTMENT: MAIN	Jun 17, 2017	ATM DEP ADJUSTMENTS	\$0.00	\$120.00
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	CARDHOLDER INSTITUTION ACTIVITY	\$0.00	\$954,750.21
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	ATM WITHDRAWALS	\$323,180.00	\$0.00
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	ATM DEPOSITS	\$0.00	\$125,045.80
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	ATM HANDPOST	\$431.22	\$0.00
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	CARDHOLDER INSTITUTION ACTIVITY	\$64,165.48	\$0.00
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	POSTAGE	\$27.00	\$0.00
2-872003000	ATM/DEBIT SWITCH SETTLEMENT	Jun 17, 2017	ATM HANDPOST	\$0.00	\$15.96



Overview by Month





- Risk reduction
 - Every transaction is reviewed and scored; not just a sample of transactions
- Efficiency
 - Smart data ingestion significantly reduces time required to massage and input data
- Grow the scale
 - Increase the capacity of audit team to handle more audit due to efficiency enhancements



Moderate Entry Example

Transaction #	Overall Risk	Posted Date	Monetary Value	# of Entries	Status
71570	43%	Jan 31, 2017	\$20,000.00	2	Mark as normal Follow Up
Account ▶	Account Name	Posted Date ▶	Memo	Debit ▶	Credit ▶
50100	Direct Materials Expense	Jan 31, 2017	#15-022 Back Charge	-	\$20,000.00
10102	Cash-Checking-BnkofAmerica	Jan 31, 2017	#15-022 Back Charge	\$20,000.00	-

Showing 2 entries out of 2



- **Modules include:**

- General ledger
- Expenses
- Account payable
- Loans receivable
- Hours saved, risk reduced, cost controlled long term
- Expanded scope

Thank you



Robin D. Hoag, CPA, CGMA, CMC
Practice Leader, Financial Institutions Group
Office: (248) 244-3242
Email: hoag@doeren.com

