

2017 INTERNAL AUDIT  
WEBINAR SERIES

# HARNESSING THE POWER OF DATA ANALYTICS AND CONTINUOUS MONITORING

SEPTEMBER 26, 2017

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Kirstie Tiernan, CFE, OCA | Managing Director, Forensic Technology Services



# CPE AND SUPPORT

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- ▶ You'll need to actively participate throughout the program.
- ▶ Be responsive to at least 75% of the participation pop-ups.
- ▶ Please refer the CPE & Support Handout in the [Handouts](#) section for more information about group participation and CPE certificates.

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*\*Please note that questions and answers submitted/provided via the Q&A feature are visible to all participants as well as the presenters.*

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# SHANA MCGEE, CIA

## MANAGER | RISK ADVISORY SERVICES



### PROFESSIONAL AFFILIATIONS

Institute of Internal Auditors, Houston Chapter  
ISACA, Houston Chapter

### EDUCATION

B.B.A., Business Administration, LeTourneau  
University

Shana McGee is a Manager in BDO Advisory's Houston office with more than 10 years of audit and consulting experience, with four of those years working for a Big 4 firm. Shana is a Certified Internal Auditor with a focus in internal audit, Sarbanes-Oxley compliance, ITGC reviews, and contract compliance.

Shana uses her data mining skills and software to analyze client system data and identify compliance issues, process inefficiencies and cost recoveries. Her clients span a variety of industries where she utilizes a series of computer-assisted auditing tests that examines client's vendor master, accounts payable, payroll, general ledger, etc. for the potential of fraud, noncompliance of company policies, inefficient business processes, and excessive company costs. She has assisted clients in determining continuous monitoring solutions which best fits their needs.

# KIRSTIE TIERNAN, CFE, OCA

## MANAGING DIRECTOR | FORENSIC TECHNOLOGY SERVICES



### PROFESSIONAL AFFILIATIONS

Association of Certified Fraud Examiners

### EDUCATION

M.B.A, Fraud Management and Economic Crime, Utica College

B.S., Computer Information Systems, Indiana University

Kirstie Tiernan is a Director in BDO Consulting's Chicago office with more than 14 years of experience providing data analytics, technology consulting, and risk management services. A Certified Fraud Examiner and an Oracle Certified Associate, Kirstie assists clients with utilizing data across the organization from multiple sources, locations, systems, languages, and functions.

Kirstie is experienced in managing big data analytics projects requiring the collection of entire ERP systems with experience in many accounting systems, including PeopleSoft, SAP and Oracle. Managing a team of database and data analytics experts, she provides clients with the necessary dashboards, statistical models, and predictive analytics to turn data into information upon which key business decisions are made. Applying her expertise in artificial intelligence and machine learning, Kirstie regularly works with clients to prevent and detect organizational fraud.

Kirstie approaches projects with a focus on process efficiency, regularly implementing technological advancements within systems and databases in order to improve and accelerate time-consuming client processes. She also incorporates strategic data analytics initiatives to assist litigants, claimants, investigators and auditors with creating decisive and definite reports and conclusions.



# TODAY'S LEARNING OBJECTIVES

At the conclusion of this course, participants will be able to:

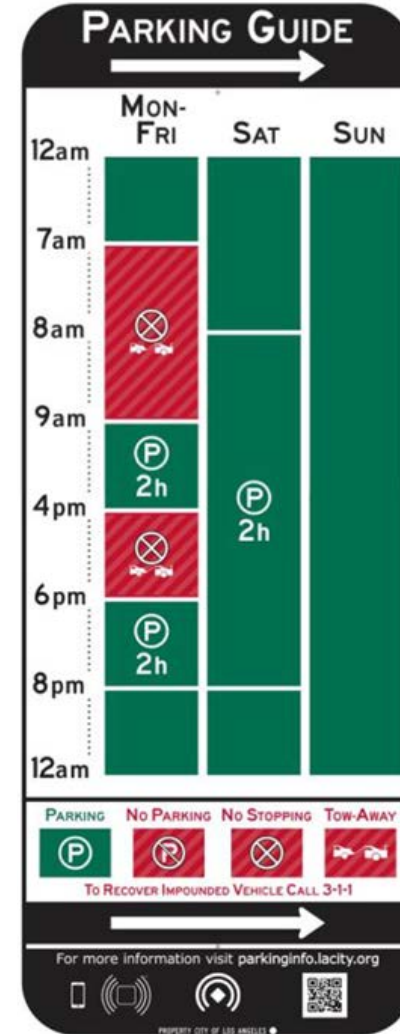
- ▶ Describe the process of continuous monitoring and use of data analytics;
- ▶ Discuss the steps to identify and plan continuous monitoring projects; and
- ▶ Describe the benefits of data analytics and continuous monitoring.

# TODAY WE WILL EXPLORE...

- ▶ Data Analytics and What It Can Do for Your Company
- ▶ How Data Analytics and Internal Audit Connect
- ▶ Challenges and Roadblocks
- ▶ How to Create Value through Data Analytics and Understand Where Your Company Is
- ▶ Sample Analytics and Use Cases for Internal Audit Processes
- ▶ How You Can Get Started Implementing Data Analytics into Your Internal Audit Department

# DATA ANALYTICS AND ITS USES

# REAL LIFE ANALYTICS





# WHAT IS DATA ANALYTICS?

- ▶ The process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making.
- ▶ Computer-assisted audit techniques (CAATs) which includes generalized audit software programs and specialized programs that test the processing logic and controls of other software and systems.

# WHAT IS CONTINUOUS MONITORING?

- ▶ Continuous Monitoring is the process and technology used to detect and monitor compliance and risk issues associated with an organization's financial and operational environment.
- ▶ Management is able to use summary information to monitor daily transaction volume or activity, and identify any exceptions or anomalies in a timely manner.
- ▶ The financial and operational environment consists of people, processes, and systems working together to support efficient and effective operations.

# INTERNAL AUDIT AND DATA ANALYTICS

- ▶ Using data analytics to strengthen risk assessments and the audit plan
- ▶ Leverage data analytics to strengthen individual audit engagements
- ▶ Data visualization to communicate audit results
- ▶ Continuous monitoring to identify problem areas in a timely manner

# CHALLENGES AND ROADBLOCKS

- ▶ Cost
- ▶ Knowledge and Resources
- ▶ Support and commitment
- ▶ Data availability and quality
- ▶ Completeness and accuracy
- ▶ Knowing/understanding exceptions, 'false positives'
- ▶ Measuring and reporting on success



POSTED ON LITTLEFUN.ORG

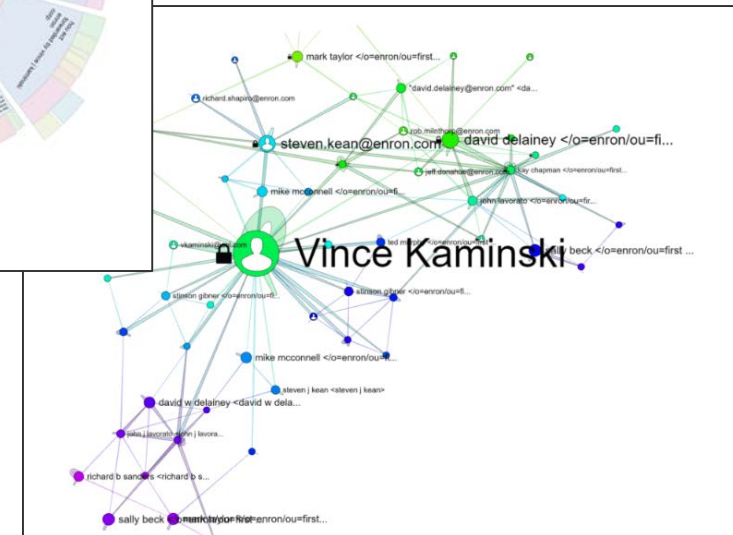
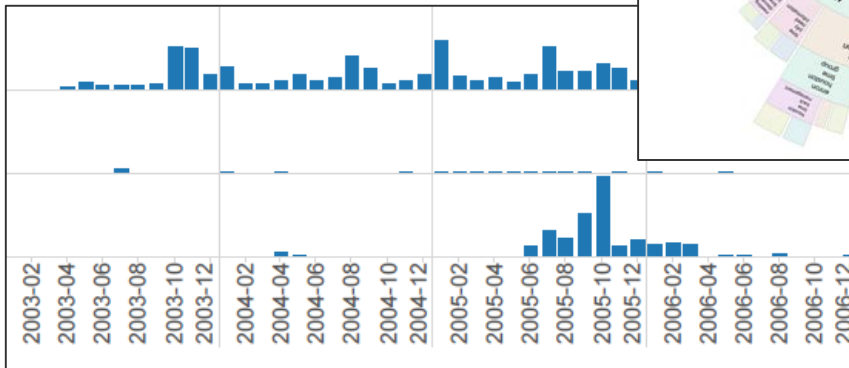
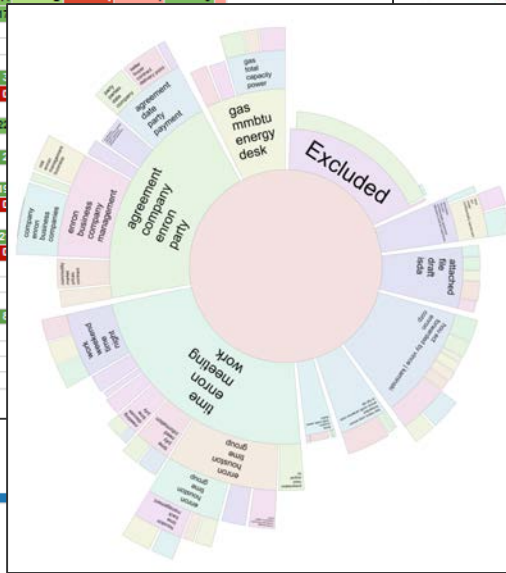
# CREATING VALUE THROUGH ANALYTICS

- ▶ Drive and gain efficiencies
- ▶ Drive internal audit coverage and focus
- ▶ Identify and test higher risk transactions

RISK ASSESSMENT MATRIX				
SEVERITY \ PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

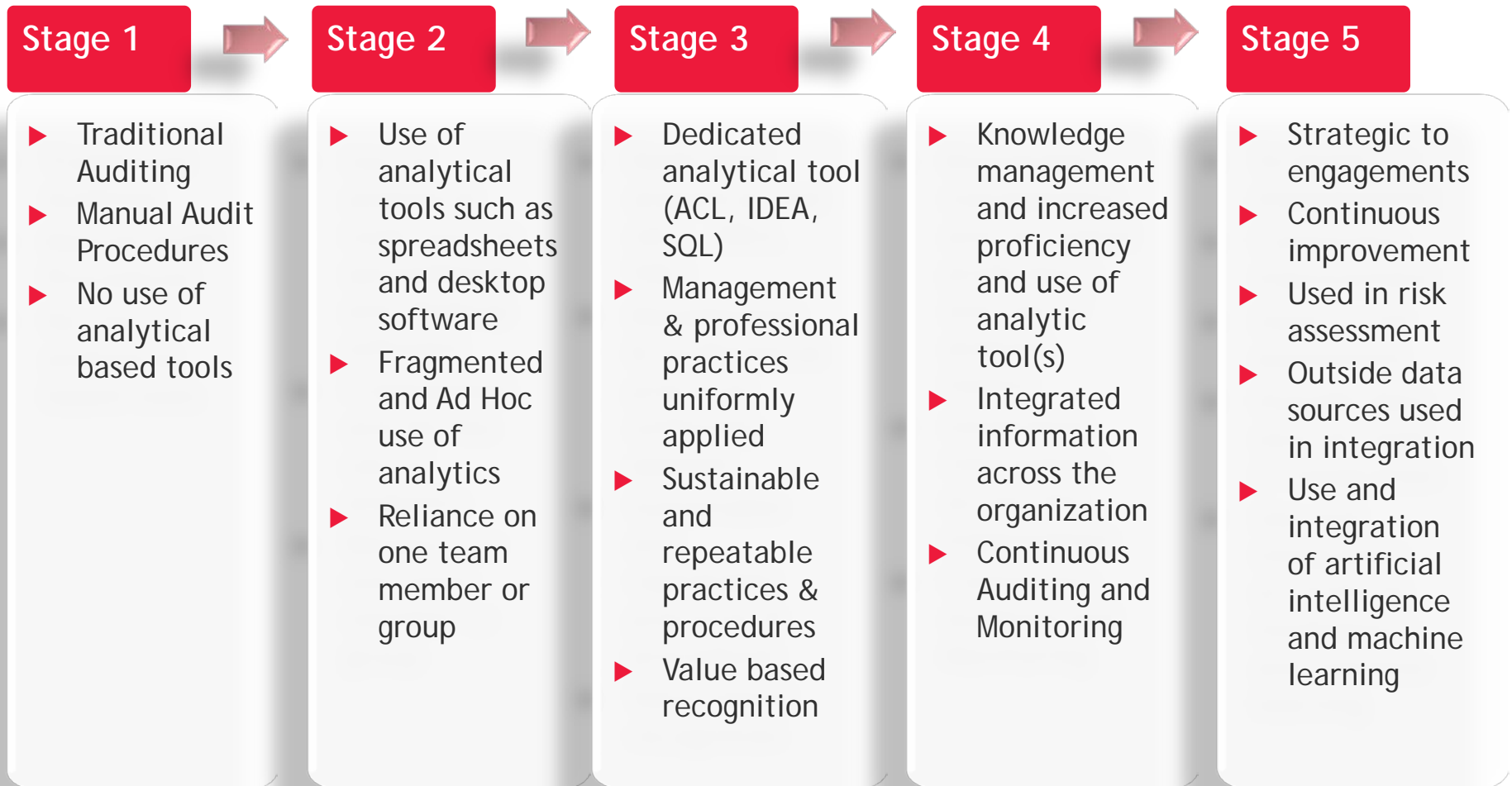
# CREATING VALUE... CONT'D.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6	Term 7	Term 8	Term 9	Term 10	Term 11	Term 12	Term 13	Term 14	Term 15	Term 16	Term 17	Term 18	
Term 1		1,187	1	498	88	144	370	992	48	54	0		36	98	2	1	163		
Term 2	1,187		1	268	70	124	339	437	33	35	0		33	116	1		154		
Term 3	1	1											0		0		0		
Term 4	498	268			76	116	122	132	35	40			30	8			27		
Term 5	88	70		76		65	58	78	28	36			11	2	1		7		
Term 6	144	124		116	65		78	106	29	21			23	4	2	1	19		
Term 7	370	339		122	58	78		263	29	21			33	61	1		125		
Term 8	992	437		132	78	106	263		36	34			22	56			109		
Term 9	48	33		35	28	29	29	36					11	2	1	1	6		
Term 10	54	38		40	36	21	21	34	22				11	2	1	1	6		
Term 11	0	0																	
Term 12																			
Term 13	36	33	0	30	11	23	33	22	11	17									
Term 14	98	116		8	2	4	61	56	2	3									
Term 15	2	1	0		1	2	1		1	1	0								
Term 16	1					1	1												
Term 17	163	154	0	27	7	19	125	109	6	19									
Term 18	11	3	0	2		2	2	2	1	1	0								
Term 19	82	73		9	2	2	38	34	4	6									
Term 20																			
Term 21	96	64		57	12	46	50	62	31	6									
Term 22	5	3	1	2	0	4	2	1	1	1	0								
Term 23	1					1	1												
Term 24	214	195		42	12	36	222	139	13	7									
Term 25	2	1		1	2	2	1	2	2	2	0								
Term 26	1	0				1	1												
Term 27																			
Term 28	0	1	0																
Term 29	25	17		19	11	19	11	18	12	6									
Term 30																			
Term 31																			
Term 32	0	0	0																
Term 33																			



# IDENTIFYING AND PLANNING

# WHERE ARE YOU?





# SAMPLE ANALYTICS

## GL

- Account flow matrix
- Account balance trend analysis
- Transaction reversals within 6 weeks
- User activity summary
- Most and least utilized accounts
- Duplicate journal entries

## Vendor

- One time vendors
- Blocked/deleted/do not use vendors
- Vendors without an address
- Vendors with similar names or addresses
- Vendors with non-standard payment terms
- Inactive vendors with activity in last year
- Keywords analysis of vendor name
- Duplicate vendor IDs

## Disbursement

- Payments created on weekends, holidays, or in off hours
- Round dollar payments
- Duplicate payments (same amount, payee, date)
- Keyword analysis on payment description
- Benford's Law on payment amounts
- Payments just below approval limit
- Summary of payments by users
- Payments to vendors not in vendor master

## Employee

- Vendor/employee similar name, address, phone or tax ID
- Payroll trend analysis by function
- Duplicate employees
- Employees without payroll deductions
- Employees with a PO box address

## Invoice

- Invoices created on weekends, holidays, or in off hours
- Round dollar invoices
- Keyword analysis on description
- Zero amount invoices
- System created invoices
- Invoices from vendors not in vendor master
- Invoices with no description



# INTERNAL AUDIT SCENARIO #1

## PAYROLL AUDIT

- ▶ As part of the annual payroll audit for a healthcare organization, internal audit reviewed payroll reports to ensure compliance with overtime policies and procedures; however, payroll reports were limited by department or group.
- ▶ Each department head reviewed their own payroll reports to ensure overtime hours were in line with company policy and sign off was obtained.

# INTERNAL AUDIT SCENARIO #1, CONT'D.

Traditional Audit	Audit Using Data Analytics/Continuous Monitoring
<ul style="list-style-type: none"><li>▶ Payroll reports reviewed by department heads for overtime compliance;</li><li>▶ Internal audit reviewed reports for reasonableness and verified reports were signed off by dept head;</li><li>▶ Internal audit tied a sample of employees from payroll report back to timesheet.</li></ul> <p><b>Results</b> No exceptions noted.</p>	<ul style="list-style-type: none"><li>▶ A download of payroll data obtained by IT department for a period of one year;</li><li>▶ Payroll data was tied to general ledger and totals from payroll reports reviewed by departments to ensure completeness and accuracy of data;</li><li>▶ Data imported into data analytic software and tested 100% of hours for all hourly employees across all departments.</li></ul> <p><b>Results</b></p> <ul style="list-style-type: none"><li>▶ Identified employees with excessive overtime per day spread across multiple departments during the period audited.</li><li>▶ Set up continuing monitoring of process by creating automated scripts to identify these exceptions on a timely basis.</li></ul>

# INTERNAL AUDIT SCENARIO #2

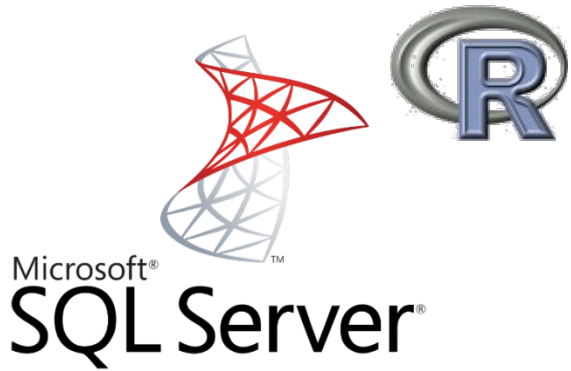
## PURCHASE TO PAYABLES AUDIT

- ▶ A manufacturing company is concerned that the company is not leveraging their buying power with suppliers to get the best price and utilizing volume discounts.
- ▶ The CFO has requested internal audit to review this process for high volume materials purchased within the past year during the purchase to payables audit.

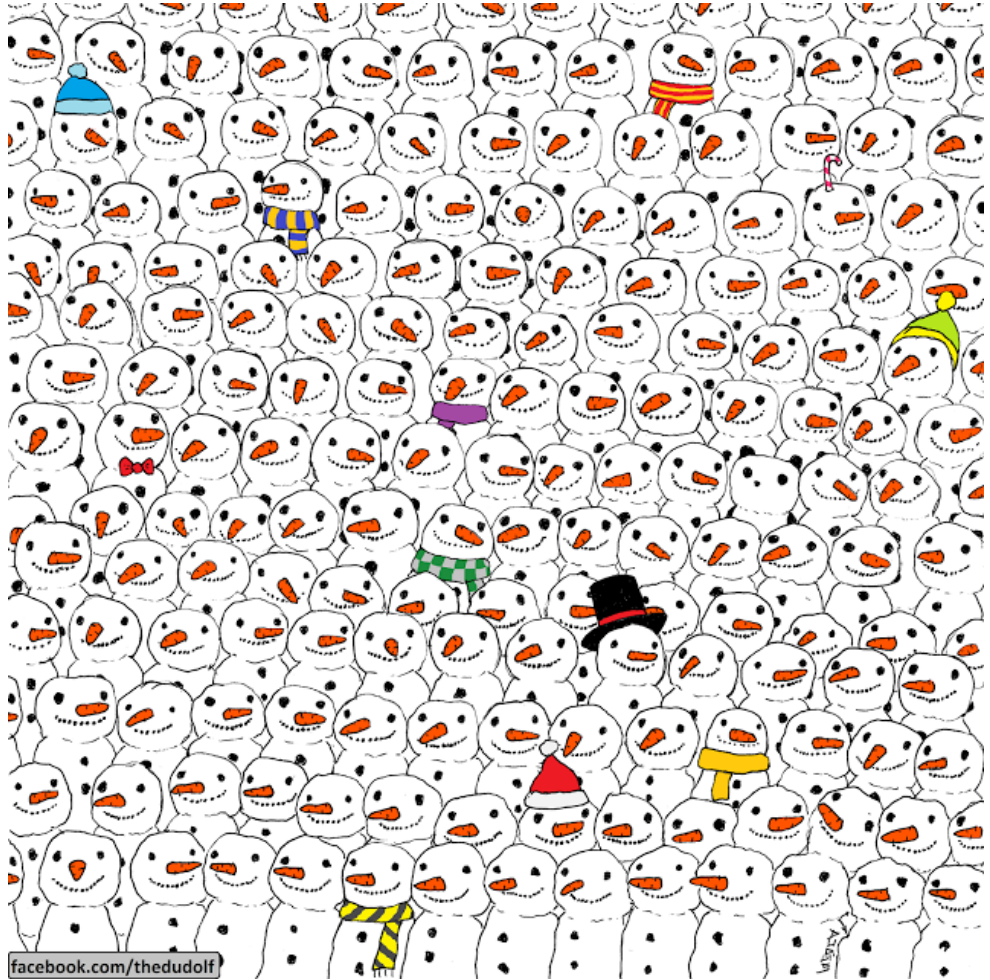
# INTERNAL AUDIT SCENARIO #2, CONT'D.

Traditional Audit	Audit Using Data Analytics/Continuous Monitoring
<ul style="list-style-type: none"><li>▶ Internal Audit interviews process owners to understand the procurement of materials, supplier selections and payment process.</li><li>▶ A sample of payments for high volume materials are reviewed to supporting documentation to test for approvals, three-way match, discounts taken, etc.</li></ul>	<ul style="list-style-type: none"><li>▶ Internal Audit obtained a download of accounts payable, purchase order, and vendor master detail to perform the following data analytics on 100% of population:<ul style="list-style-type: none"><li>• Vendor spend by material for the period or by month;</li><li>• Comparison of pricing for same materials but different suppliers;</li><li>• Vendor payments compared to vendor master payment terms</li></ul></li></ul>
<p><b>Results</b> Internal audit was able to test if discounts were taken and suppliers used; however, unable to determine if company is leveraging buying power from sample.</p>	<p><b>Results</b> Data analytic results assisted company in making informed decisions to leverage their buying power. Continuous monitoring was implemented by distributing daily/weekly summary reports to management so they can monitor process in a timely manner.</p>

# TOOLS

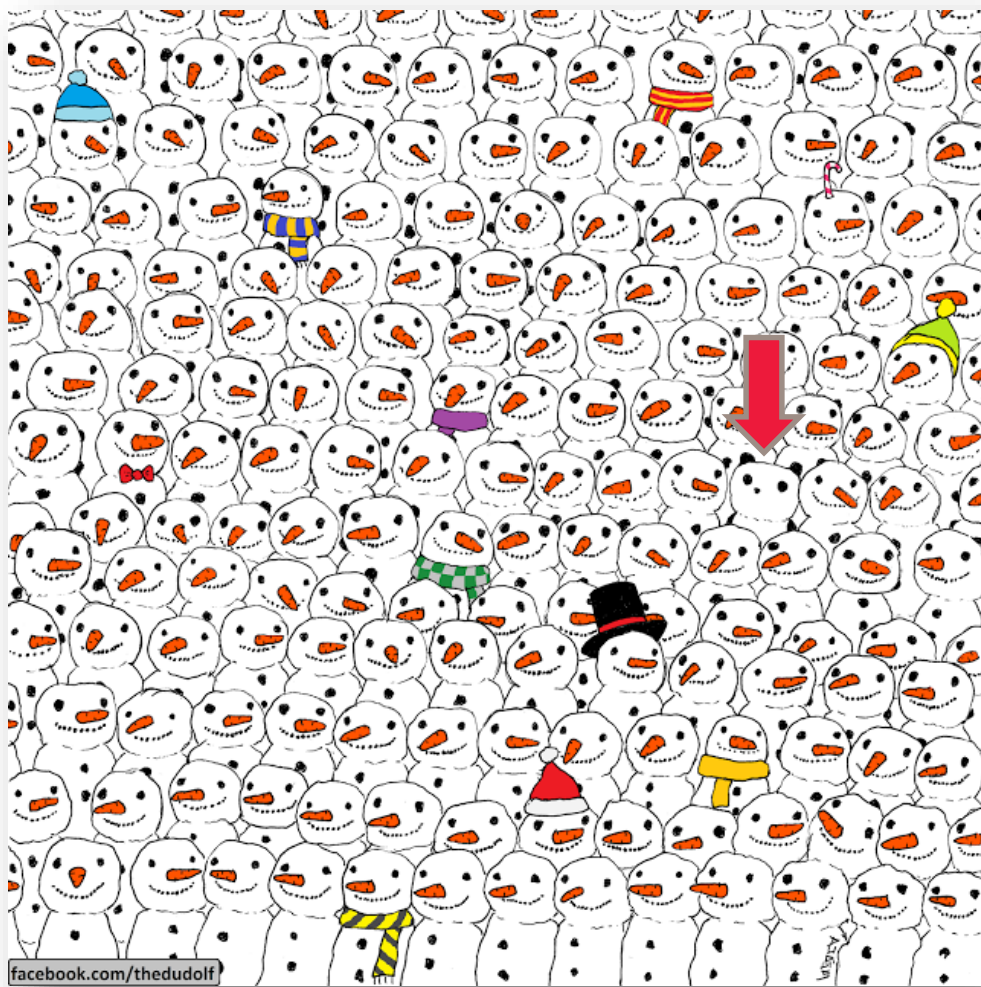


# SAMPLING VS ANALYTICS



facebook.com/thedudolf

# SAMPLING VS ANALYTICS





# SAMPLING VS ANALYTICS: RANDOM SAMPLING



Out of 176 objects, we randomly selected 10.

We had to run 31 instances of random sampling to get #84 to show up in our population.

# SAMPLING VS ANALYTICS: RULES BASED REVIEW



Expected Attributes

Select all objects...

- 1) with hats
- 2) with scarves
- 3) without eyes
- 4) without a nose

Similar to:

Round dollar

Weekend payments

Keywords

# SAMPLING VS ANALYTICS: 100% REVIEW



One targeted analytic on what we know:

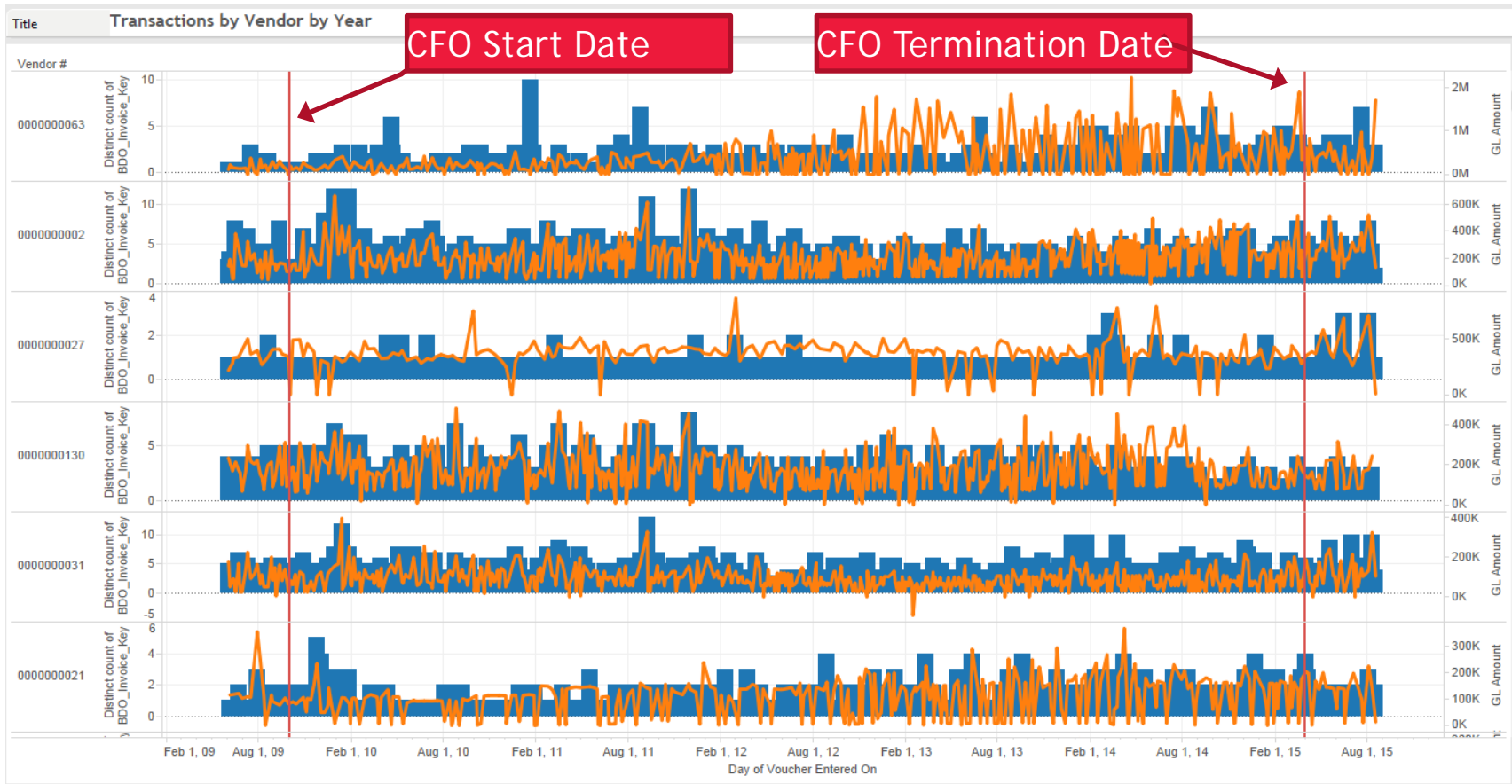
Select all objects *without*: eyes, a carrot nose, AND a mouth

# INVESTIGATION

6,000 Vendors Limited by:

- Location of interest
- Vendor spend over \$50,000

160 Vendors to Review

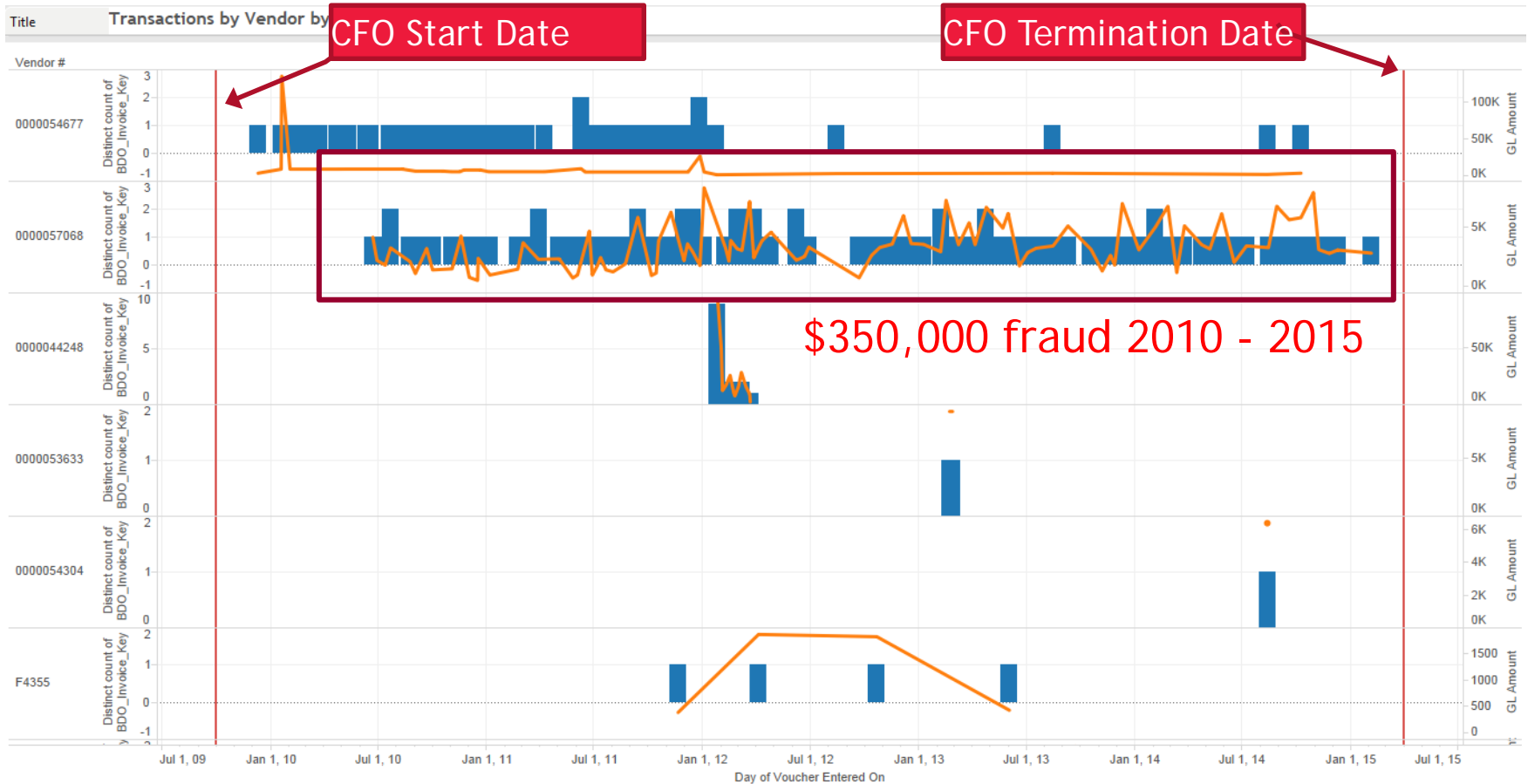


# INVESTIGATION

Limited by:

- Specific user time of employment
- Round dollar amounts

11 Vendors to Review



# INVESTIGATION

Order Taken By [REDACTED]

Customer Order # [REDACTED] Added per Mr. [REDACTED]

Job Name [REDACTED]

Job Location [REDACTED]

Job Phone [REDACTED]

Starting Date

QUANTITY	MATERIAL	PRICE	AMOUNT
1	[REDACTED]	\$1279.50	\$1279.50
10	[REDACTED]	\$ 79.80	\$ 798.00
1	[REDACTED]	\$1450.00	\$1450.00

DESCRIPTION OF WORK
As always we really appreciate your business!!!!

574009 - 1279.50 will supplies  
 574229 - 798.00 safety supplies  
 634006 - 1450.00 cleaning R411

OTHER CHARGES	AMOUNT
---------------	--------

**PAID**  
 APR 23 2014

[REDACTED]

TOTAL OTHER			
LABOR	HOURS	RATE	AMOUNT

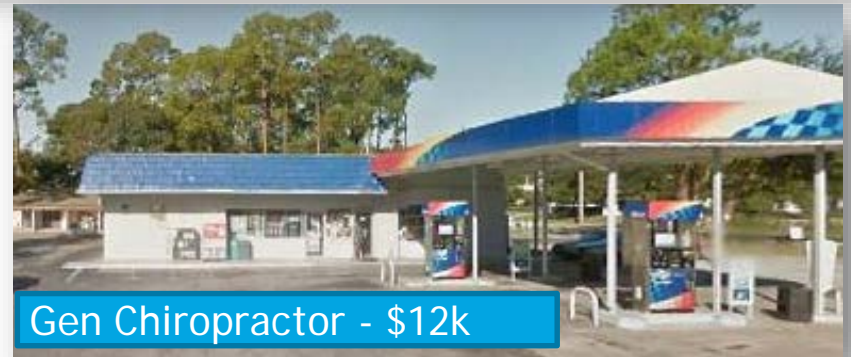
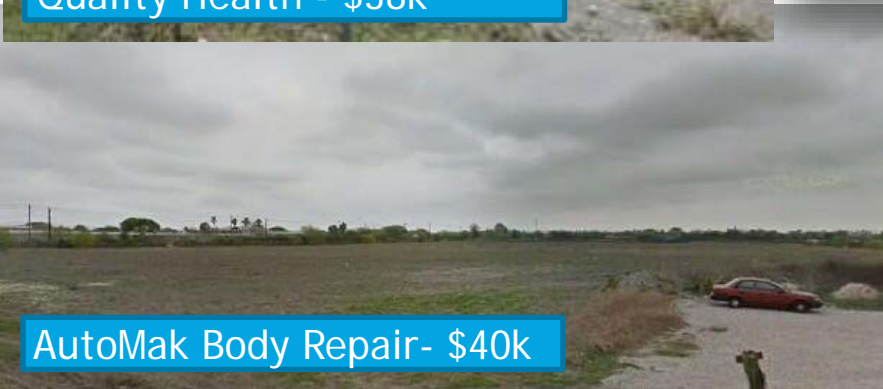
# VENDOR GEOGRAPHIC REVIEW



## Vendors of Interest

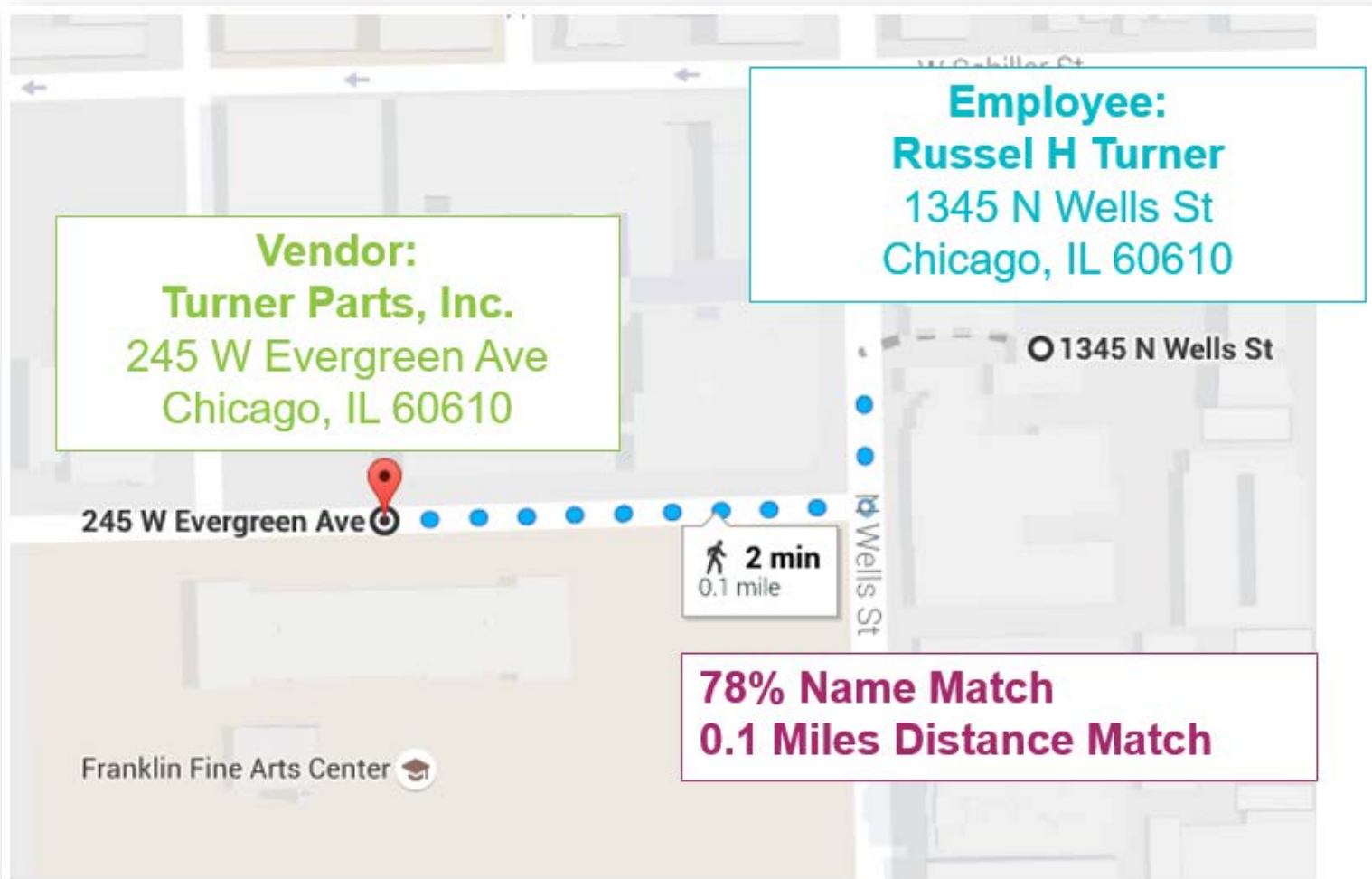
BDO ID (Sup..	City	State	Month of Eff Date						
			February 2015	March 2015	April 2015	May 2015	June 2015	July 2015	August 2015
40	Indianapolis	IN			235			235	
93	Jeanette	PA		7,950					
488	Columbus	IN						26,868	
1198	Mt. Laurel	NJ		50					
1277	Amherst	NY			8,402				
1316	Columbus	IN					39,933		
1413	Columbus	IN				1,123			
1510	Noblesville	IN	1,200	1,200	2,400	1,200	1,200	1,200	1,200

# VENDOR GEOGRAPHIC REVIEW

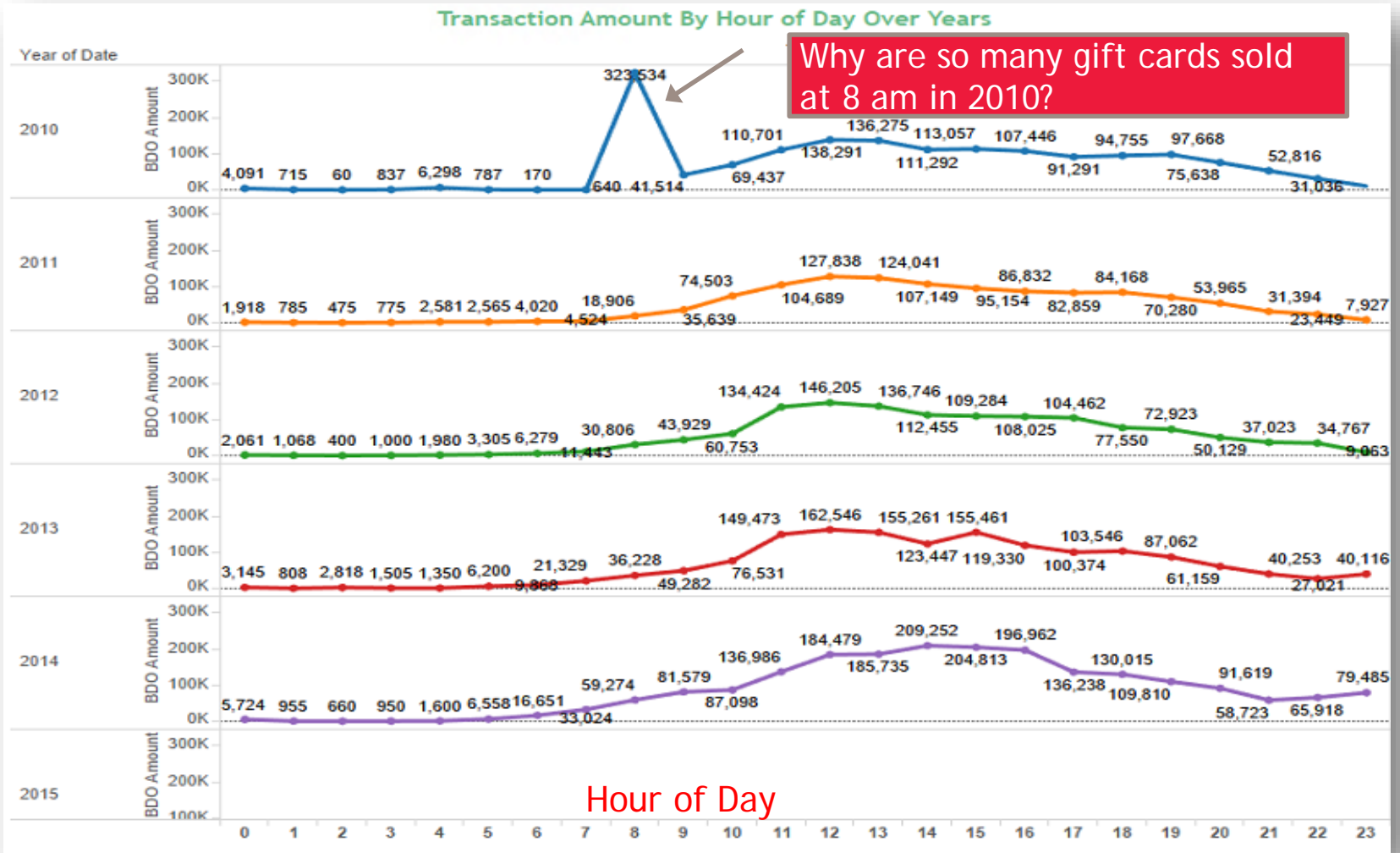




# RELATED PARTY DISTANCE ANALYSIS



# GIFT CARD ANALYSIS



Why are so many gift cards sold at 8 am in 2010?

# BENFORD'S LAW

Most common iPhone passcodes

People wounded by terrorism (1970-2013)

People killed by terrorism (1970-2013)

Distance of stars from Earth in light years

Loan amounts on kiva.org

Total number of print materials in US libraries

Population of Spanish cities

File sizes in the Linux 2.6.39.2 source tree

Population of Mexico's Counties (Municipios)

Stack Overflow User Reputation

Line count of the Rails 3.0.9 core source code

UK government spending May-Sept 2010

2011 Russian Parliamentary Elections Results: Votes for United Russia

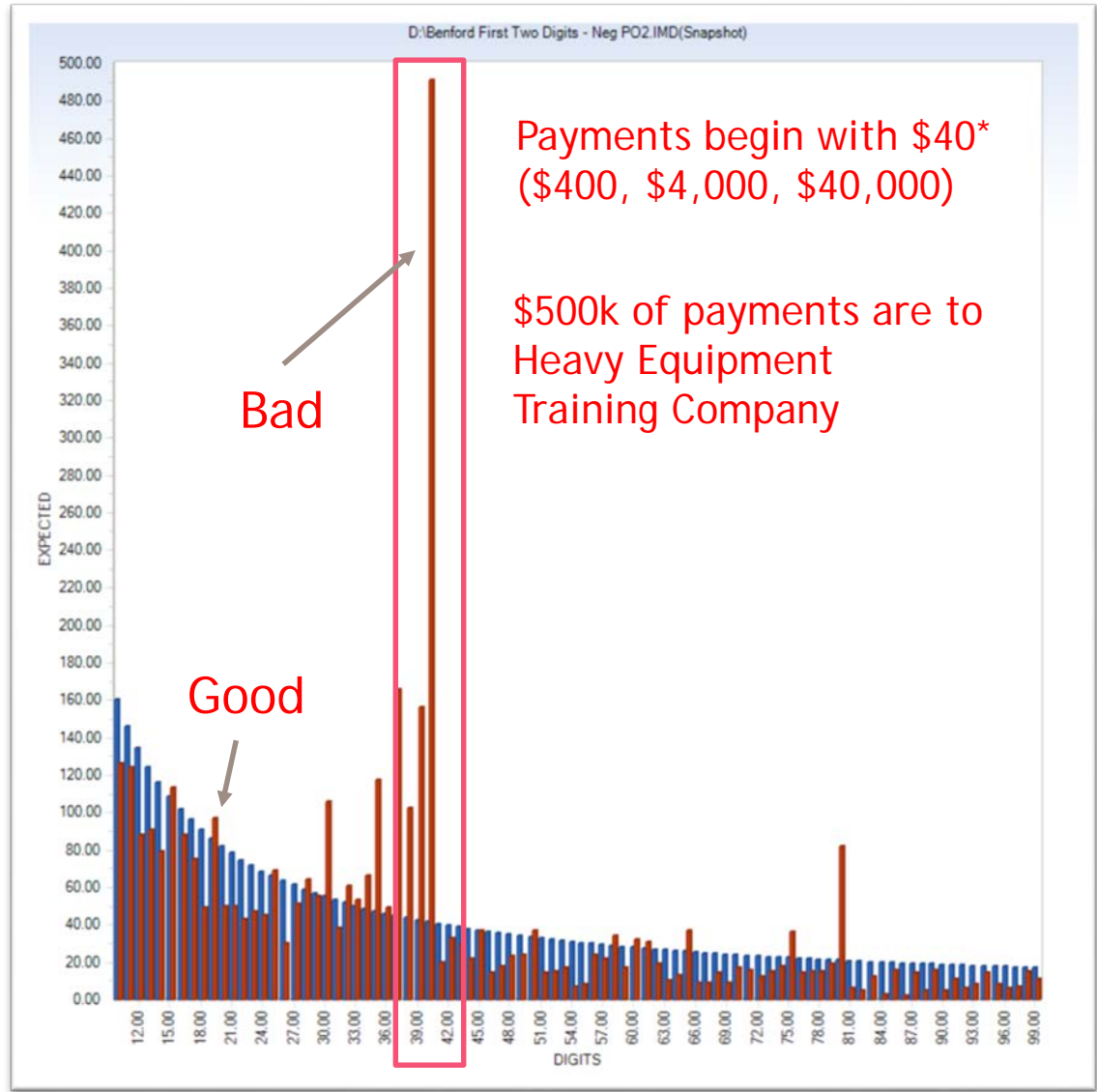
Population of Turkish boroughs

Google books unique 1-grams

2007 population per district in Peru. Source: INEI

First 652066 Fibonacci Numbers

# BENFORD'S LAW



# D.C. Job Training Funds Went To Firms In Legal Trouble

By: [Patrick Madden](#)

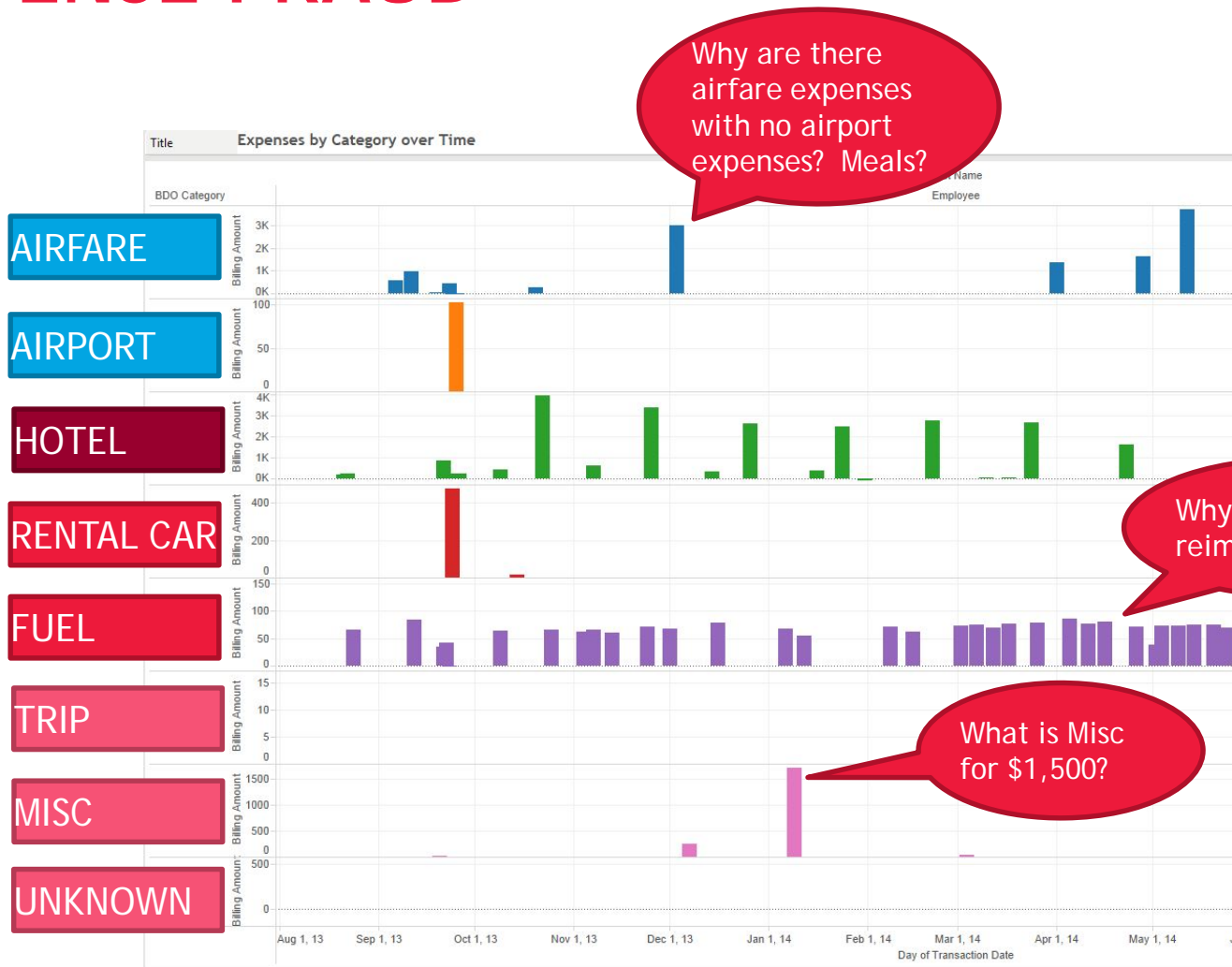
January 18, 2012

▶ PLAY

comments 1



# EXPENSE FRAUD



# ABC UNIVERSITY

## REVENUE TESTING (TUITION/FINANCIAL AID, MEALS, HOUSING, ETC.) LOOKING FOR FAKE STUDENTS

### Typical Audit Test:

Sample of 15 students, pull documents related to class registration, payments

### Using Data Analytics:

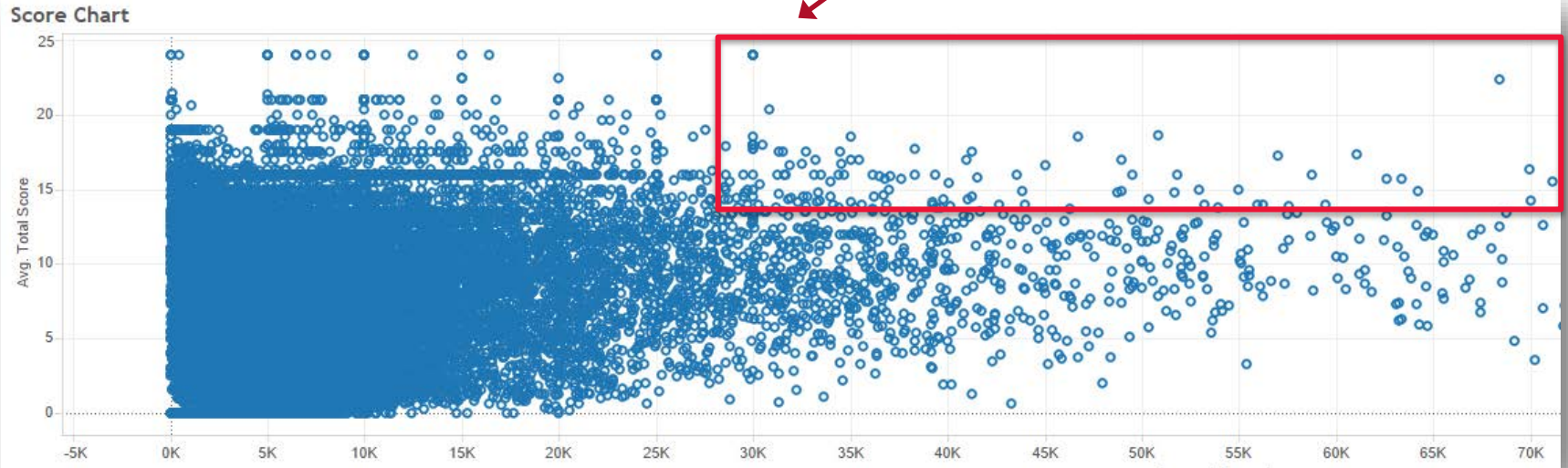
Students must use ID badge on campus (food, buildings, parking, etc.)

Students actually attending classes will not be expected to be getting all Ds/Fs

- ▶ Obtain badge security swipe data
- ▶ Obtain transcript data
- ▶ Run analysis to check for students with fewer than 10 swipes
- ▶ Run analysis to check for students with all Ds/Fs implying they aren't actually attending classes (will expect some false positives for deadbeat college kids)

# SCORING MODELS

High Score, High Amount



## Examples:

Round Dollar

Weekend Payments

Missing Address

Duplicate Payments

One-Time Vendors

Payment within 15 days of Invoice Issued Date



# ARTIFICIAL INTELLIGENCE

## The poker-playing AI is getting smarter and the humans are getting tired

*The bot likes to bluff, but has few tells*

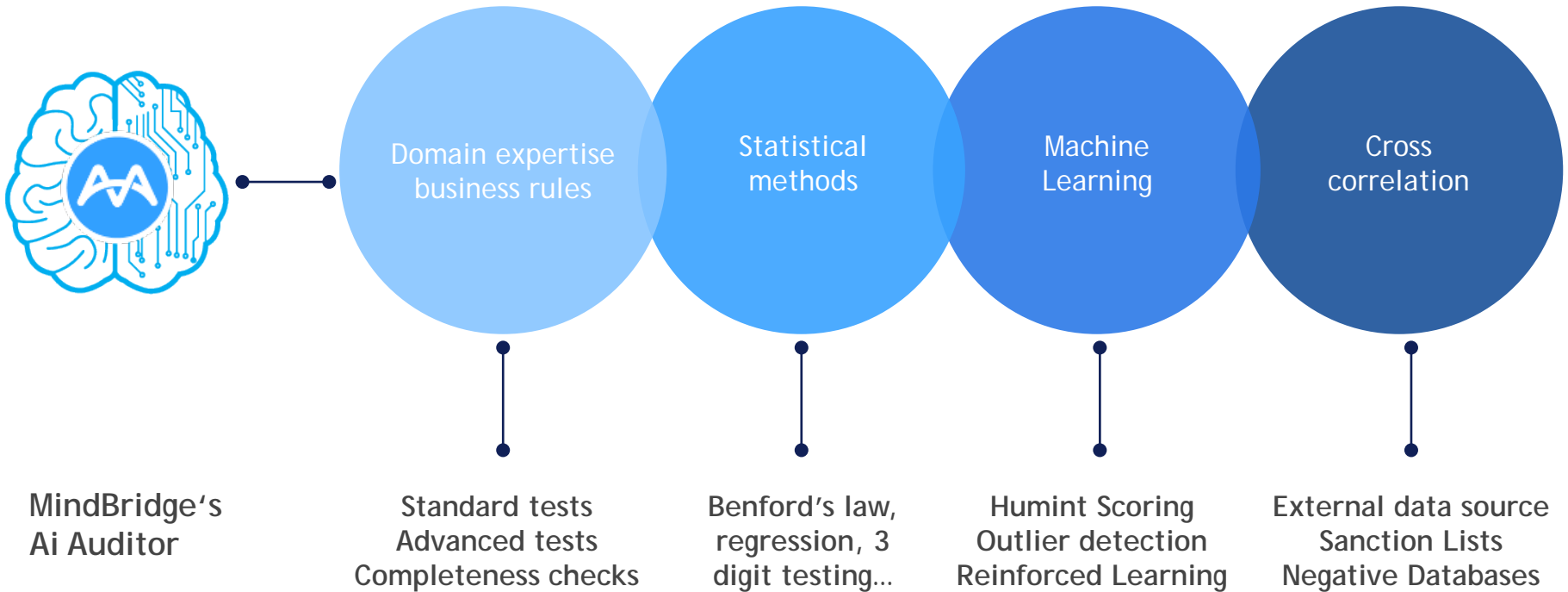
by Ben Popper | Jan 25, 2017, 12:50pm EST

“It’s not about the money, it’s about preserving human dignity, and it’s not going well.”

- 80,000 hands of poker (tournament was 20 days, 10 hours per day)
- Humans are losing by \$750k
- AI system has vulnerabilities but fixes them quickly
- Learned to bluff
- Spends nights improving strategy and decisions while lazy humans sleep

<https://www.theverge.com/2017/1/25/14358246/ai-poker-tournament-cmu-libratus-vs-human-losing>

# MINDBRIDGE AI AUDITOR



## Examine

Home / Clients / Stormac / Files - stormacgl\_2016.csv / Examine

**\$631K** High Risk

21 Transactions (1%)  
are considered high risk

**\$566K** Medium Risk

108 Transactions (2%)  
are considered medium risk

**\$2.6M** Low Risk

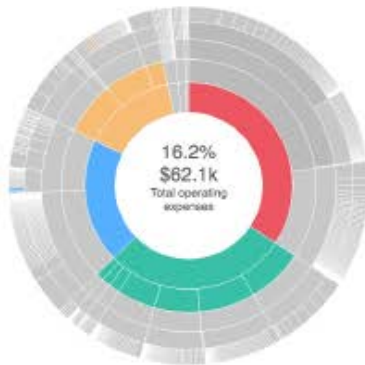
5,851 Transactions (97%)  
are considered low risk

Stormac

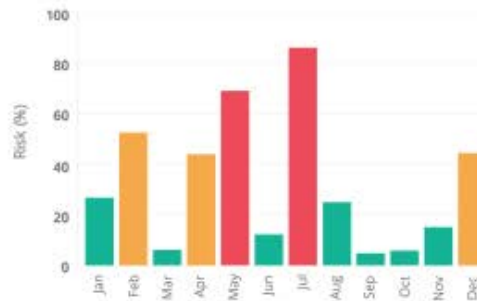
stormac\_gl\_2016.csv

01/01/2015 to 01/12/2016

Uploaded by: Chrissy Bridges



Average risk per month



Control Total

Debits	Credits
\$3,797,138.38	\$3,797,138.38

Spend per account



- 12000 - Accounts Receivable
- 15300 - Hardware
- 10600 - Regal Bank Current
- 23100 - GST Charged on Sales
- 21000 - Accounts Payable
- 50200 - Material: Hardware
- 54100 - Wages & Salaries
- 54950 - Subcontractors

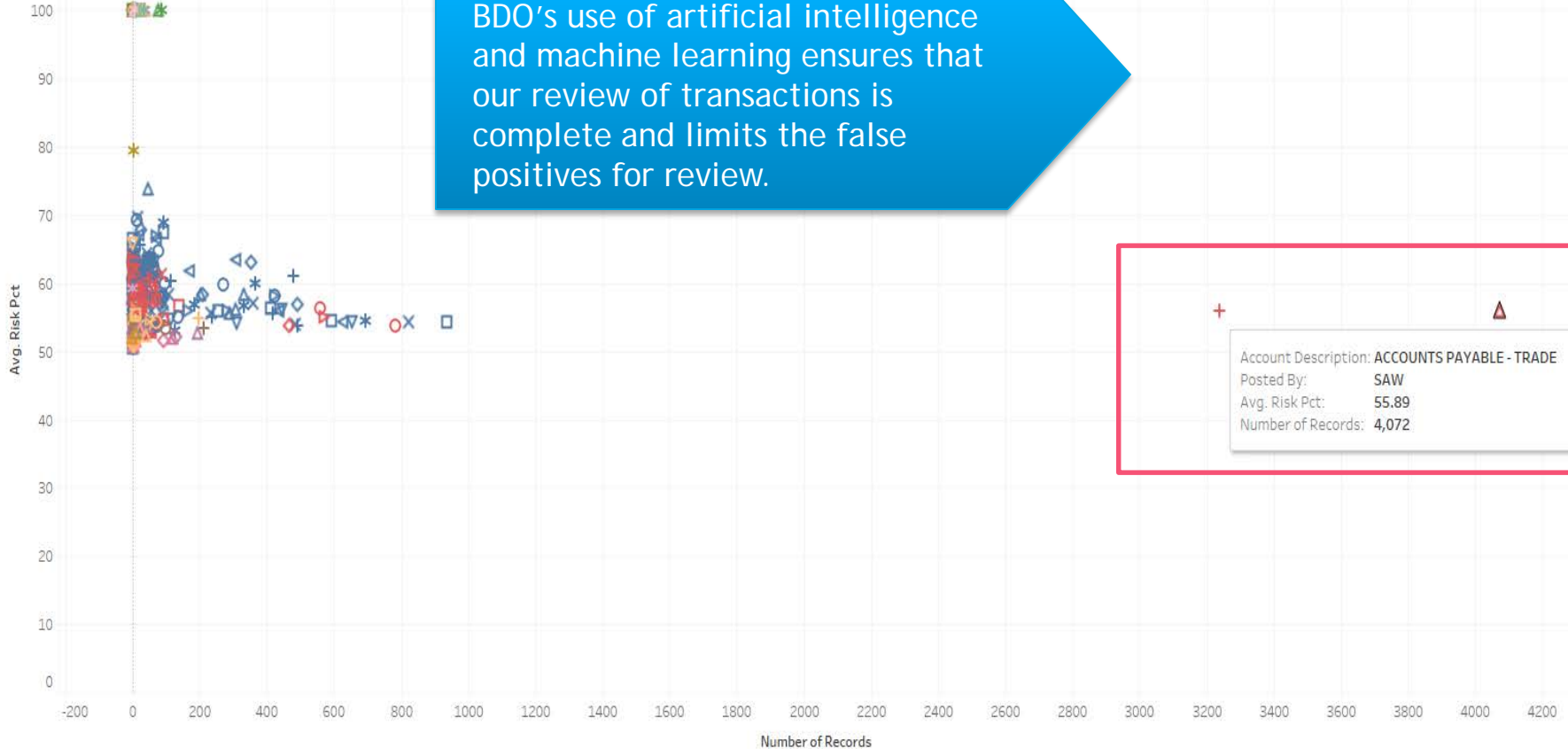
Latest Activity

Today at 4:03 PM  
• File uploaded.

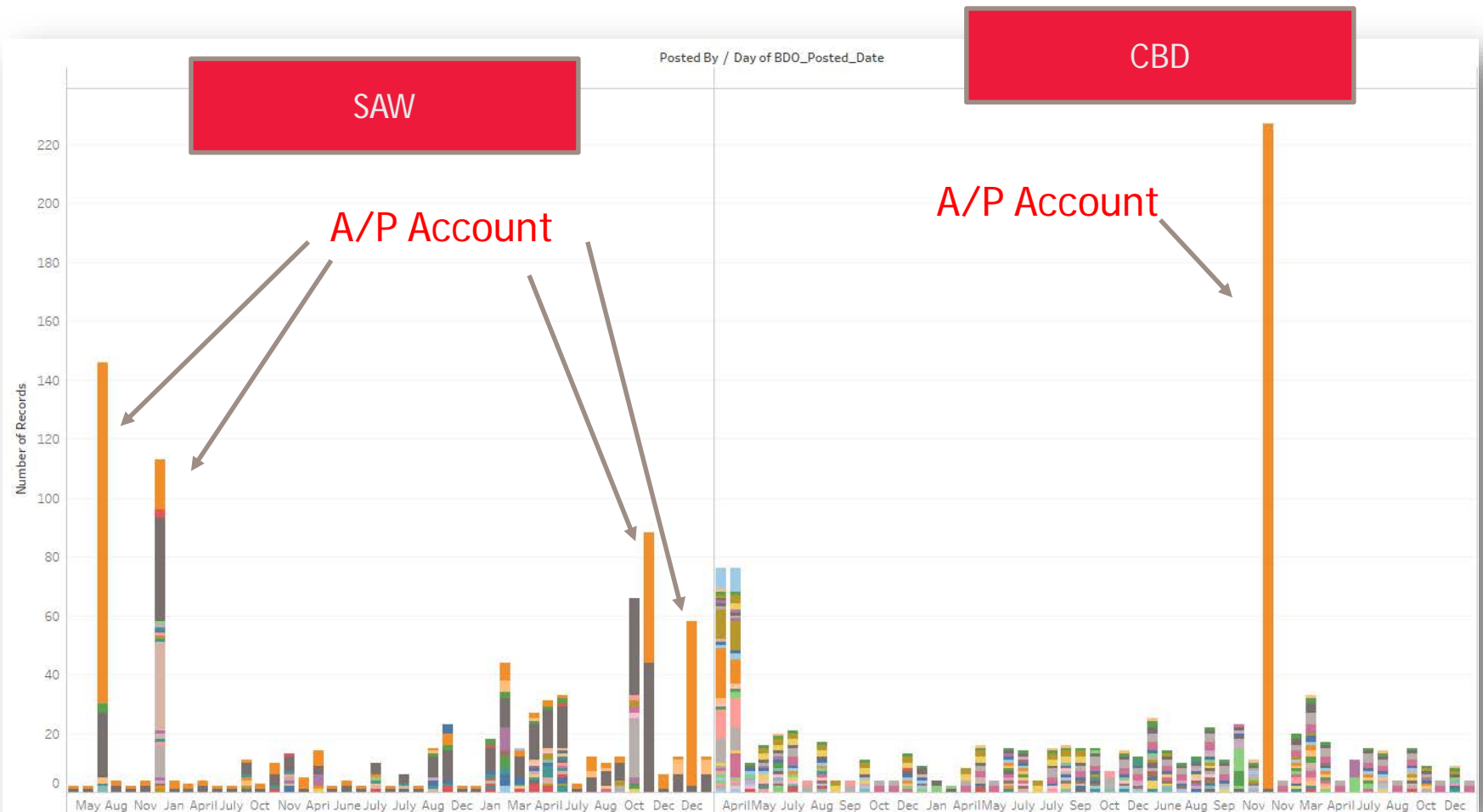
# ARTIFICIAL INTELLIGENCE

Title	Risk by User by Account	
AVG(Risk Pct)	50.15	100.00
SUM(Number ...)	1	4,072

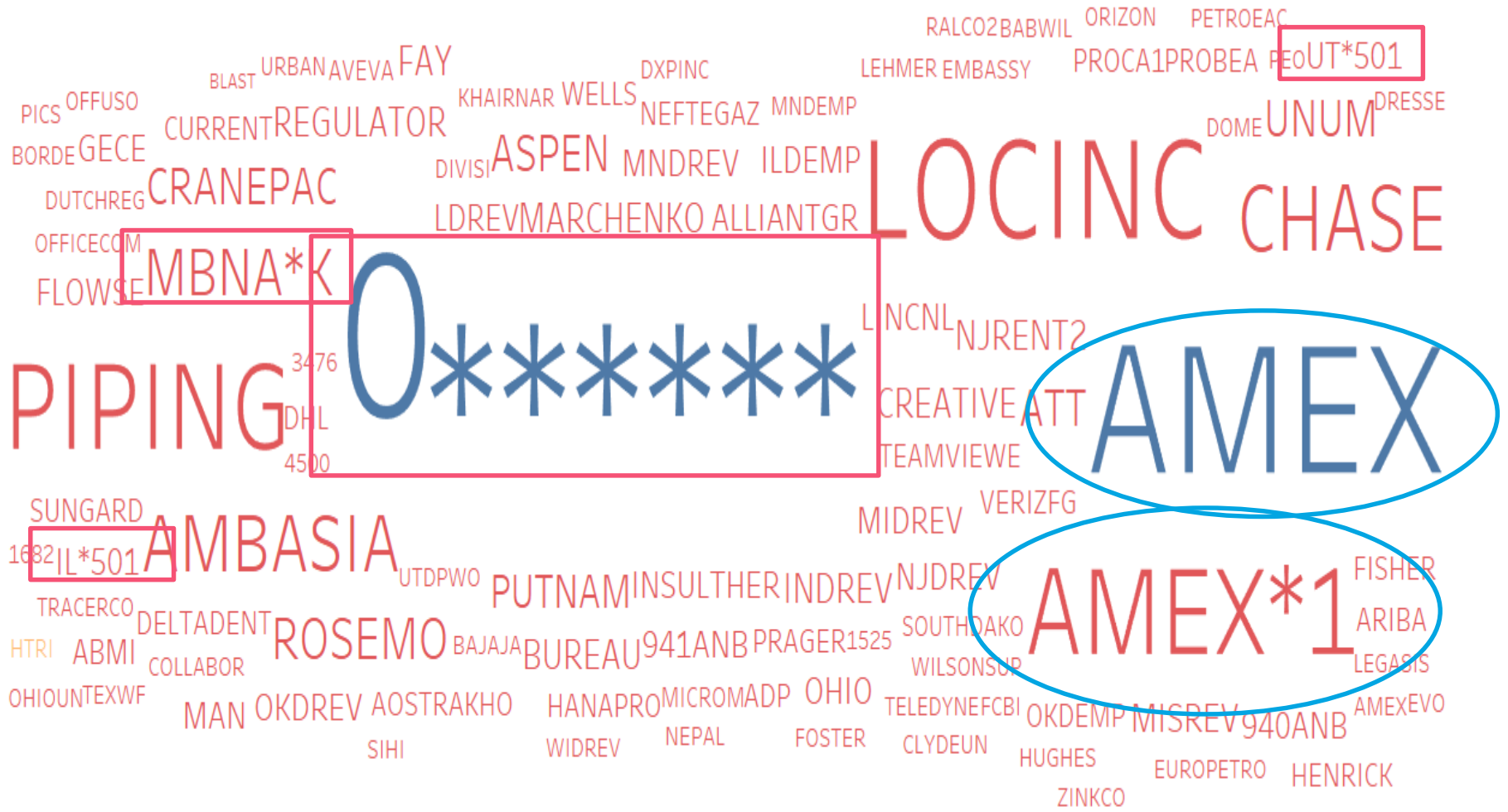
**ARTIFICIAL INTELLIGENCE TOOLS**  
BDO's use of artificial intelligence and machine learning ensures that our review of transactions is complete and limits the false positives for review.



# ARTIFICIAL INTELLIGENCE



# ARTIFICIAL INTELLIGENCE



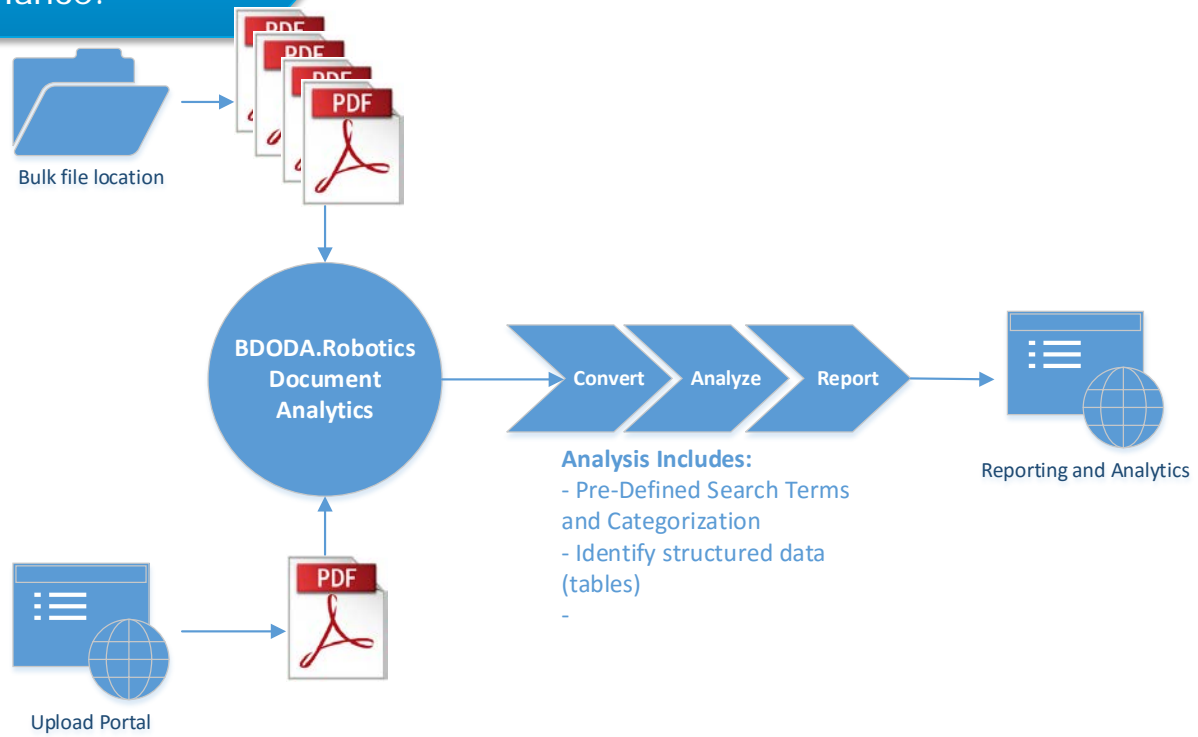
# VENDOR FRAUD

Account Description					
AFLAC INSURANCE RECEIVABLE	67.30	72.32	71.52	66.12	
AFLAC INSURANCE	67.30	72.32	71.52	66.12	
ACCOUNTS RECEIVABLE - OTHER				52.68	
CHILD CARE/FLEX RECEIVABLE	60.00	61.47	59.44	61.00	
EQUIPMENT LEASES	59.23				
CHILD CARE/FLEX PAYABLE	60.00	61.47	59.44	61.00	
PREPAID LICENSE AGREEMENT	59.23				
PREPAID INS - EMPLOYEES LTC			59.88		
PREPAID INS - EMPLOYEES VISION	64.15				
CASH IN BANK - REGULAR CHECKING	61.95	62.37	55.83	60.43	
EMPLOYEE LTC INSURANCE PAYABLE			59.88		
CASH IN BANK - PAYROLL★	78.98		59.71		
ACCOUNTS PAYABLE - TRADE★	61.47	62.46	55.58	61.26	

# CONTRACT REVIEW

## CONTRACT REVIEW TOOLS

Import PDF documents, such as engagement letters or client contracts and apply text analytics to review for completeness and compliance.





# INCORPORATING DATA ANALYTICS INTO YOUR INTERNAL AUDIT FUNCTION

# PRELIMINARY STEPS TO TAKE

- ▶ Assess your current data analytics capabilities
- ▶ Determine where you want to be
- ▶ Obtain the appropriate resources
- ▶ Determine opportunities and needs of the company
- ▶ Obtain the support of management

# ESTABLISH OBJECTIVES AND ACTION ITEMS

## ▶ Short-Term Objectives

- Identify resources - in-house/outsourced
- Identify systems/applications and ability to provide complete and accurate data
- Determine appropriate data analytic tool(s)
- Begin incorporating data analytics into internal audits
- Establish training and procedures for data analytics (including data integrity and completeness checks)

# ESTABLISH OBJECTIVES AND ACTION ITEMS

## ▶ Longer-Term Objectives

- Include data analytics in planning and annual internal audit plan
- Establish complete inventory listing of systems and data by process area
- Establish training and procedures for data analytics (including data integrity and completeness checks)
- Maintain library of sustainable and repeatable data analytic tests and scripts
- Establish continuous monitoring and auditing programs

# ESTABLISH OBJECTIVES AND ACTION ITEMS

- ▶ Continue to grow and improve your data analytics program each year!
- ▶ Contact us for a complimentary analytics test run
  - [Shana McGee | smcgee@bdo.com](mailto:smcgee@bdo.com)
  - [Kirstie Tiernan | ktiernan@bdo.com](mailto:ktiernan@bdo.com)

# QUESTIONS?



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COMING SOON...

Internal Audit Webinar Series, Course #5:  
November 28, 2017

## Internal Audit's Role in Monitoring and Controlling International Exposure

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# CONCLUSION

*THANK YOU FOR YOUR PARTICIPATION!*

**Certificate Availability** | If you participated the entire time and responded to at least 75% of the participation pop-up questions, you may click the **Participation tab** to access the print certificate button.

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