AML and Data Analytics

Presentation by Deniz Appelbaum, PhD
for the
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“Fraud and Fraud Detection”
AML and Data Analytics

The AML Process
The AML Process

• MONEY LAUNDERING IS A FINANCIAL TRANSACTION SCHEME to conceal or attempt to conceal the identity of proceeds illegally obtained so that the proceeds appear to come from legitimate sources.

• IMF estimation: money laundering amounts to 2-5% of global GDP (www.farf-gafi.org/faq/moneylaundering) – 800 Billion to 2 Trillion dollars

• Money laundering disguises the illegal origin and legitimizes the funds so they can be openly used.

• Three main stages: placement, layering, and integration
Placement: The riskiest phase

- Direct connection to money source
- Most legislation is developed to prevent/detect this stage
- Large amounts of cash are chunked or disguised to escape detection/alerts
  - “smurfing”/structuring: splitting larger amounts so as to avoid detection (below 10K)
  - Physically move money
  - Exchanging to alternative currencies
  - Purchasing gems, bitcoins, money orders, cashiers checks
Layering: the most complex stage

- Where the origin of the money is being made difficult to trace.
- A number of transactions or layers need to be put between the original sources of the funds before they are brought back into the legal economy.
- Funds might be moved to foreign countries that usually have strong bank secrecy laws, moved into accounts in the name of others who are nominees, or moved to accounts held by offshore corporations where the beneficial ownership is hidden and the funds can be withdrawn and redeposited to a number of other accounts.
- Other layering tools and techniques include:
  - Bank secrecy laws
  - Offshore banks
  - Tax havens
  - Shell corporations
  - Trade-based laundering
  - Digital currencies
Integration: Re-Introduction phase

- In the integration stage, the money enters back into the legitimate economy where it appears to have come from legal and normal transactions.
- Difficult to detect, unless there is a PAPER TRAIL
- Depending on the layering stage, the return may appear to come from a sale of assets such as real estate.
  - False loans from off-shore companies
  - False inheritances
  - False gambling winnings
  - Credit cards issued by off-shore banks
  - Salary from false business
  - Importing/exporting/distribution
  - Co-Mingling of funds with legitimate businesses (high cash based businesses)

An AML scheme cannot be successful unless the paper trail is eliminated or made very complex!
Alberto Barrera ran a rather sophisticated structuring operation that involved bank accounts in cities all over the United States. Barrera and his accomplices would fly to different U.S. cities, traveling to various banks and purchasing cashier’s checks and money orders in amounts less than $10,000 (to avoid U.S. federal reporting requirements). They would then travel to banks in other cities, where they would deposit some of the purchased checks and money orders into accounts controlled by Barrera. Once the money was converted or deposited, it was transferred to banks in other countries.
Money Laundering Methods

• Using a Front Business to Launder Funds
  • Seemingly legitimate business
  • Comings and goings will not stand out
  • Provides cover for delivery and transportation related to AML activities
  • Expenses from illegal activity can be concealed

• Overstating Revenues and Expenses
• Depositing, but NOT RECORDING, revenue
Luxury Antiques is a chain of antique stores with several locations within and around a major metropolitan center. It is locally owned. The bulk of its activity is in the sale of antique figurines. Luxury Antiques sells an average of 200 pieces per month.

Customers are encouraged to pay in cash and, when they do so, are usually pleased when they receive a “special discount” (which can be as high as 25 percent) off of the “official invoice price.” The invoice the customer receives shows the full price rather than the discounted price. If a customer questions this practice, the store owner explains it is done for “competitive reasons.”

Over the course of a year, Luxury Antiques sells 2,400 total figurines for an average “official invoice price” of $4,000. This yields $9,600,000 of recorded revenues. Actual cash received from customers falls short of that figure by 20 percent, for a total of $7,680,000. The difference—$1,920,000—is now available for laundering purposes. To take advantage of this situation, the owner simply deposits cash receipts of $1,920,000 from his illicit sources as legitimate business income. The result is that $1,920,000 has been successfully laundered.
Another way for Luxury Antiques to overstate reported revenues is to create fictitious sales with all the normal paperwork. If 50 fictitious sales are created each month at the average “official price” of $4,000, an additional $2,400,000 of laundered receipts are produced each year. The result is that $2,400,000 of illicit funds can be disguised as legitimate business income. (Note that this method involves potentially more risk than the first because it involves completely fabricating all the elements of a sale rather than merely modifying one part of a normal sale.)
Money Laundering Methods

- Overstating Expenses to make payoffs, buy illegal goods, other illegal investments
  - Padding expense accounts
  - Payments for supplies never received
  - Fees to suspicious consultants
  - Salaries for non-existent employees
  - Basically:
    - Fictitious employees
    - Fictitious fees or vendors
    - Inflated invoices
Luxury Antiques has six salespeople and two assistant sales managers on the payroll. All eight employees are fictitious. Their pay, as well as sales commissions paid to the fictitious sales managers, represents an annual expense inflation of $500,000. Luxury Antiques’ owner does not have to pay taxes on this $500,000 and can take that amount of cash out of the business and put it into his own pocket.
EXAMPLE

Luxury Antiques has lawyers and consultants on “retainer” for a total of $600,000 per year. They perform little or no business work, but they do submit invoices for fees on expensive stationery and with suitably vague descriptions of their activities. Once again, the money paid out is not taxed and can be put to illicit purposes.
EXAMPLE

Luxury Antiques makes purchases from a supplier, who agrees to inflate invoices by 25 percent. The supplier then gives back four-fifths of the inflated amount, keeping the other one-fifth. On $500,000 of actual purchases per year, Luxury Antiques reports expenses of $625,000—an inflation of $125,000.
EXAMPLE

A Luxury Antiques supplier, Import Associates, which provides 40 percent of the antiques sold by Luxury Antiques, sells figurines to Luxury Antiques in lots consisting of 150 to 200 pieces. The individual prices and the exact number of figurines in each lot are vaguely described in these “wholesale” bills of sale. As a result of its long association with Import, Luxury Antiques is able to arrange for the invoices to be inflated by an average of 30 percent. This gains Luxury Antiques about $580,000 per year in inflated expenses (assuming 960 figurines at an average real cost of $2,000 = $1,920,000). By inflating the invoice by 30 percent, the invoice price will reflect a price of about $2,500,000, the difference representing laundered expenses.
Money Laundering Methods

• Depositing, but not recording, revenue (cash)
  • “Loan proceeds”
  • “Sale of property”
  • “Capital investments”

• Check documentation!

EXAMPLE

Each month, an extra $360,000 is deposited into Luxury Antiques’ bank account. To offset the entry, sales are credited for the laundered cash by either being fictitious or marked up.
Money Laundering Methods

Characteristics of Favorite Businesses for Hiding or Laundering Money

• Revenue:
  • Revenue base is difficult to measure
  • Cash transactions
  • Variable amounts

• Expense:
  • Variable and tough to measure

• History:
  • Ethnic ties
  • Supplier/customer ties
Money Laundering Methods

• Bars, restaurants, and night-clubs
  • High or variable prices
  • Varied clientele
  • Lots of traffic
  • Cash
  • Fast food (although lower $, mainly cash)

Examine traffic versus books
Money Laundering Methods

• Vending Machine Operations
  • Highly variable
  • Hard to measure volume of cash receipts and expenses

• Wholesale Distribution
  • Diverse product line
  • Falsified invoices
  • Fake Vendors
  • Fake Customers
  • Expenses easy to inflate
The Real Estate Industry

• Present a broad range of options
• Multiple parties, layering is possible
  • Obscure funding source
    • Loan-back schemes
    • Back-to-loan schemes
    • Shell entities
    • Appraisal Fraud
  • Monetary Instruments
    • Mortgage schemes
  • Obscure identity of owner

But, documentation!
ATMs

- Inexpensive
- Privately owned
- Easy to load
- ATM debits the cardholder and credits the ATM owner
- No requirement to check background of ATM owner
- No mandatory reporting procedures
- No rules for maintaining ATM sales records
Pre-paid Items

- Goods and services that are paid for in advance
  - Open, closed, semi-open
- Gift cards
- Pre-paid debit cards
- Payroll cards
- Prepaid mobile phones
- Mass transit cards
- Gaming and lottery cards
Mobile Banking

• Using an account associated with a mobile account...Samsung pay
  • Incomplete regulations
  • Transactions overseas hard to trace
  • Can move funds anywhere
  • Phone account owner can be anonymous
Digital Currencies
and Virtual Assets

Online payment service which accepts funds in a variety of ways to transfer funds to and from individuals/businesses

Exist and are traded in a digital format

- Growing in number
- Loosely regulated
- Most transactions considered final
- International person-to-person
- No required customer identification, just the random “address”
- Poor record-keeping
- Unlimited volume
- Transactions almost instant

- Liberty Reserve (May 2013): $6 billion AML assets since 2000
Another example:

The Seoul Metropolitan Police uncovered a money laundering ring that moved $38 million from South Korea to China during the course of 18 months. The group purchased in-game gold of an online video game “farmed” by low-cost laborers in China, and then sold it to exchangers in South Korea. The criminals placed the money into accounts opened under fake or stolen identities, and then disguised wire transfers to a Hong Kong–based paper company as product purchases. To avoid detection, group members used technology to spoof their IP address and make it look like they were operating out of an Internet café in South Korea.
Banks and MSBs (Money Services Businesses)

- **Banks:**
  - Employee collusion
  - In-effective policies and controls
  - In some jurisdictions, may be a front

- **MSBs:**
  - Currency exchangers
  - Check Cashers
  - Issuers or redeemers of money orders, etc
  - Money transmitters
  - Prepaid access providers and sellers
    - Loose regulations
    - Lax ID requirements
Casinos!!!

- High volume and cash intensive
- Provides a broad range of financial services
- Chips for AML:
  - Hold for a while, then cash in
  - Use chips as cash to purchase drugs
  - Use chips to gamble, generate legit winnings
Shell Companies

- Hide ownership
- Mask financial details
- Conceal assets
In 2012, an orthodox rabbi from New York was sentenced to four years in prison for his involvement in a widespread money laundering and corruption scheme. The case was part of the FBI’s “Bid Rig III” crackdown that involved the arrests of more than 40 people, including politicians and other religious leaders. The rabbi ran a collection of community charities known as gmachs. An undercover informant approached the rabbi and sought his assistance in laundering money through the charities. The rabbi deposited check donations of almost $1 million into accounts owned by the charities. He then used an underground financial network that operated between the United States and Israel to convert the funds into cash. After taking a 10 percent commission, he physically delivered the cash to the undercover informant.
AML and Data Analytics

Data Analytics
Data Analytics: What does it actually mean?

- **Data Analytics** - A process of inspecting, cleaning, transforming, and modelling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making.

- **Data Mining** is a particular data analysis technique that focuses on modelling and knowledge discovery for predictive rather than purely descriptive purposes.

- **Business Intelligence** - Covers data analysis that relies heavily on aggregation (summarization), focusing on business information.

- **Predictive Analytics** focuses on application of statistical or structural models for predictive forecasting or classification.

- **Text Analytics** - Applies statistical, linguistic, and structural techniques to extract and classify information from textual sources, a species of unstructured data.
Data analysis technology enables auditors and fraud examiners to:

- Analyze business data to test the effectiveness of internal controls
- Identify transactions that may indicate fraudulent AML activity

Data analysis also provides an effective way to fight against AML.

- Provides the ability to test 100% of the records or any size sample
  - Enables investigations professionals to focus investigation actions on those transactions that are suspicious or are identified as areas of weaknesses

Data analysis technology also enables organizations to:

- Conduct ad hoc analysis based on a report of wrongdoing or to perform repeatable automated procedures, for continuous auditing and monitoring
- Provide insight into the integrity of financial and business operations through transactional analysis.

Improves the ability to better assess and manage AML risk.
The standard process of analytics consists of the following phases / processes:

- **Determine Scope & Requirements**
  - Understand the purpose of the analysis, define the objectives & profile potential fraud schemes

- **Identify & Extract Information Sources**
  - Identify the relevant data sets, extract the data in a useable format (consider legal ramifications of data integrity if conducting and investigation and consider computer forensics) & verify the data as accurate after extraction

- **Data Extraction & Preparation**
  - Cleanse the data sets, de-duplication of data if relevant, reformat as required (maintaining records of all changes made to the data set), transform the data into the require sets for import into test tools.

- **Testing & Interpretation**
  - Determine testing regime to be applied, conduct standard and unique tests as per the objectives, record results (Note: Most commercial tools generate and audit log for this purpose)
  - Interpret the results of the data tests and identify potential issues, weaknesses or suspicious transactions and activities

- **Post Analysis Phase**
  - Prepare data testing report (if a consulting, investigation analysis or audit)
  - Determine required preventative tests to be applied on a schedule for fraud and corruption prevention activities as part of an overall data analysis program
ACFE Data Analysis Process

Planning Phase
- Understand the data
- Define examination objectives
- Build a profile of potential frauds
- Determine whether prediction exists

Preparation Phase
- Identify relevant data
- Obtain, verify, cleanse, and normalize the data

Testing and Interpretation
- Analyze the data!

Post-Analysis Phase
- Response to findings
- Monitor the data
Data Sources and Extractions

• Big Data: data of high volume, high velocity, and high variety that requires new and different forms of processing to enable enhanced decision making, insight discovery, and process optimization

• Continuous information source

• Qualitative Data
  • PDF documents
  • Twitter/Blog feeds
  • Audio and Video files
  • Emails, texts, corporate minutes
  • Mainframe and laptop software and logs
  • GPS data
  • Phone call meta-data
  • Receipts
  • Interview recordings/logs
Planning Phase

- Understand the Data
  - Availability
  - Structure
  - Dictionary
  - Links
- Define Examination Objectives and Scope
  - Purpose of exam and structure/size/resources/thresholds/limits
- Build a Profile of Potential Frauds
  - Also profile potential NON-FRAUD instances
- Determine Whether Prediction Exists: BASIS OF FRAUD EXAMINATION!
  - Totality of circumstances would lead a professionally trained and reasonable person to conclude that fraud might be occurring
Preparation Phase

- Identify relevant data
- Obtain the data
- Verify the data:
  - Control totals
  - Correct periods
  - Gaps/missing fields
  - Reasonableness tests
- Cleanse/Normalize Data
Testing and Interpretation Phase

- Analyze the data
  - Geo-location
  - Business unit
  - Time period
  - Dollar value
  - By Unique Identifier(s)

- Issues:
  - The Role of Concealment
  - Addressing False Positives
    - Data validity/integrity issues?
    - Data merging difficulties
    - Legitimate data that falls outside the norm
Post-Analysis Phase

- Respond to Analysis Findings
- Monitor the Data
- Spectrum of Analysis:
  - Ad-hoc testing
  - Repetitive testing
  - Continuous testing
Data Mining

• Searches and explores data for previously undiscovered instances
• Can be used preventatively and for detection
• Pattern analysis, trend ratios, matches, hidden connections
  • Employee/vendor
  • Duplicate bank accounts
  • Abnormal transaction days/times/amounts
  • Round numbers
  • Missing numbers
  • Benford’s Analysis
Five Advantages of Using Data Analysis Software

1) allows examiner to centralize an investigation
2) assures completion and accuracy
3) bases predictions about the probability of a fraudulent situation on reliable statistical information
4) allows searches of entire data files for red flags of possible fraud
5) assists in the development of reference files for ongoing fraud detection and investigation work
Core Data Analysis Functions in Software Packages

- Sorting
- Record Selection
- Joining Files
- Multi-file processing
- Correlation Analysis
- Trend Analysis
- Time Series
- Verifying multiples of a number
- Compliance verification
- Duplicate searches
- Expressions and Equations

- Graphing
- Filter and Display criteria
- Fuzzy logic matching
- Gap tests
- Pivot tables
- Regression Analysis
- Sort and index
- Statistical analysis
- Stratification
- Date functions
- Benford’s Law analysis
## Sorting

Arrange the data in a meaningful order for analysis

### Sample Customer Sales Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Customer</th>
<th>Invoice</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/12/20X6</td>
<td>V45892</td>
<td>J54534</td>
<td>$10,000</td>
</tr>
<tr>
<td>4/8/20X6</td>
<td>V45892</td>
<td>J54535</td>
<td>$10,000</td>
</tr>
<tr>
<td>5/7/20X6</td>
<td>V78293</td>
<td>J70384</td>
<td>$15,698</td>
</tr>
<tr>
<td>2/8/20X6</td>
<td>V90132</td>
<td>J37234</td>
<td>$85,365</td>
</tr>
<tr>
<td>12/15/20X5</td>
<td>V10345</td>
<td>J12853</td>
<td>$47,952</td>
</tr>
<tr>
<td>1/8/20X6</td>
<td>V78343</td>
<td>J26487</td>
<td>$52,978</td>
</tr>
</tbody>
</table>

### Data Sorted by Invoice Number

<table>
<thead>
<tr>
<th>Date</th>
<th>Customer</th>
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<th>Amount</th>
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</tr>
<tr>
<td>5/7/20X6</td>
<td>V78293</td>
<td>J70384</td>
<td>$15,698</td>
</tr>
</tbody>
</table>

### Data Sorted by Amount

<table>
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<th>Date</th>
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<th>Invoice</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/15/20X5</td>
<td>V10345</td>
<td>J12853</td>
<td>$47,952</td>
</tr>
<tr>
<td>1/8/20X6</td>
<td>V78343</td>
<td>J26487</td>
<td>$52,978</td>
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<td>5/7/20X6</td>
<td>V78293</td>
<td>J70384</td>
<td>$15,698</td>
</tr>
</tbody>
</table>
Record Selection

- Select specific records for analysis
- For example: NYC Office of the Mayor employees with OT pay in 2016

<table>
<thead>
<tr>
<th>PAY_BASIS</th>
<th>REGULAR_HOURS</th>
<th>REGULAR_GROSS_PAID</th>
<th>OT_HOURS</th>
<th>TOTAL_OT_PAID</th>
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</thead>
<tbody>
<tr>
<td>per Annum</td>
<td>1,355.00</td>
<td>27,540.90</td>
<td>50.25</td>
<td>1,012.00</td>
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<tr>
<td>per Annum</td>
<td>1,826.28</td>
<td>46,779.24</td>
<td>109.00</td>
<td>2,391.28</td>
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<tr>
<td>per Annum</td>
<td>760.00</td>
<td>14,898.94</td>
<td>89.25</td>
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</tr>
<tr>
<td>per Annum</td>
<td>1,123.00</td>
<td>22,469.86</td>
<td>96.50</td>
<td>1,565.75</td>
</tr>
<tr>
<td>per Annum</td>
<td>820.00</td>
<td>45,463.16</td>
<td>3.50</td>
<td>88.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,830.00</td>
<td>46,285.89</td>
<td>15.00</td>
<td>352.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,830.00</td>
<td>33,692.76</td>
<td>9.00</td>
<td>209.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,830.00</td>
<td>54,647.32</td>
<td>96.75</td>
<td>3,507.25</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,830.00</td>
<td>64,690.62</td>
<td>18.75</td>
<td>670.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,830.00</td>
<td>54,450.51</td>
<td>41.00</td>
<td>1,232.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,008.00</td>
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<td>per Annum</td>
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<td>per Annum</td>
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<td>48.50</td>
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<td>per Annum</td>
<td>1,830.00</td>
<td>54,687.13</td>
<td>83.00</td>
<td>2,969.00</td>
</tr>
<tr>
<td>per Annum</td>
<td>1,827.15</td>
<td>39,350.97</td>
<td>63.75</td>
<td>1,418.00</td>
</tr>
</tbody>
</table>
Joining Files

- Connects fields from two sorted input files into a third file.
- Frequently used to match invoice data with A/R files, using common identifier.
Multi-file processing

- Allows the user to relate several files by defining their relationship without the use of join. For example, relate an outstanding invoice master file to A/R file using an account number. Can relate invoice numbers as well.
Correlation Analysis

• Relationships in raw data
• Examine correlations in data for deviations from expected relationships
• Pair-wise relationship between two sets of data; each $x$ has a unique $y$
• The strength of this relationship is measured by the correlation coefficient
• In Excel, the CORREL(array1,array2) function returns this coefficient
• IDEA example
Trend Analysis

- Calculates the values of data over time and forecasts values into the future based on the assumption that the expected behavior will continue.
- Beneficial for fraud examiners to benchmark future behaviors of accounts, persons, transactions types.
- Seasonal data should be examined with Time Series Analysis.
- Based on linear regression using the method of least squares.
- Quantifies the trend of the data – which department shows a supplies expense that exceeds past trends?
- IDEA Trend Analysis demo.
Time Series Analysis

- Calculates the trend of data over time with a seasonal component
- Decomposition Method of Time Series Analysis is the most useful for FINANCIAL data
- Testing based on seasonality — higher values at year end?
- IDEA example
Verifying Multiples of a Number

• Are numbers consistent with the regular or expected rate? Or, are transactions under or above the limit? Or, do they lie just below the limit?
  • IDEA limits tests/IDEA stratifications
Compliance Verification

- Are controls/rules being observed?
- Feature/attribute/limits tests
- Can be scripted as apps (Excel, IDEA, ACL) to run upon command or automatically as part of a monitoring system

```
Set db = Client.OpenDatabase(“Employee T0532.XML”)
Set task = db.ExportDatabase
task.IncludeAllFields
eqn = “”
task.PerformTask “C:\Users\Deniz\OneDrive\Documents\My IDEA Documents\IDEA Projects\PCard Project\Exports\ILB\Employee T0532.XLSX”, “Employee T0532”, “XLSX”, 1, db.Count, eqn
Set do = Nothing
Set task = Nothing

MsgBox “Employee T0532 of Global Analytical has 2 transactions that occurred on 5/05/2013 for $2147.81 for Nvidia from www.newegg.com. Global Analytical is an IT department and Nvidia is a…”
MsgBox “Please evaluate the risk for personal use of Employee T0532 with this transaction. You want to remember that PCards are for MRO and the relationship between department…”
Call RunRiskDialog() work on EmployeeT0532
```
## Duplicate Searches

- Identify duplicate values in specified fields
- Single file or joined files
- Addresses, identifiers, days, amount

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>China</td>
<td>Zhang</td>
<td>Chu</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>China</td>
<td>Liu</td>
<td>He</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>U.S.A.</td>
<td>Alice</td>
<td>Saunders</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>U.S.A.</td>
<td>Anna</td>
<td>Phillips</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>China</td>
<td>Yzhi</td>
<td>Le</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>China</td>
<td>Wu</td>
<td>Niu</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Germany</td>
<td>Lea</td>
<td>Wagner</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Germany</td>
<td>Leon</td>
<td>Newmann</td>
</tr>
</tbody>
</table>
Expressions and Equations

- Fraud examiners can build expressions and equations based on their knowledge and expectations of the data.
- Also used with compliance testing.
Filter and Display Criteria

- Fraud examiners can create filters or queries based on specific user-defined criteria that results in only those records being displayed.
- Can be deployed when loading the data or later as an extraction or criterion for another test.
- In IDEA: Equation Editor box.
Fuzzy Logic Matching

• Matching very similar attributes that might escape normal matching algorithms
• For example: First Street, First St, and 1\textsuperscript{st} Street
• Very useful when the perpetrator has taken steps to mask steps
• May produce an increased number of false positives
Gap Tests

• Identifies items missing in expected sequences or series (check and invoice numbers)

• Finds sequences where none are expected to exist (employee government ID numbers, SSNs)

<table>
<thead>
<tr>
<th>From: CHEQUE</th>
<th>A52656</th>
<th>To: CHEQUE</th>
<th>A52656</th>
<th>Total number of items detected</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A52656</td>
<td></td>
<td></td>
<td>Total number of gaps detected</td>
<td>1</td>
</tr>
</tbody>
</table>

| SOUB | 99999 | OKAY YAHS | 1/6/2015 | 8714356E0U | A52655 | 1/29/2015 | 100081900 | WIT | 37,418.72 |
| MIA | 99999 | MILES LONG | 1/13/2015 | GR13297 | A52655 | 1/29/2015 | 100000400 | HMV | 26,340.30 |
| MIA | 99999 | CARY S MATIC | 1/3/2015 | 574518C | A52655 | 1/29/2015 | 100081800 | HMV | 17,304.80 |
| MIA | 92211 | RICARDO BAL | 1/8/2015 | BC 454701W | A52657 | 1/31/2015 | 100083700 | H.M.V. | 11,001.66 |
| SOUB | 20533 | BURKHARDT | 1/4/2015 | CS - 562 -97 | A52656 | 1/31/2015 | 100084500 | HMV | 20,431.80 |
| CW | 20533 | BURKHARDT | 1/1/2015 | FR-96332 | A52659 | 2/1/2015 | 100084300 | HMV | 8,579.04 |
Pivot Tables

- Interactive data summarization tool found in Excel and also in IDEA
- It is used to sort, count, total, or give the average of specified data
- Assists in providing the “big picture”

<table>
<thead>
<tr>
<th>Salesperson</th>
<th>CAN</th>
<th>MEX</th>
<th>UK</th>
<th>USA</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carson</td>
<td>$978</td>
<td>$24,613</td>
<td></td>
<td></td>
<td>$25,591</td>
</tr>
<tr>
<td>Grant</td>
<td>$7,842</td>
<td></td>
<td>$1,248</td>
<td></td>
<td>$9,090</td>
</tr>
<tr>
<td>Hughes</td>
<td>$6,777</td>
<td>$1,203</td>
<td></td>
<td></td>
<td>$7,980</td>
</tr>
<tr>
<td>Jamison</td>
<td></td>
<td>$8,596</td>
<td>$5,634</td>
<td></td>
<td>$14,230</td>
</tr>
<tr>
<td>Jarrison</td>
<td>$9,785</td>
<td>$4,576</td>
<td>$7,854</td>
<td></td>
<td>$22,215</td>
</tr>
<tr>
<td>Miller</td>
<td>$452</td>
<td>$552</td>
<td>$9,809</td>
<td></td>
<td>$10,813</td>
</tr>
<tr>
<td>Parsons</td>
<td>$9,846</td>
<td></td>
<td>$2,458</td>
<td></td>
<td>$12,304</td>
</tr>
<tr>
<td>Grand Total</td>
<td>$25,443</td>
<td>$44,649</td>
<td>$8,834</td>
<td>$23,297</td>
<td>$102,223</td>
</tr>
</tbody>
</table>
Regression Analysis

- Statistical method that uses a series of records to create a model relationship between a dependent variable and one or more independent variables.
- Ex: Regression could be used to determine the number of widgets manufactured based on materials and labor numbers.
- Periods where sales of widgets are higher or lower than expected would require analysis.
Sort and Index

• Arranges the data in a manner that assists analysis – ascending, descending

• Depending on the field type, could be alphabetically or numerically
Statistical Analysis/Descriptive Statistics

- Calculating statistics such as averages, mins and maxes and absolute values
- IDEA Field Statistics
Stratification

• Breaks the data down into intervals or strata
• Very useful for limits testing!
## Date Functions

### Aging Analysis:

<table>
<thead>
<tr>
<th>Invoice Number</th>
<th>Customer Name</th>
<th>Amount Receivable</th>
<th>Amount Owed</th>
<th>1–30 Days</th>
<th>31–60 Days</th>
<th>61–90 Days</th>
<th>90–120 Days</th>
<th>120+ Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>6987</td>
<td>McClintock Fabrics</td>
<td>$1,250</td>
<td>$250</td>
<td>$250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5365</td>
<td>ABC Incorporated</td>
<td>$5,250</td>
<td>$650</td>
<td>$650</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8942</td>
<td>Riley’s Pest Control</td>
<td>$1,000</td>
<td>$200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5410</td>
<td>Bob’s Lawn Service</td>
<td>$250</td>
<td>$50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9463</td>
<td>Clean 4 You</td>
<td>$750</td>
<td>$300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7156</td>
<td>XYZ Corporation</td>
<td>$6,250</td>
<td>$1,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Benford’s Test

• Founded on counterintuitive observation that individual digits of multidigit numbers are not random, but follow a pattern
  • Describes expected frequencies of digits in numbers
  • UNTAMPERED NATURALLY OCCURING NUMBERS!
• Posits that distribution of first digits is positively skewed, or more heavily weighted toward smaller numbers
• Number series must follow a geometric sequence
  • Each successive number calculated as a fixed percentage increase over previous number
• Applications
  • Net income
  • Earnings per share
  • Income tax
  • Fraud detection
Benford’s Test: expected Digital Frequencies

<table>
<thead>
<tr>
<th>Digit</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
<th>Fourth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.11968</td>
<td>.10178</td>
<td>.10018</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.30103</td>
<td>.11389</td>
<td>.10138</td>
<td>.10014</td>
</tr>
<tr>
<td>2</td>
<td>.17609</td>
<td>.10882</td>
<td>.10097</td>
<td>.10010</td>
</tr>
<tr>
<td>3</td>
<td>.12494</td>
<td>.10433</td>
<td>.10057</td>
<td>.10006</td>
</tr>
<tr>
<td>4</td>
<td>.09691</td>
<td>.10031</td>
<td>.10018</td>
<td>.10002</td>
</tr>
<tr>
<td>5</td>
<td>.07918</td>
<td>.09668</td>
<td>.09979</td>
<td>.09998</td>
</tr>
<tr>
<td>6</td>
<td>.06695</td>
<td>.09337</td>
<td>.09940</td>
<td>.09994</td>
</tr>
<tr>
<td>7</td>
<td>.05799</td>
<td>.09035</td>
<td>.09902</td>
<td>.09990</td>
</tr>
<tr>
<td>8</td>
<td>.05115</td>
<td>.08757</td>
<td>.09864</td>
<td>.09986</td>
</tr>
<tr>
<td>9</td>
<td>.04576</td>
<td>.08500</td>
<td>.09827</td>
<td>.09982</td>
</tr>
</tbody>
</table>
First Digit Test

• Compares the first-digit profile of a data set to Benford’s first digit profile
First-Two-Digits Test

• Compares the first two digits of a data set with Benford’s profile for the first two digits (purchases at $300 threshold)
Last-Two-Digits Test

- Compares the last two digits of a data set with Benford’s profile for the last two digits
Points regarding Benford’s Tests

- Data should describe the sizes of similar events ($ of purchases)
- No built in Mins or Maxes in the data
- Only positive data should be analyzed
- Numbers should occur naturally, not be assigned
- Smaller amounts occurring more frequently
- Handy for identifying shell company schemes (AML or non-AML)
- Fictitious sales/checks/transactions
- Bid-splitting and other schemes involving limits (identifies concentrations)
Graphics

- Invaluable for exploratory and explanatory analysis
- Graphics are more exciting than spreadsheets!
Examples of AML data analysis queries

• Benford’s Law tests can be used to highlight abnormal duplications. These duplications may be the result of making up expense numbers to offset illicit funds recorded in revenue to avoid paying tax on the excess revenues.
  • The duplications may also be in the made-up revenue recorded in the sales register.
  • The first two digits test, the last two digits test, and the numbers duplication test of Benford’s Law can be utilized.
• The relative size factor test can flag transactions in sales or expenses that are out of line for each customer or vendor.
• The same-same-same test and the same-same-different test can output specific duplications within selected fields, and those duplications with a selected difference field.
• The even amounts test/round numbers: payments paid in exactly even thousands or hundreds of thousands.
Examples of AML data analysis queries

• Extract and review cash transactions from the payment register.
• Extract from sales or accounts receivable files high amounts paid with cash.
• Compare bank deposits with sales by joining electronic bank statement records with accounts receivable credits.
• Summarize sales from source categories for each year, join, and chart to determine unusual increases in revenue.
• Extract from the asset register significant additions and disposals and review.
• Test if transactions were at fair market value.
• Extract from the asset register items that are not normally associated with the nature of the business, such as works of art, precious metals, and so on.
• Extract from the liabilities loan accounts and review for unusual arrangements.
• Extract high-interest payments made and review.
Examples of AML data analysis queries

- Extract related-party transactions from purchase and sales.
- Extract from the customer master file new additions and join to sales and summarize.
- Extract from the vendor master file new additions and join to purchases and summarize.
- Summarize sales by unit item. Summarize costs of goods sold by unit item and join to the summarized sales file. Calculate the gross margin and extract those with unusually high margins.
- Summarize sales by unit item and by customer and extract those customers who were charged significantly more than normal. The Z-score test would be appropriate here.
- Extract transactions with offshore entities.
- Create a list or file containing countries that are considered high risk for money laundering and extract transactions with those countries.
Cash manipulation and AML

• Misappropriation of incoming cash and cash equivalents
  • Check washing: using chemicals to erase data from checks such as the payee name, the date, and the check amount

For AML:
• Altering amount of check received
• Altering amount of expenses to offset enhanced revenue

"Well, the boss told us to launder the money, didn't he?!"
Cash Manipulation

• Case study: “Sample – Detailed Sales”, “Sample – Detailed Previous Year”, 2015 and 2014 respectively, in the sample project
  • Append an 11th field called MONTH: @Month(INV_DATE), to isolate month in each dataset
  • Summarize Sales Representative field and total on the sales before taxes
  • Set view vertically to display files side-by-side
  • Combine both files using JOIN feature, create a new joined file called “2014_2015 by sales rep”
  • Visualize your results. Visualize the number of sales records per sales rep for the two years.
  • Pivot Table: for 2015, create pivot tables by sales rep, on month and then on month/custno.
Customer and Billing Schemes

• Submission of a false or an altered invoice
• Payables fraud (to shelter income):
  • Fake vendors (collusion required for goods, less so for services)
  • Altering and/or double paying non-complicit vendor’s statements
  • Making personal purchases with company funds (ie procurement cards etc)
• Dummy or shell companies:
  • Post office box
  • No phone number
  • Duplication of employee data: addresses, names, phone numbers, bank accounts
Billing Schemes

• Case Study: using OK data set
  • Please extract 10,000 records from the dataset
  • Create a NEW PROJECT in IDEA: OK Vendor Payments_2015
  • Upload your 10,000 row excel file into this project, please name the dataset “State Vendor Payments”
  • Open the file and perform field statistics
  • Payment amount and transaction type are most interesting
    • B—The voucher type for all the records is JRNL with PAYMENT_AMOUNT as zero; it seems that these are journal entries
    • C—Contains both positive and negative amounts in the PAYMENT_AMOUNT field
    • H—Contains negative amounts and are noted as Regular Voucher
    • P—Paid amounts
    • R—Refunds
    • W—Negative amounts
Billing Schemes

• Case Study, cont.:

• **Extract** all records that are paid to new file name: “Payments trans type P”, by using the equation: TRANSACTION_TYPE=“P”

• Using this new paid file, perform **Benford’s Tests** (pg 138) on the payment amounts.
  • Benford’s **First Digit** test
  • Create a 3D bar chart of the **first two digit** tests
  • Create a 3D bar chart of the **last two digit** tests

• Using the same paid dataset, **extract** a new file called “Even Thousand Amounts” using this equation (pg 141):

\[(\text{PYMNT\_AMT} \mod 1000) = 0 \land \text{PYMNT\_AMT} \neq 0\]
Check-Tampering Schemes

• The sheer volume of business payments still made by check today will maintain this as the preferred method of payment.
• The traditional check-tampering fraud schemes will continue to exist as long as check payments exist.
• Electronic-payment systems open the door to new types of fraud that must be guarded against.
• Many organizations use both traditional checks and electronic transfer payments.
• It is not unusual that an organization would use electronic direct deposits for their payroll and checks as payments for everything else.
• It is also not unusual for a business to use a hybrid system for receiving payments.
Check Tampering: The Payee

• Checks can be made out in favor of the fraudster, an accomplice, shell company, or even cash. They can also be made out to legitimate vendors to pay for personal items. Checks made payable to the fraudster, while easy to cash, are also easier to detect.

• If checks are already prepared, the payee name can be altered and replaced with the fraudster’s name. Amounts can be also changed. Modification of the existing name by adding additional letters to the end of the payee line or setting up shell companies with similar names of legitimate vendors facilitate the conversion of checks to be cashed.

• If the fraudster has access to the payments system in updating or changing vendor names, this can be done just prior to a check being issued and then changed back afterward.

• Addresses may also be changed at the same time to divert the check to the fraudster or an accomplice.

• If the check is made out to a third party, then the fraudster would have to forge the endorsement also. Having matching identification may be an issue for the fraudster.
Case Study: Check Tampering

Open the Samples Project and use the Payments file for these tests.

1) Normalize the inconsistent data in the AUTH file by APPENDING another field – name this field AUTHORIZED with the equation of @Strip(AUTH).

2) Next, test for separation of duties. Perform a direct extraction, creating a new dataset called SEP_OF_DUTIES, with the equation:
   
   AUTHORIZED==POSTED_BY

3) Last, test for missing entries by creating a new dataset called BLANK_ENTRIES, with the equation:

   AUTHORIZED == " " .OR. POSTED_BY == " " 
Payroll Fraud and AML

• Ghost Employees
• Falsified or Excess Overtime
• Fraud related to commissioned earnings
Case Study: Payroll Fraud – test for employees with the same address
<table>
<thead>
<tr>
<th>BRANCH</th>
<th>COUNTRY</th>
<th>FIRST_NAME</th>
<th>NAME</th>
<th>SALARY</th>
<th>CURRENCY</th>
<th>ADDRESS</th>
<th>CITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>Zhang</td>
<td>Chu</td>
<td>360000</td>
<td>CHY</td>
<td>1469 Huihai Zhonglu</td>
<td>Shanghai</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
<td>Liu</td>
<td>He</td>
<td>190000</td>
<td>CHY</td>
<td>1469 Huihai Zhonglu</td>
<td>Shanghai</td>
</tr>
<tr>
<td>3</td>
<td>U.S.A.</td>
<td>Alice</td>
<td>Saunders</td>
<td>19567</td>
<td>USD</td>
<td>215 N. Main Street</td>
<td>Houston</td>
</tr>
<tr>
<td>4</td>
<td>U.S.A.</td>
<td>Anna</td>
<td>Phillips</td>
<td>62000</td>
<td>USD</td>
<td>215 N. Main Street</td>
<td>Knoxville</td>
</tr>
<tr>
<td>5</td>
<td>China</td>
<td>Yzhi</td>
<td>Le</td>
<td>600000</td>
<td>CHY</td>
<td>313 Mid-Changjiang Road</td>
<td>Hefei</td>
</tr>
<tr>
<td>6</td>
<td>China</td>
<td>Wu</td>
<td>Niu</td>
<td>240000</td>
<td>CHY</td>
<td>313 Mid-Changjiang Road</td>
<td>Hefei</td>
</tr>
<tr>
<td>7</td>
<td>Germany</td>
<td>Lea</td>
<td>Wagner</td>
<td>54000</td>
<td>EUR</td>
<td>Im Muhlenbruch 6</td>
<td>Geolsmarienhutte</td>
</tr>
<tr>
<td>8</td>
<td>Germany</td>
<td>Leon</td>
<td>Newmann</td>
<td>37028</td>
<td>EUR</td>
<td>Im Muhlenbruch 6</td>
<td>Dueren</td>
</tr>
</tbody>
</table>
Test for payments made after termination dates
Test for payments made after termination dates
RESULT: Test for payments made after termination dates
Expense Reimbursement Schemes and AML

Travel and Entertainment expenses

Procurement Cards

Improper Expense claims include:
- Personal items
- Expenses that never materialized or were subsequently canceled
- Fake or Altered Receipts

Fraudulent Expense reimbursements:
- Overstated Expense Reimbursements
- Mischaracterized Expense Reimbursements
- Multiple Reimbursements
- Fictitious Expense Reimbursements
Any Store - Any Date - Any Amount
Falsified Travel Expenses and AML

Load the provided excel travel expenses file into IDEA as a managed project called Employee Travel Expenses_Ch11

Days Traveled Test: Create a field called DATE_DIFF with the equation:

@Age(END_DATE, START_DATE)

Same Day Traveled with Accommodation Charges:

DATE_DIFF = 0 .AND. ACCOMMODATION > 0

Same Day Traveled with Flight Charges:

DATE_DIFF = 0 .AND. AIR_FARE > 0

Same Day traveled with both flight and accommodation changes:

DATE_DIFF = 0 .AND. AIR_FARE > 0 .AND. ACCOMMODATION > 0
Traveled with Flight but No Accommodation Charges:

\[ \text{DATE\_DIFF} > 0 \ AND \ \text{AIR\_FARE} > 0 \ AND \ \text{ACCOMMODATION} = 0 \]

SAME-SAME-SAME (Duplicate Tests)

Using the main Travel Expenses data set, test for duplicates on \text{START\_DATE} and for \text{EMPLOYEE\_NO}.

Using the main Travel Expenses data set, test for duplicates on \text{EMPLOYEE\_NO} and \text{AIR\_FARE}, where \text{AIR\_FARE} is greater than 0.

Likewise, test for duplicates on \text{EMPLOYEE\_NO} and \text{ACCOMMODATION}, where \text{ACCOMMODATION} > 0.

Extraction bases on Audit Unit: Please extract the following, creating a new data set called Ass.Dep.Min.:

\[ \text{POSITION} = \text{"Assistant Deputy Minister"} \]. Please display the result in a graphic format that you feel is most appropriate.
Types of Non-Cash Misappropriations

✓ Misuse and Abuse
✓ Unconcealed Misappropriations
  ✓ In plain view
  ✓ Suspicion only
  ✓ Poor management/employee relationships
  ✓ No whistleblowing process
  ✓ Perpetrator hold management position
  ✓ Lack of desire to get involved
✓ Transfer of Assets
✓ Proprietary Information
Concealment of Non-Cash Misappropriations for AML

- Falsifying Sales or Purchase records

- Remove sales documents from files before shipping
- Overstate COGS and ship to an accomplice for billing adjustments
- Charging small sales to a customer with a large A/R balance
- Charging a larger sale into smaller chunks spread across several customers
- Discount/write-off the false sale to bad debt
Example: Round Dollar Payments
Data Analytics

Data Files

Ensure data validity
Consider data format and structure
Compare the cost and benefit of potential analysis
Consider the spectrum of distinct levels of aggregation at which fraud monitoring is required

BEGIN WITH THE END IN MIND (will this algorithm hold up under intense scrutiny of a court case???)

“Surely there’s an easier way of moving files?”
Other Analytics for AML Schemes

- Social media/web-scraping
- Summarize per employee/vendor for links
- Analyze all bid/purchase data for reasonableness
- Match bid data to originals
- Look at successful bid trends
- Run duplicate tests for addresses, etc.

Concealments: Look at fields such as “Consulting fees”, and “legal fees”

Look for personal relationships, family connections – more qualitative examination/investigation

CONCLUSION: Controls, right-to-audit, identify red-flag transactions
Textual Analytics

- Social media Posts
- Instant Messages
- Videos
- Voice/audio files
- User Documents
- Mobile software apps
- News feeds
- Sales and marketing materials
- Presentations!

Enhanced Text Mining:
- Weighted fraud indicators
- Emotive tone
- Unethical behavior
- Entity Extraction
- Text link Analysis
- Social Network Analysis
- Fraud Triangle Analytics
Suggested Fraud Keywords for AML

**Pressure:** deadline, quota, trouble, short, excessive, overage, problem, alert, concern, limits

**Opportunity:** Override, inflate, revenue inflation, expense padding, adjust, reserves, new vendors, consulting fee, legal expense, incentive payment, donation, goodwill payment

**Rationalization:** reasonable, deserve, temporary
Additional Visual Analytics: Tree Maps

Graphical representation of the data by rectangular spaces, size, and colors/intensities.
Additional Visual Analytics: Link Analysis with SAS Visual Investigator

- Creates visual representations of links between people, social networks, and indirect relationships
- Beneficial for AML: can track the placement, layering, and integration of money as it moves around unexpected sources
- Can also: associate communications, uncover indirect relationships, show discreet connections, and demonstrate complex networks
Geo-Spatial Analysis

- Displays geo-locational data along with other attributes, can reveal intersections and clusters of behavior
Clustering (with WEKA)

As defined by Sharma & Panigrahi (2013):
“is known as gaining insights and identifying interesting patterns from the data stored in large databases in such a way that the patterns and insights are statistically reliable, previously unknown, and actionable [3].

- Cluster analysis as a data mining technique helps finding similar objects in data.
- Kaufman & Rousseeuw (2009) have defined cluster analysis as “the art of finding groups in data.”
“Birds of a Feather Flock Together”

Legacy costs and budget maneuvers explain 58.42% of the point variability...
Artificial Intelligence and AML

- Artificial intelligence (AI) allows IT systems to imitate the cognitive ability of human – “problem solving”, “reasoning”, “planning” and “learning”

- AI enabled systems possess inbuilt intelligence to sift through, aggregate, blend, and identify patterns and relationships that are buried within mountains of data - a large number and types of data sources.
  - Customer onboarding
  - Link analysis
  - Customer segmentation
  - Screening
  - Risk management
  - Transaction monitoring
  - Alert investigation, reporting and case management

- HSBC is partnering with Ayasdi, FinCEN has been using its own AI system FAIS
Blockchain and AML

• Bitcoin as digital currency is highly suspect, not on official books

“It essentially provides users with a digital public record of Bitcoin transactions (the digital currency through which these transactions are conducted) that have been executed by a particular entity. It is inherently difficult for hackers to manipulate”

• Blockchain – semi-private? Peers? Impossible to change values without consensus....plus changes are recorded
Evaluating Data Analysis Software

- Data import/export capabilities
- Data visualization
- Suite of tools?
- Tailoring:
  - Performance
  - Functionality
  - Usability
  - Support for additions
Possible data Mining and Analysis Software

- Excel
- IDEA/CaseWare
- ACL
- ActiveData for Excel
- Thompson Reuters
- Tableau
- Python
- R
- WEKA
- Oversight
- SAS
- Oracle
- IBM Watson and IBM Blockchain
Thank You!
Questions?
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