Secrets, Conspiracies and Hidden Patterns:
Fraud and Advanced Data Mining

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Agenda

➤ Fraud update

➤ Exploratory text mining and latent semantics

➤ Data mining and fraud investigations

➤ Continuous auditing
Fraud update

- Typical organization loses 5% of its annual revenue to fraud
  - Translates to a potential fraud loss of $3.5 trillion worldwide (2011)

- Median loss was $140,000 for all companies
  - One fifth of losses were over $1 million

- Frauds lasted 18 months before being detected

Source: ACFE 2012 Report to the Nations
Fraud Update

- Most prevalent type of fraud
  - Misappropriation represents over 85% of all fraud

- Most prevalent fraud schemes in education
  - Billing schemes = 24.9%
  - Skimming schemes = 14.6%
  - Expense reimbursement schemes = 14.5%
  - Check tampering = 11.9%
  - Cash larceny = 11.0%

Source: ACFE 2012 Report to the Nations
Fraud update

- Initial detection method
  - Tip = 43.3%
  - Management review = 14.6%
  - Internal audit = 14.4%
  - By accident = 7.0%
  - Account reconciliation = 4.8%
  - Document examination = 4.1%
  - External audit = 3.3%

Source: ACFE 2012 Report to the Nations
## Fraud update

<table>
<thead>
<tr>
<th>Control</th>
<th>% of Cases Implemented</th>
<th>Control in Place</th>
<th>Control Not in Place</th>
<th>% Reduction</th>
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</thead>
<tbody>
<tr>
<td>Management review</td>
<td>60.5%</td>
<td>$100,000</td>
<td>$185,000</td>
<td>45.9%</td>
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<td>Employee support programs</td>
<td>57.5%</td>
<td>$100,000</td>
<td>$180,000</td>
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<td>Hotline</td>
<td>54.0%</td>
<td>$100,000</td>
<td>$180,000</td>
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<td>$100,000</td>
<td>$158,000</td>
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<td>External audit of ICOFR</td>
<td>67.5%</td>
<td>$120,000</td>
<td>$187,000</td>
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<td>Fraud training for employees</td>
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<td>Formal Fraud Risk Assessments</td>
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<td>$150,000</td>
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<td>Internal audit/FE department</td>
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<td>80.1%</td>
<td>$140,000</td>
<td>$145,000</td>
<td>3.4%</td>
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</tbody>
</table>

Median Loss Based on Presence of Anti-Fraud Controls

Source: ACFE 2012 Report to the Nations
Data mining

- More and more companies are mining their data to create a competitive advantage and garner customer loyalty by tailoring the customer’s experience to the customer
- Companies with the ability to mine their data are becoming the most powerful – World Economic Forum
Hot off the press
Forensic data mining

Use of sophisticated procedures and technologies to identify concealed patterns in financial, nonfinancial and textual data that would not otherwise be detectable due to the size and complexity of the data.
Patterns identified with data mining

- **Numeric Patterns** – fictitious invoice numbers, fictitiously-generated transaction amounts…

- **Time Patterns** – Transactions occurring too regularly, activity at unusual times or dates…

- **Name Patterns** – Similar and altered names and addresses…

- **Geographic Patterns** – Proximity relationships between apparently unrelated entities…

- **Relationship Patterns** – Degrees of separation…

- **Textual Patterns** – Detection of “tone” rather than words…

- **Unknown Patterns** – Things you haven’t thought of…
Cutting edge

Non-Obvious Relationship Association ("Link Analysis")
Linking items that are related but removed by several degrees of separation to mask their relationship.

Latent Semantic Analysis
Concept searching based on tone, recurring themes and communication nuances
Non-Obvious Relationship Association

Items related by degrees of separation

Carrie Fischer was in Star Wars with Harrison Ford who was in The Fugitive with Tommy Lee Jones who was in Batman Forever with Val Kilmer who was in Heat with Robert De Niro who was in Sleepers with KEVIN BACON!

Credit: Coleen McCue

experience BKD CPAs & Advisors
Sources of Information
- Investigator notes
- Interviews
- Email and Text
- Bank documents
- **Social Networking**
- Internet lookups
- Phone records
- Cell phone records
- Public records searches
- Secretary of state listings
Latent semantics (text mining)

- Only 20% of data in an organization is structured data
- 80% is unstructured (not housed in a database)
- Most of today’s commonly used anti-fraud/fraud detection and audit techniques focus on the 20% structured data
Sources for text mining

- Corporate and personal email
- Board minutes
- Company document collections
- Employee reviews and performance appraisals
- Corporate telephone records, cell phones
- Public records information and personnel files
- Computer hard drives, chat, IM, Skype
- Internet activity
From: The Boss
To: Everyone

I wanted to congratulate Lisa on her really outstanding presentation at the meeting! The update was easy to follow and was very well received by the group. Great job, Lisa! Kim also gave a nice presentation. We appreciate you both.
Text data mining and the fraud triangle

Pressure/Incentive
Key Words
- Meet the deadline
- Make sales quota
- Under the gun

Opportunity
Key Words
- Override
- Write-off
- Recognize revenue

Rationalization
Key Words
- I think it’s OK
- Sounds reasonable
- I deserve

Source: “Detecting Fraud by Integrating E-mail Analytics with the Fraud Triangle,” Fraud Magazine, May/June 2009
Count of vague, evasive or nervous–toned communications
Text is a window to the soul…

- Behavioral red flags of perpetrators
  - Living beyond means = 35.6%
  - Financial difficulties = 27.1%
  - Usually close association with customers/vendors = 19.2%
  - Control issues = 18.2%
  - Divorce/family issues = 14.8%
  - Wheeler/dealer attitude = 14.8%
  - Irritability, suspiciousness or defensiveness = 12.6%
  - Addiction problems = 8.4%
Text mining challenges

- No outstanding tools for it yet
- None can really pick up on true “tone” yet
- Largely keyword or keyword class-based
- Therefore, still have to determine relevance
- Artificial intelligence will find really dumb patterns!
Data Mining to Continuous Auditing
How Frauds Are Detected

Source: 2012 Report to the Nations - Association of Certified Fraud Examiners, Inc.
Paper-based and limited electronic testing (Sampling)

Data Mining and Data Analytics (100% coverage, ad hoc electronic testing)
Why Data Mining?

- Efficiency and effectiveness
- Data sets are massive in size and often proprietary in format
- “100% analysis is the most effective way to analyze for fraud”
  
  (Dr. Conan Albrecht, BYU)
Common Data Mining Areas

- Vendors and accounts payable
- Employees and payroll
- Expense reimbursement
- Travel and entertainment
- General ledger
- Purchasing cards
- Compliance
Employee/Vendor Relationships

<table>
<thead>
<tr>
<th>Matching Attributes</th>
<th>Employee ID</th>
<th>First Name</th>
<th>Middle Initial</th>
<th>Last Name</th>
<th>Vendor ID</th>
<th>Name</th>
<th>City</th>
<th>State</th>
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<td>131313131</td>
<td>Beth</td>
<td>E</td>
<td>Davis</td>
<td>D58468431</td>
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<td>Address, TIN</td>
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</table>

![Map Image]
Employee/Vendor Proximity

Vendor (A)
Jeremy’s Design Company, 123 5th Street, Anytown, MO (Total Payments = $84,337)

Employee (B)
Jeremy Clopton, 4300 Oak Street, Anytown, MO
Payment Trend Analysis

By Day of Week

By Day of Month

By Month
Check Sequence Analysis

<table>
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<tr>
<th>Journal</th>
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## Split Purchase Analysis

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<th>Merchant Name</th>
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<th>Transaction Amount</th>
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<th>max</th>
<th>limit</th>
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<tr>
<td>GENERAL SERVICES DEPT</td>
<td>WHEELER PUMP CO, INC</td>
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<tr>
<td>PUBLIC HEALTH</td>
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</tbody>
</table>

<< End of File >>
Analysis of Hours – Excessive Overtime (654 hrs)
Analysis of Hours – Excessive Holiday (182 hrs)
Continuous Auditing
Data Mining to Continuous Auditing

- Our experience talking with CAE’s
- Buzzword “continuous auditing”
- IIA begins to issues guidance
- Movement to bring electronic tools to internal audit
- Accomplishing knowledge transfer from forensics practices

experience BKD CPAs & Advisors
Paper-based and limited electronic testing (Sampling)

Continuous Auditing (Automated mining and analytics, 100% coverage)

Data Mining and Data Analytics (100% coverage, ad hoc electronic testing)

Responsiveness

Reactive

Proactive
Case Study 1 - Manufacturing

- Company Description
  - Fortune 500 Manufacturing Company
  - Revenues: $5 billion+
  - Internal audit personnel: 5
  - 20 divisions
  - 100,000+ vendors
  - 10,000 employees
  - 250,000 payments/year
Case Study 1 - Manufacturing

- Solution: Continuous Auditing
  - Tool of choice: ACL

- Results
  - Related Party Testing
    ✓ Continuous = quarterly
    ✓ Identified approx. 50 related parties
  - Accounts Payable Testing
    ✓ Continuous = monthly
    ✓ Identified 100+ duplicate payments
Case Study 2 – University

- Organization Description:
  - Public university
  - Revenues: $1 billion+
  - Internal audit personnel: 5
  - Purchasing cards through organization
Case Study 2 – University

- Solution: Continuous Auditing
  - Tool of choice: IDEA

- Results:
  - Duplicate payment testing
    - Possible duplicates with “A” on end of invoice
    - System errors – allowing same invoice number, date, amount
  - Purchasing cards
    - Individuals with multiple purchases at single location on single day
    - Multiple people in a department making purchase at same store on same day
CM/CA Relationship

- Comprehensive monitoring = reduced effort by IA
- Little monitoring = significant effort by IA
Challenge to Consider – Data Quality

- 417-865-8701, (417)865-8701, 8658701, 417-8658701
- Missoura, MO, Mis, Miss, MZ, MS, Miz, Mizz
- PO Box 34, P.O. Box 34, Box 34, Bx 34, P.O Box 34
- Mallery, Malery, Mallrey, Mallory, Malory
Progression of Procedure Development

- Single-purpose (Individual) Tests
- Repetitive Individual Tests
- Groups of Repetitive Similar Tests
- Automation of Groups of Tests

Groups of Similar Tests
Resources

- IIA Global Technology Audit Guides
  - Continuous Auditing
  - Fraud Prevention and Detection in an Automated World
  - Data Analysis

- http://www.acl.com
- http://www.audimation.com
Questions?

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