

# Audit Analytics



Qi Liu

Rutgers Business School

ISACA New York 2013

# What is Audit Analytics



- ❧ The use of data analysis technology in Auditing.
- ❧ Audit analytics is the process of identifying, gathering, validating, analyzing, and interpreting various forms of data within organization to further the purpose and mission of auditing.
- ❧ It can also assist audit departments in fulfilling their responsibilities to evaluate and improve the governance, risk management, and control (GRC) processes as part of the assurance function.



# Benefit of Audit Analytics



## ☞ Productivity and cost savings

- ☞ broaden the scope of their assurance activities

- ☞ reduce of staff necessary to complete the audit plan

## ☞ Efficiency in data access

- ☞ auditors can access and query data by themselves

## ☞ Audit risk

- ☞ significantly reduce audit risk by honing the risk assessment and stratifying the population



# The Evolving Role of Audit Analytics



## Past

- ❧ Specialized technology
- ❧ The domain of specialized IT auditors

## Now

- ❧ Essential technique
- ❧ Valuable in the majority of audit procedures

## Future

- ❧ Integrated throughout the audit process
- ❧ All auditors to have an appropriate level of technological competency

# Approaches to Audit Analytics



Ad Hoc	Repetitive	Continuous
Explorative and investigative in nature.	Periodic analysis of processes from multiple data sources.	"Always on" – scripted auditing and monitoring of key processes.
Seeking documented conclusions and recommendations.	Seeking to improve the efficiency, consistency, and quality of audits.	Seeking timely notification of trends, patterns and exceptions.  Supporting risk assessment and enabling audit efficiency.
Specific analytic queries – performed at a point in time – for the purpose of generating audit report findings.	Managed analytics – created by specialists – and deployed from a centralized, secure environment, accessible to all appropriate staff.	Continual execution of automated audit tests to identify errors, anomalies, patterns and exceptions as they occur.

# Applications of Audit Analytics



- ❧ Analytical Review
- ❧ Controls Assessment and Testing
- ❧ Substantive Testing
- ❧ Fraud Detection
- ❧ General Analysis and Reporting
- ❧ Financial and Non-financial Transactions

# Data analysis in audit cycle



The analytic routines and the results they generate should be included in the audit review.

Review

Planning

Define and create an audit plan that focuses on the areas of highest concern



Analyze entire population instead of sampling to increase overall departmental efficiency and allow for greater insight into high risk areas.

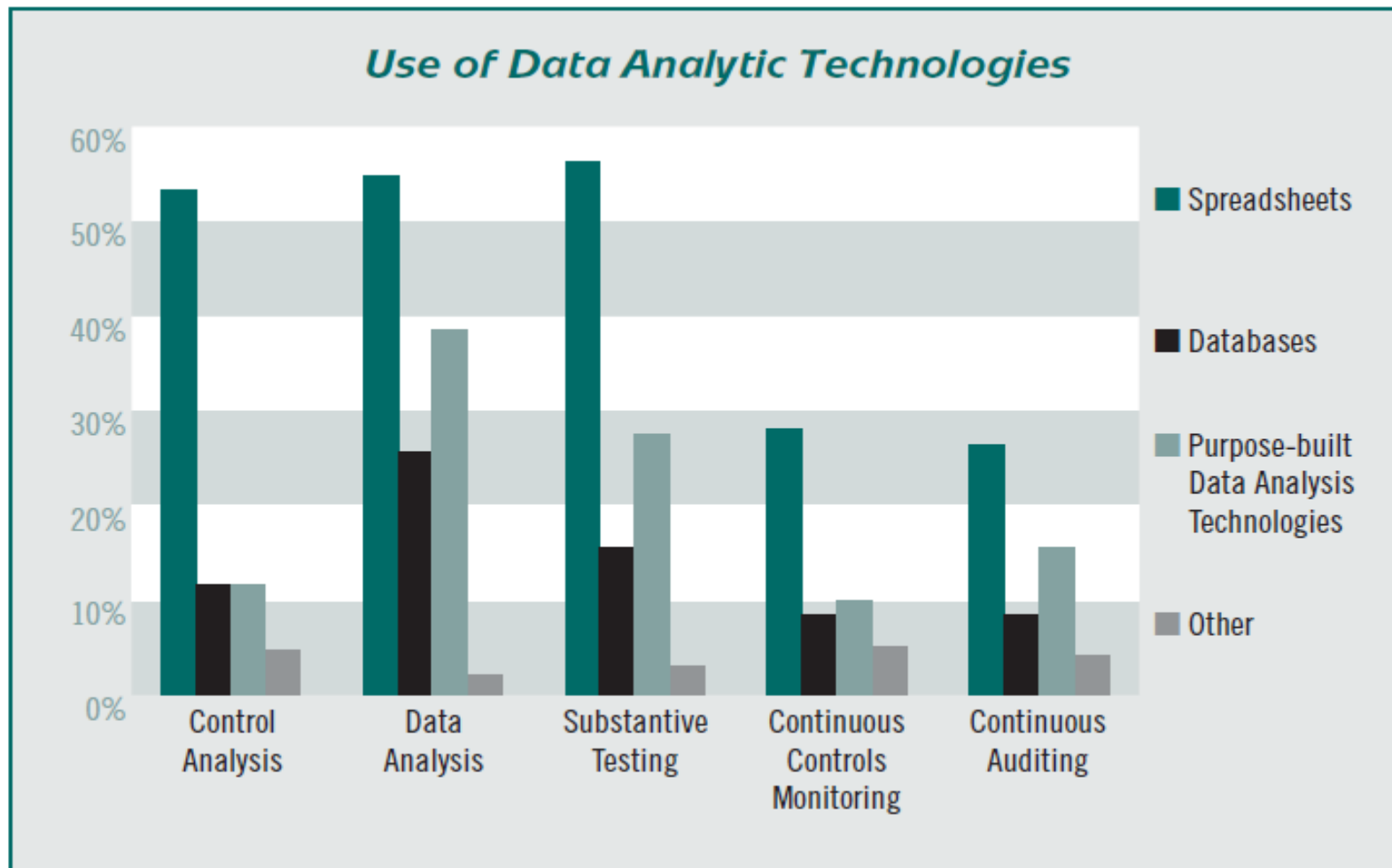
Testing

Preparation

Avoid delay of data access



# Using Data Analysis Technology





# Understanding Clients' Data

## -- Descriptive statistics & Visualization

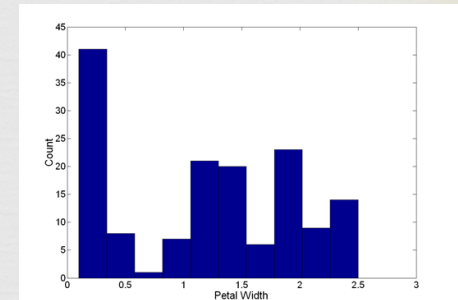


Descriptive statistics

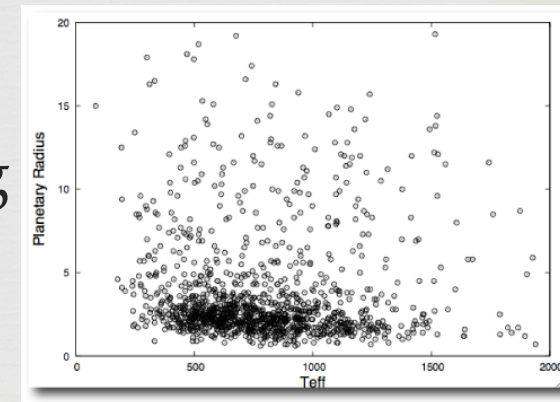
- ❧ Sum
- ❧ Mean
- ❧ Max
- ❧ Min
- ❧ Standard deviation
- ❧ Count number
- ❧ Frequency

Visualization

❧ Histogram



❧ Graphing



# Basic Analytical Techniques



- ❧ Summarization
- ❧ Classification
- ❧ Stratification
- ❧ Age Analysis
- ❧ Duplication Testing
- ❧ Gap Testing
- ❧ Benford's Law

# Application of the basic analytical techniques in auditing

---

- ❧ Accounts receivable audit (demonstration in ACL)
  - ❧ Age analysis
  - ❧ Analyze the balances by account
  
- ❧ Accounts Payable audit (demonstration in IDEA)
  - ❧ Analyze the profile of payments
  - ❧ Test for duplicate payments
  - ❧ Searching for gaps in the check Number Sequence

# Age analysis in ACL



Age

Main | More | Output

Age On... Subtotal Fields...

DATE

Cutoff Date  
四月 1, 2008

Aging Periods  
0  
31  
59  
90  
121

Name	Title
PST	PST
GST	GST
1 GROSS_AMT	GROSS_AMT

If...

确定 取消 帮助

Minimum encountered was 0  
Maximum encountered was 149

Days	Count	Percent of Count	Percent of Field	GROSS_AMT
<a href="#">0 - 30</a>	167	55.67%	53.47%	233,037.89
<a href="#">31 - 58</a>	93	31%	28.23%	123,058.59
<a href="#">59 - 89</a>	37	12.33%	17.05%	74,303.08
<a href="#">90 - 121</a>	2	0.67%	0.72%	3,119.75
<a href="#">&gt;121</a>	1	0.33%	0.54%	2,345.54
<b>Totals</b>	300	100%	100%	435,864.85



# Analyze the balances by account in ACL



Summarize

Main | More | Output

Summarize On...

Name	Title
CUST_REF	CUST_REF
COMMENT	COMMENT
1 ACCOUNT_NO	ACCOUNT_NO

Subtotal Fields...

Name	Title
PST	PST
GST	GST
1 GROSS_AMT	GROSS_AMT

Other Fields...

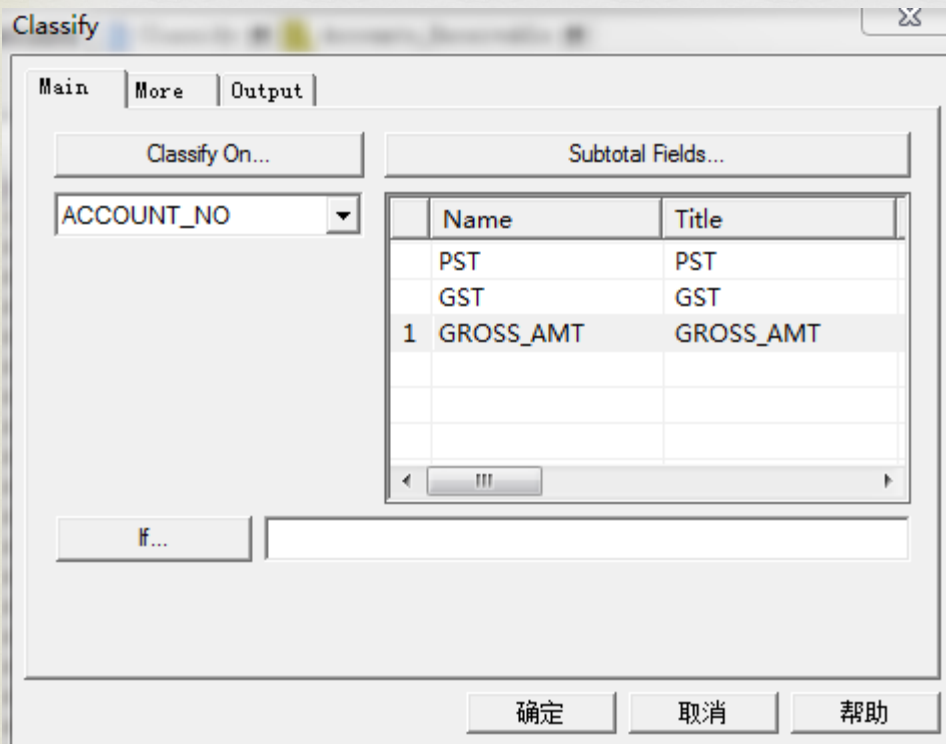
Name	Title
TYPE	TYPE
PST	PST
PAID_FLAG	PAID_FLAG

Presort      If...

确定      取消      帮助

ACCOUNT_NO	GROSS_AMT	Count
<a href="#">A123</a>	7,091.08	9
<a href="#">A128</a>	5,779.09	6
<a href="#">B008</a>	-431.00	1
<a href="#">B010</a>	6,753.69	9
<a href="#">C020</a>	19,973.49	10
<a href="#">D014</a>	21,576.24	11
<a href="#">D025</a>	10,731.56	12
<a href="#">F123</a>	6,905.79	9
<a href="#">F128</a>	5,779.09	6
<a href="#">F130</a>	-431.00	1
<a href="#">G010</a>	6,753.69	9
<a href="#">G020</a>	16,933.65	9
<a href="#">H014</a>	21,576.24	11
<a href="#">H025</a>	11,686.70	13
<a href="#">K001</a>	14,111.39	8
<a href="#">M010</a>	8,087.05	9
<a href="#">M014</a>	24,689.89	11

# Analyze the balances by account in ACL



ACCOUNT_NO	Count	Percent of Count	Percent of Field	GROSS_AMT
<a href="#">A123</a>	9	3%	1.63%	7,091.08
<a href="#">A128</a>	6	2%	1.33%	5,779.09
<a href="#">B008</a>	1	0.33%	-0.1%	-431.00
<a href="#">B010</a>	9	3%	1.55%	6,753.69
<a href="#">C020</a>	10	3.33%	4.58%	19,973.49
<a href="#">D014</a>	11	3.67%	4.95%	21,576.24
<a href="#">D025</a>	12	4%	2.46%	10,731.56
<a href="#">F123</a>	9	3%	1.58%	6,905.79
<a href="#">F128</a>	6	2%	1.33%	5,779.09
<a href="#">F130</a>	1	0.33%	-0.1%	-431.00
<a href="#">G010</a>	9	3%	1.55%	6,753.69
<a href="#">G020</a>	9	3%	3.89%	16,933.65
<a href="#">H014</a>	11	3.67%	4.95%	21,576.24
<a href="#">H025</a>	13	4.33%	2.68%	11,686.70
<a href="#">K001</a>	8	2.67%	3.24%	14,111.39
<a href="#">M010</a>	9	3%	1.86%	8,087.05
<a href="#">M014</a>	11	3.67%	5.66%	24,689.89

# Analyze the profile of payments in IDEA

Stratification

Group by: don't group      Increment: 50,000.00

Field to stratify:

- SUPPNO
- PAYEE
- INVOICE
- INV\_DATE
- AMOUNT
- CHECK
- PAY\_DATE
- AUTH

Fields to total on:

- AMOUNT
- CHECK

	>= Lower Limit	< Upper Limit
1	0.00	10,000.00
2	10,000.00	20,000.00
3	20,000.00	30,000.00
4	30,000.00	40,000.00
5	40,000.00	50,000.00
6	50,000.00	60,000.00
7	60,000.00	70,000.00
8	70,000.00	80,000.00
9	80,000.00	90,000.00
10	90,000.00	100,000.00
11	100,000.00	150,000.00
12	150,000.00	200,000.00
13		
14		
15		

Criteria:

Create database     Include stratum intervals     Create result

File name: Stratification      Result name: Stratification

Buttons: OK, Cut off, Fields, Insert, Remove, Cancel, Help

Stratum #	>= L Limit	< U Limit	# Records	(%) # Records	AMOUNT	(%) AMOUNT
1	0.00	10,000.00	280	28.03	1,200,650.85	3.52
2	10,000.00	20,000.00	149	14.91	2,257,164.61	6.61
3	20,000.00	30,000.00	116	11.61	2,912,354.72	8.53
4	30,000.00	40,000.00	82	8.21	2,881,028.82	8.44
5	40,000.00	50,000.00	78	7.81	3,521,137.79	10.31
6	50,000.00	60,000.00	72	7.21	3,913,479.17	11.46
7	60,000.00	70,000.00	61	6.11	3,926,579.42	11.50
8	70,000.00	80,000.00	84	8.41	6,363,260.83	18.64
9	80,000.00	90,000.00	36	3.60	3,069,755.59	8.99
10	90,000.00	100,000.00	38	3.80	3,612,217.66	10.58
11	100,000.00	150,000.00	1	0.10	104,112.83	0.30
12	150,000.00	200,000.00	2	0.20	383,558.60	1.12
		Lower limit exce...	0	0.00	0.00	0.00
		Upper limit exce...	0	0.00	0.00	0.00
		Totals:	999	100.00	34,145,300.89	100.00

# Test for duplicate payments in IDEA

**Duplicate Key Detection**

Output Duplicate Records  
 Output Records Without Duplicates

Criteria:

File name: Duplicate

**Define Key**

Base index on:  
NEW INDEX

Field	Direction
SUPPNO	Ascending
AMOUNT	Ascending

**Fields**

Fields to include:

	SUPPNO	PAYEE	INVOICE	INV_DATE	AMOUNT	CHECK	PAY_DATE	AUTH
1	M100	M Cash Inc	UP-76409	2008/10/1	75,000.00	701774	2008/10/6	HMV
2	M100	Cash Inc	CS - 717 -97	2008/9/13	75,000.00	701728	2008/9/15	VST
3	M100	Co Cash Inc	T5352	2008/10/17	75,000.00	701849	2008/10/20	V.S.T
4	P007	Nellie Dunn	000528CJW	2008/6/24	145.50	701531	2008/7/19	VST
5	P007	Nellie Dunn	000526CJW	2008/6/10	145.50	701490	2008/7/10	CW



# Searching for gaps in the check Number Sequence in IDEA



Gap Detection

Field to use: CHECK Criteria:

Numeric

All Starting key value: 701,001

Range Ending key value: 702,001

Gap increment: 1

Output

Create database  Create result

File name: Gap Detection Result name: Gap Detection

OK Cancel Help

	From: CHECK	To: CHECK	Number
+	701,805	701,805	1
+	701,997	702,000	4
		Total number of items detected	5
		Total number of gaps detected	2

# Advanced Analytical Techniques

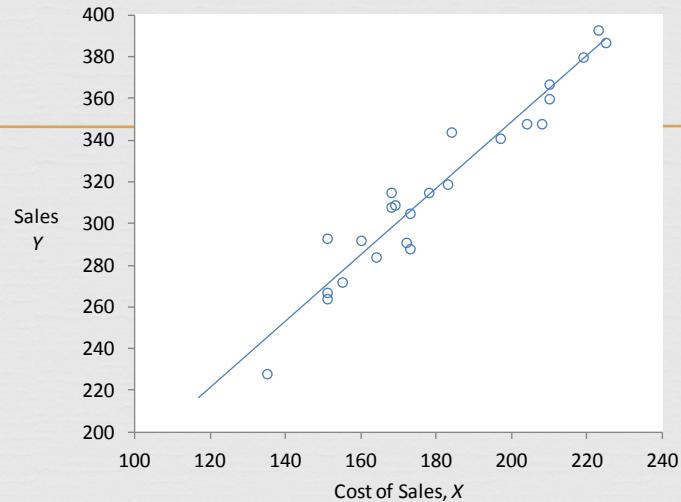


- ⌘ Regression
- ⌘ Cluster Analysis
- ⌘ Text Mining
- ⌘ Process Mining
- ⌘ Continuous Data Assurance
- ⌘ .....

# A simple regression application

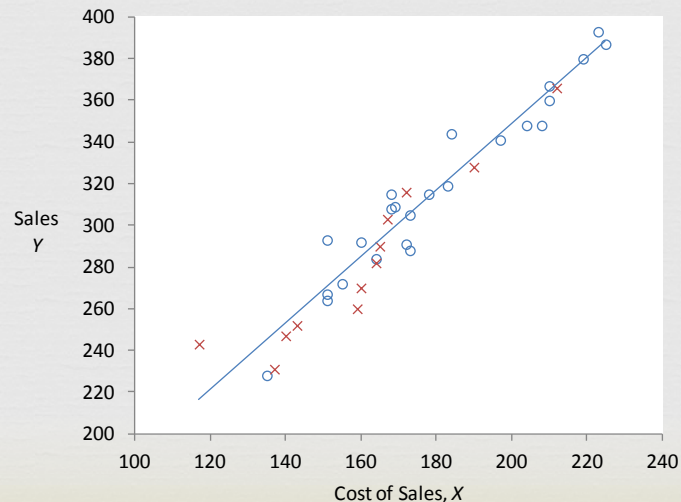
## Sales (test variable) vs. Cost of Sales (predicting variable)

		Period	Sales	COS
Base Data, Previous 2 Years	}	2009 Jan	288	173
		Feb	284	164
		Mar	393	223
		Apr	341	197
		May	387	225
		Jun	367	210
		Jul	380	219
		Aug	348	208
		Sep	360	210
		Oct	344	184
		Nov	319	183
		Dec	272	155
				<u>4,083</u>
}	2010 Jan	348	204	
	Feb	267	151	
	Mar	315	178	
	Apr	292	160	
	May	308	168	
	Jun	291	172	
	Jul	309	169	
	Aug	305	173	
	Sep	264	151	
	Oct	293	151	
	Nov	315	168	
	Dec	228	135	
			<u>3,535</u>	<u>1,980</u>
Current Data	}	2011 Jan	270	160
		Feb	231	137
		Mar	252	143
		Apr	303	167
		May	366	212
		Jun	260	159
		Jul	328	190
		Aug	247	140
		Sep	282	164
		Oct	316	172
		Nov	290	165
		Dec	243	117
				<u>3,388</u>



To form the expectation a regression function is developed based on the audited base data (two prior years in this case). The function depicted is:

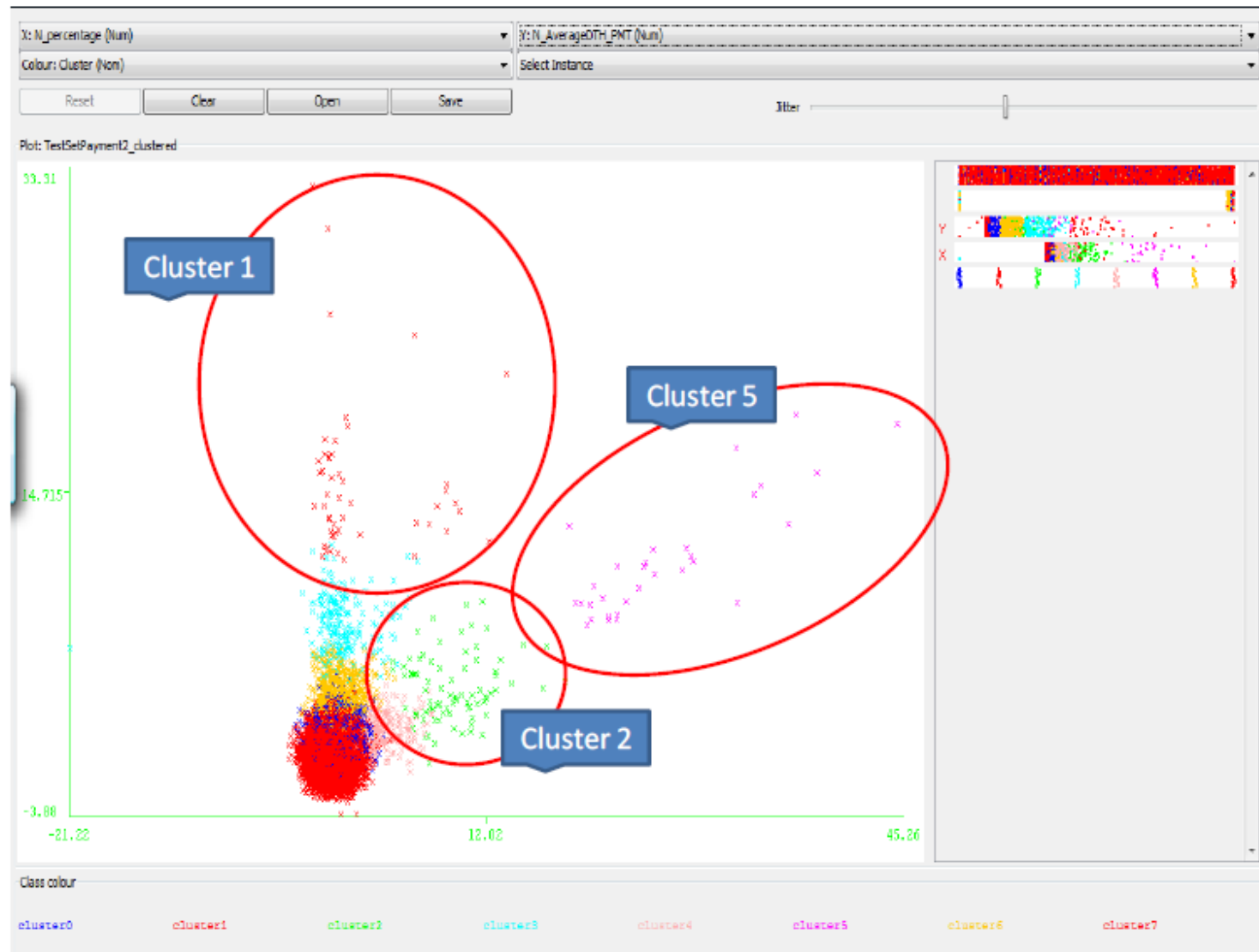
$$Y = 29.56 + 1.5951X$$



Next, *Recorded Sales* for the current period (x) are compared with *Estimated Sales* predicted by the regression model.

$$\text{Recorded} - \text{Estimated} = \text{Residual}$$

# Cluster analysis

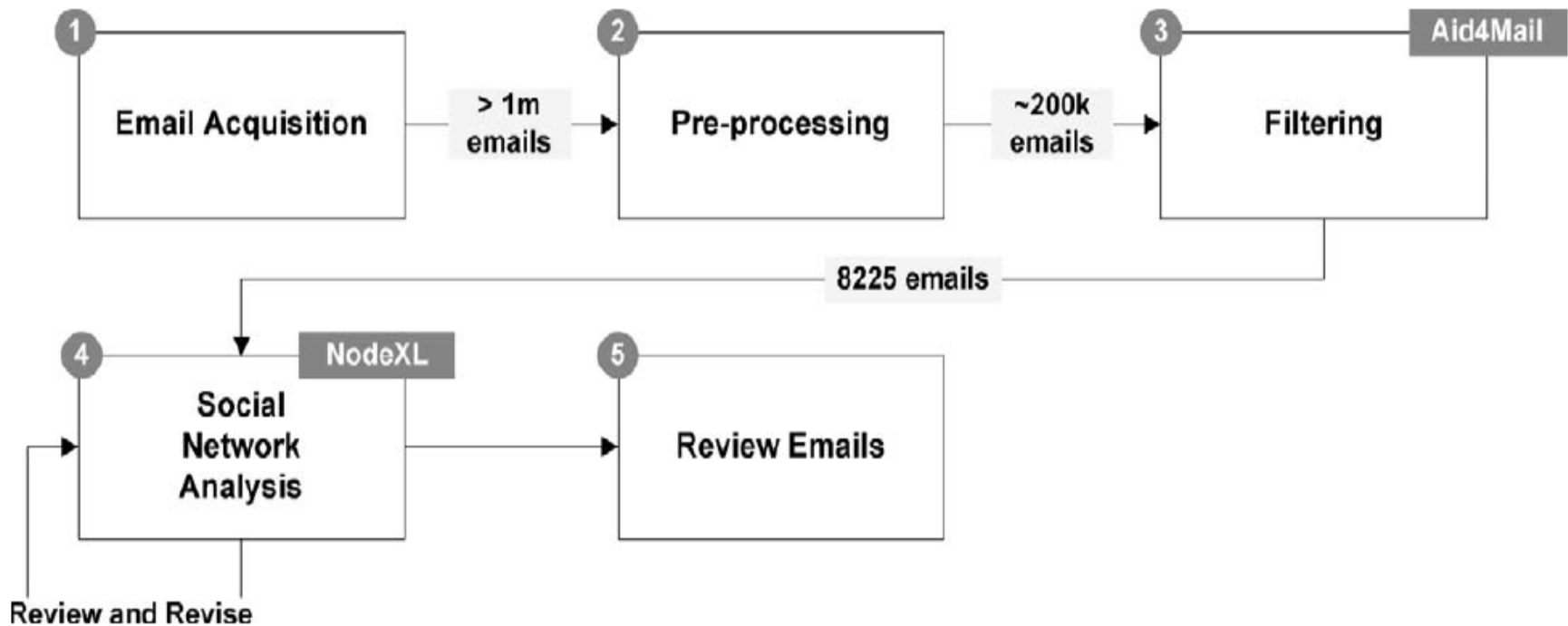




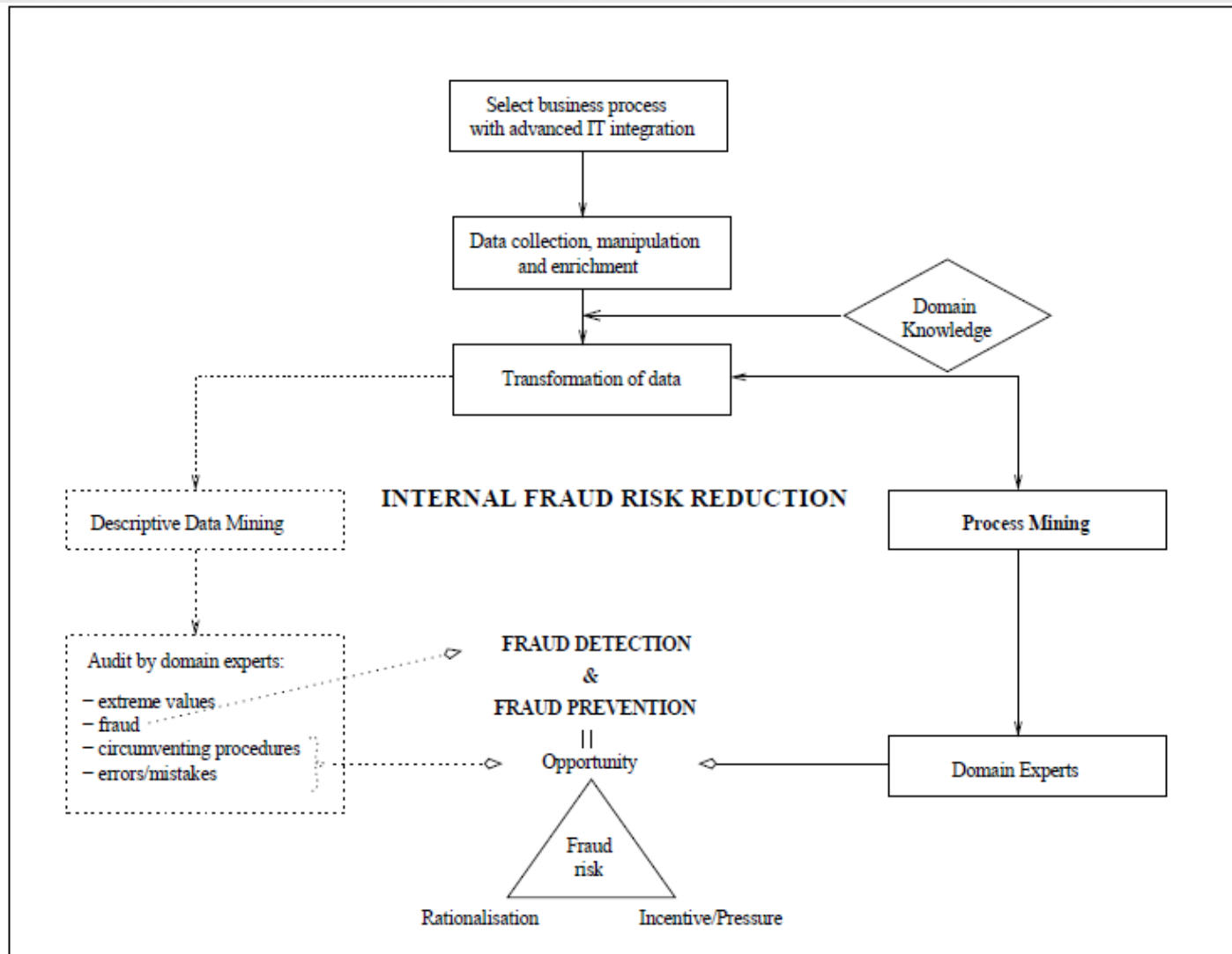
# Text mining



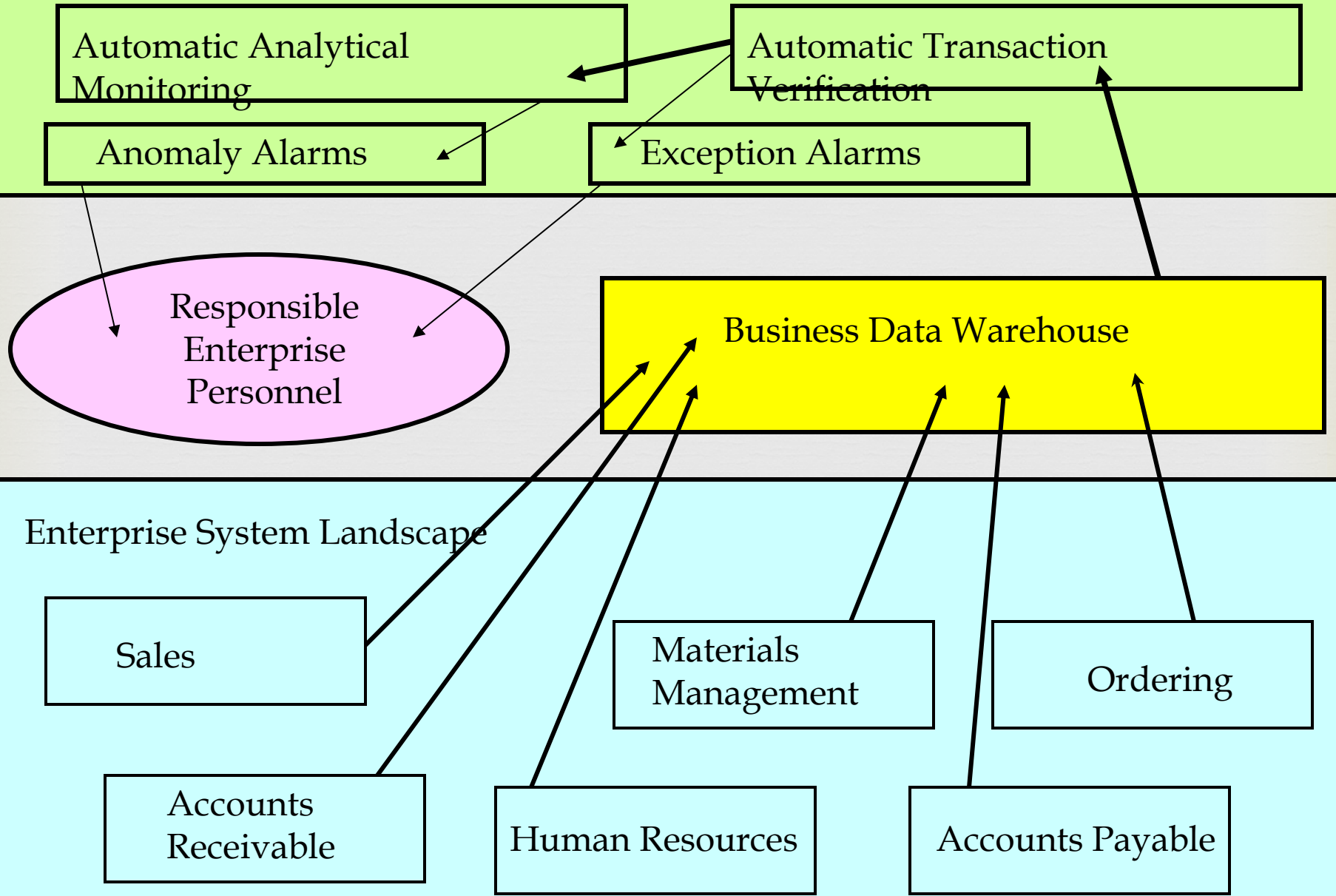
## Process Employed to Mine Enron Email Data



# Process mining



# Continuous Data Assurance System



# A new certificate in “Audit Analytics”



## ❧ Tentative courses:

❧ Audit Analytics

❧ Special Topics in Audit Analytics

❧ Information Risk Management

❧ Individual Study Course

❧ MACCY students may specialize in the area taking these courses as optionals

❧ Non-enrolled students may take the 4 course certificate independently

# Audit Analytics



## ❧ Purpose

- ❧ Meet the demand for effective and efficient audit methodologies in profession.
- ❧ Provide theoretical foundation and applied demonstration for advanced audit methodologies.

## ❧ Objectives:

- ❧ Gain a managerial overview of various analytical techniques
- ❧ Gain understanding of the evolving scenario of big data audit
- ❧ Perceive the progressive convergence of analytical methods, information processing, and auditing
- ❧ Link audit analytics to corporate continuous monitoring and business process support



# Domains of knowledge to be attained



- ❧ Analytics techniques in the audit domain
- ❧ The usage of audit analytics tools (ACL&IDEA)
- ❧ The usage of statistical software (paid or public; SAS, WEKA, R for example)
- ❧ Data extraction methods
- ❧ Statistical inference and its usage in auditing

# Analytical techniques to cover



- ❧ Descriptive statistics
- ❧ Basic data analysis
- ❧ Benford's law
- ❧ Clustering
- ❧ Text mining
- ❧ Continuity Equations
- ❧ Association Analysis
- ❧ Data Visualization
- ❧ Duplicate analysis
- ❧ Sampling
- ❧ Classification
- ❧ Regression
- ❧ Neural Network
- ❧ Process mining