RUTGERS

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Automate Contract Analysis in Auditing

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Introduction

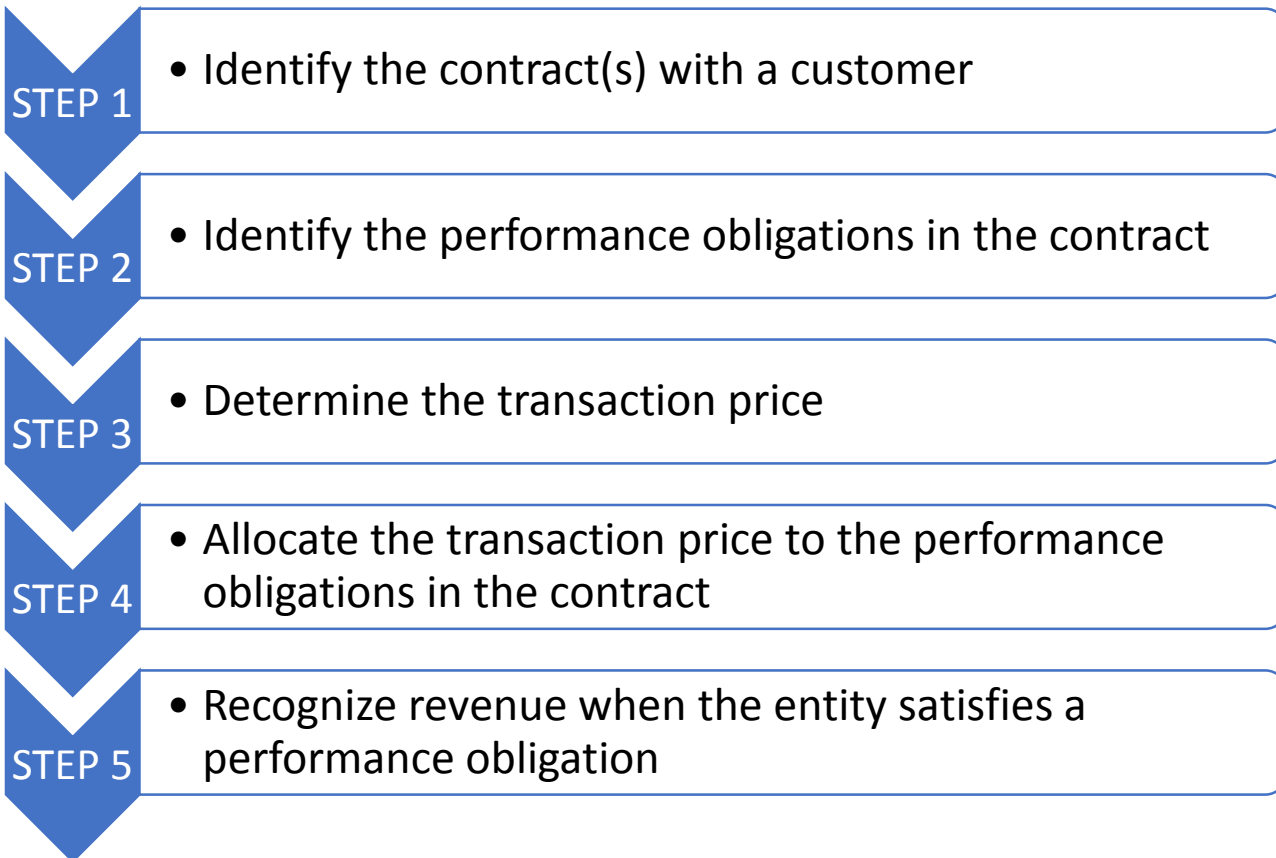- The contract is an important type of audit document throughout the audit process

Introduction

- Auditors examine contracts for *risk assessment*, *substantive test*, and *audit review*

Risk Assessment	Substantive Test	Audit Review
Litigation Risk	Sales and Revenue	Uncovered Significant Error or Fraud
Loss Assessment		
Expiring Patterns		

Introduction

- In May 2014, FASB issued ASC 606 (effective after Dec. 15, 2017): *Revenue from Contracts with Customers*

STEP 1
- Identify the contract(s) with a customer

STEP 2
- Identify the performance obligations in the contract

STEP 3
- Determine the transaction price

STEP 4
- Allocate the transaction price to the performance obligations in the contract

STEP 5
- Recognize revenue when the entity satisfies a performance obligation

Introduction

- Despite the benefits of using contract analysis to generate solid audit evidence, auditors generally only examine so-called material contracts
  - Labor intensive
  - Legal expertise
  - Not cost-benefit efficient

- The development in automated text analysis has opened up opportunities for auditors to examine populations of contracts
  - Information extraction (Kanya and Geetha, 2007)
  - Text categorization (Namburu et al., 2008)
  - Risk dictionary (Cecchini et al., 2010)
  - Topic tracking and key words extraction (Lee and Kim, 2008)

Introduction

- According to Technological Process Reframing (TPR) theory, now is an appropriate time for auditors and regulators to evaluate automated contract analysis
  - TPR theory: the reconsideration of methods and processes on an area of endeavor consequent of the advent of a disruptive technology (Issa, Sun, and Miklos, working paper)

PC
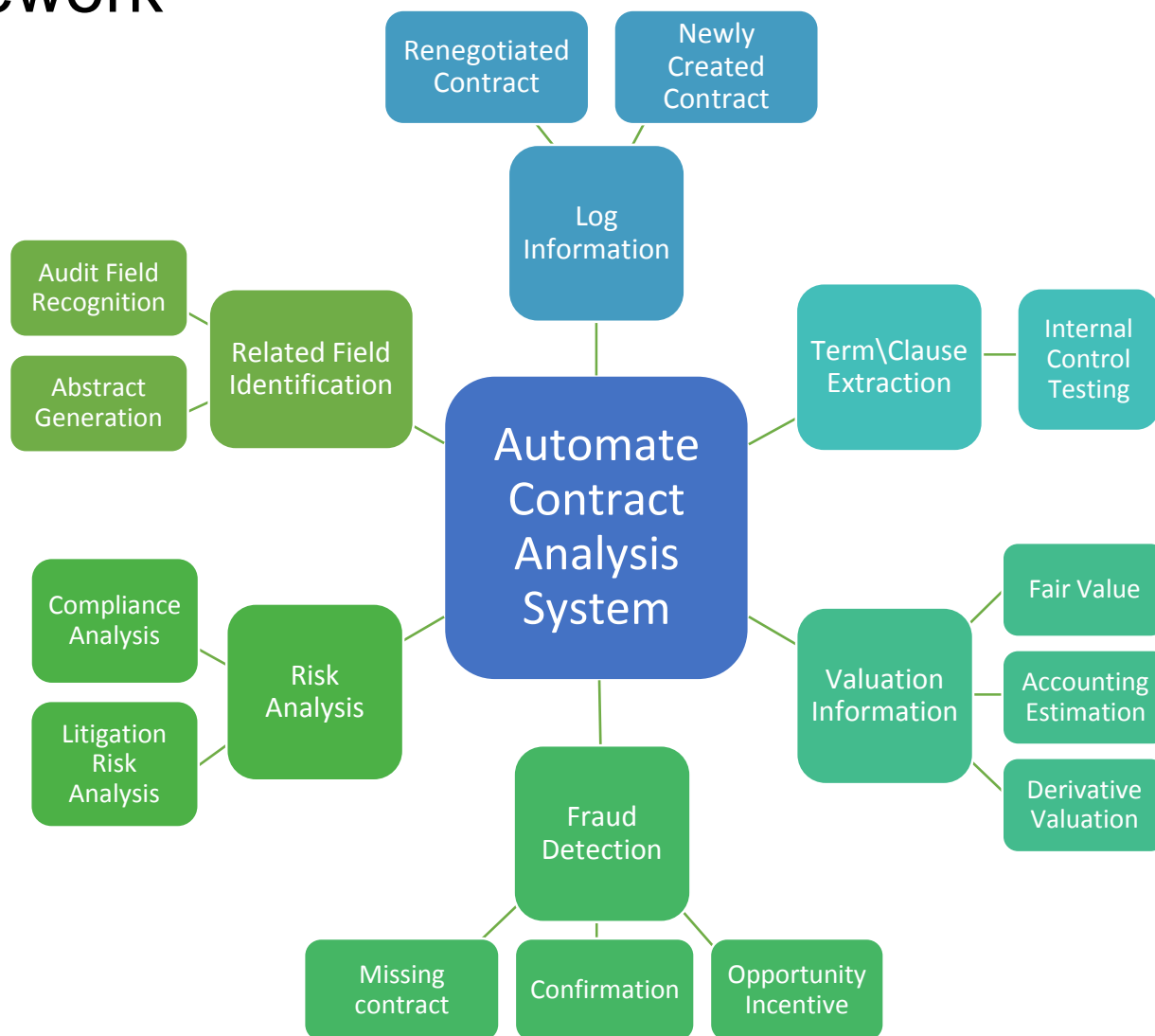
Email

Smart phone

Social
Networking

Cloud
Computing

Introduction

- In this project, we propose a framework named Automate Contract Analysis System (ACAS)
  - Enhances current contract related audit procedures

Automate Contract Analysis System (ACAS) Framework

Audit Procedures

Cushing, B. E., & Loebbecke, J. K. (1986)
modified by Deniz Appelbaum

Planning & Risk Assessment

Comparing supporting documents (e.g. contracts) to the accounting records for the evaluation of internal control (AS No. 2)

→ Automatic matching contract terms and clauses with accounting records

Evaluate exposure to losses based on contracts to decide whether the account is significant (AS No. 2)

→ Loss assessment based on text mining

Change in contracts after tests of controls is evaluated to determine whether the effectiveness of company's internal control is affected (AS No. 2; AS No. 5)

→ Log information of new or renegotiated contracts are maintained for examination

**Planning
&
Risk Assessment**

The materiality level can be affected by significant new contracts after initially established (AS No. 11)

→ Continuous monitoring materiality level relevant terms and clauses from new or renegotiated contracts

The employment and compensation contracts of executive officers are examined to assist identifying risk of material misstatement (AS No. 12)

→ Extract content from compensation contracts and present compensation structure for risk analysis

**Compliance&
Substantive Testing**

Documentation of auditing procedures includes the inspection of significant contracts or agreements (AS No. 3)

→ Automatic identify contract with its related audit area and provide key describing characteristics

Contracts and other agreements are examined to identify related parties (AS No. 18)

→ Information of related parties in contracts are extracted by contract analysis tools for further investigation

Confirming the existence and terms of important contracts is used for fraud detection (incentive and opportunity) (AU 316)

→ Significant terms and clauses are extracted for confirmation and other fraud identification analysis

Compliance& Substantive Testing

Related contracts are examined for auditing fair value measurements and accounting estimates (AU 328; AU 342)

→ Information of accounting measurement and valuation are obtained for matching with managements' assertions

Auditing derivative instruments, hedging activities, and investments in securities are based on related contract terms (AU 332)

→ Valuation characteristics of derivatives, hedging, or other investments are extracted from related contracts and used as input of valuation models for evaluation

Reading contracts, loan agreements, leases, and other similar documents concerning litigation, claims, and assessments (AU 337)

→ Extract important litigation risk related clauses and terms for further investigation by specialist

Review

Qualitative factors of evaluating audit results include examining the company's compliance with contractual agreements and violations of contractual provisions (AS No.14)
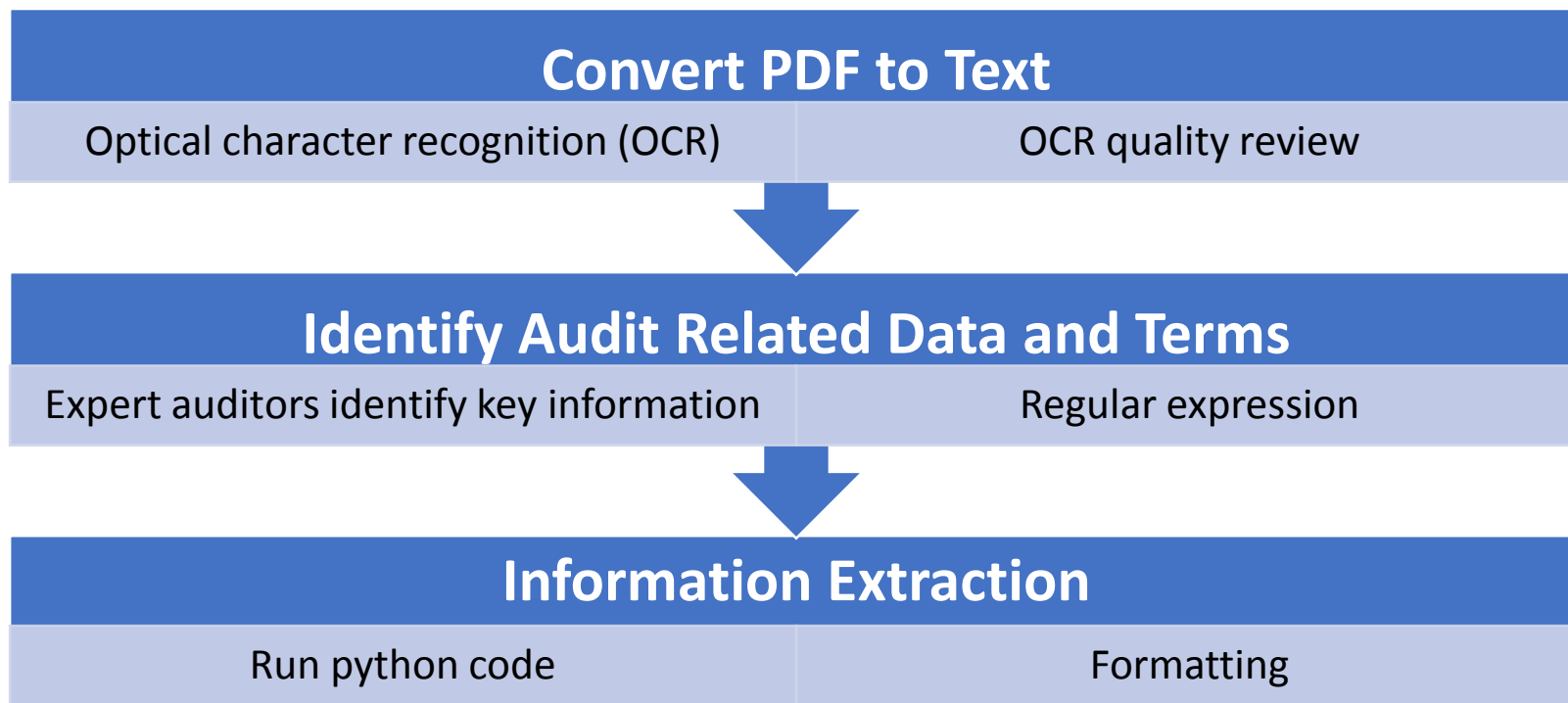
Compliance analysis is performed by extract and aggregate information from identified related contracts and present such information to auditors for compliance evaluation

Related Linguistic Analysis Techniques

- Topic tracking and key words extraction (Lee and Kim, 2008)
- Text categorization (Namburu et al., 2008)
- Association rule mining (Goh and Ang, 2007)
- Information extraction (Kanya and Geetha, 2007)
- Risk dictionary (Cecchini et al., 2010)

Case – Reinsurance Contract Information Extraction

- Sample: 10 reinsurance contracts
  - 3 sub contracts and 10 endorsements
  - Every contracts has around 29,530 words in 64 pages
  - Most contents and provisions are identical
  - PDF format

Convert PDF to Text	
Optical character recognition (OCR)	OCR quality review

Identify Audit Related Data and Terms	
Expert auditors identify key information	Regular expression

Information Extraction	
Run python code	Formatting

Case – Reinsurance Contract Information Extraction

					Variables of Contracts													
		Period of Insurance			Limit of Liability									Retention			Retroactive date	
					Professional Liability			General Liability										
Contract Number	Policy Number	From	To	Policy Aggregate	Each claim	Each Location Aggregate	Each claim	Each Location Aggregate	Products Completed Operations Aggregate	Personal and Advertising Injury Limit	Damage To Premises Rented to You Limit	Professional Liability	General Liability	Gross premium USD$	Professional Liability	General Liability
1	A4DB12012013	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/1/2000	11/2/2000
2	M0DB12012013	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	5/1/2004	5/1/2004
3	A11DB12012013	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/1/2000	11/1/2000
4	A12DB12012013	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/1/2000	11/1/2000
5	A17DB12012013	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	6/1/2001	6/1/2001
6	NA	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/112000	11/1/2000
7	NA	12/1/2013	12/1/2014	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	5/1/2004	5/1/2004
8	NA	NA	NA	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/1/2000	11/1/2000
9	NA	NA	NA	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$0	$0	NA	11/1/2000	11/1/2000

Conclusion

- The development in automated text analysis has opened up opportunities for auditors to examine and analyze contracts effectively and efficiently

- We propose a framework named Automate Contract Analysis System (ACAS) to incorporate linguistic analysis techniques to help auditors perform audit procedures on contracts

- One of the ACAS information extraction function is demonstrated in a case with reinsurance contracts

Contribution

- Expand the scope of feasible audit work by including the contract analysis

- Provide a cost-benefit efficient solution to the problem of auditing the whole population of contracts

- Demonstrate the feasibility of incorporating text mining into audit procedures

- Adapting auditing to the movement into Big Data era

Future Work

- Develop specific contract analysis procedures under the ACAS framework

- Conduct case study on ACAS framework with more sample contracts

- Expand ACAS framework to assist auditors analyze more documents with text content