TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.

Analytical Support of Financial Footnotes Analysis

XBRL Conference

Maryam Heidari

Maryam.heidari@bwl.tu-freiberg.de

01.06.2016

Prof. Dr. Carsten Felden
Technische Universität Bergakademie Freiberg (Sachsen)
Institut für Wirtschaftsinformatik
Silbermannstraße 2, 09599 Freiberg (Sachsen), Deutschland

Agenda

- Introduction
- Research Problem
- Research goal
- Research Methodologies
- Implementations
- Evaluation and Results
- Limitation and further Research

Introduction

Financial analysis Process(Bauwman et al., 1987)

Introduction : Financial footnotes and XBRL

- **Footnotes Tagging procedures (4 level)**

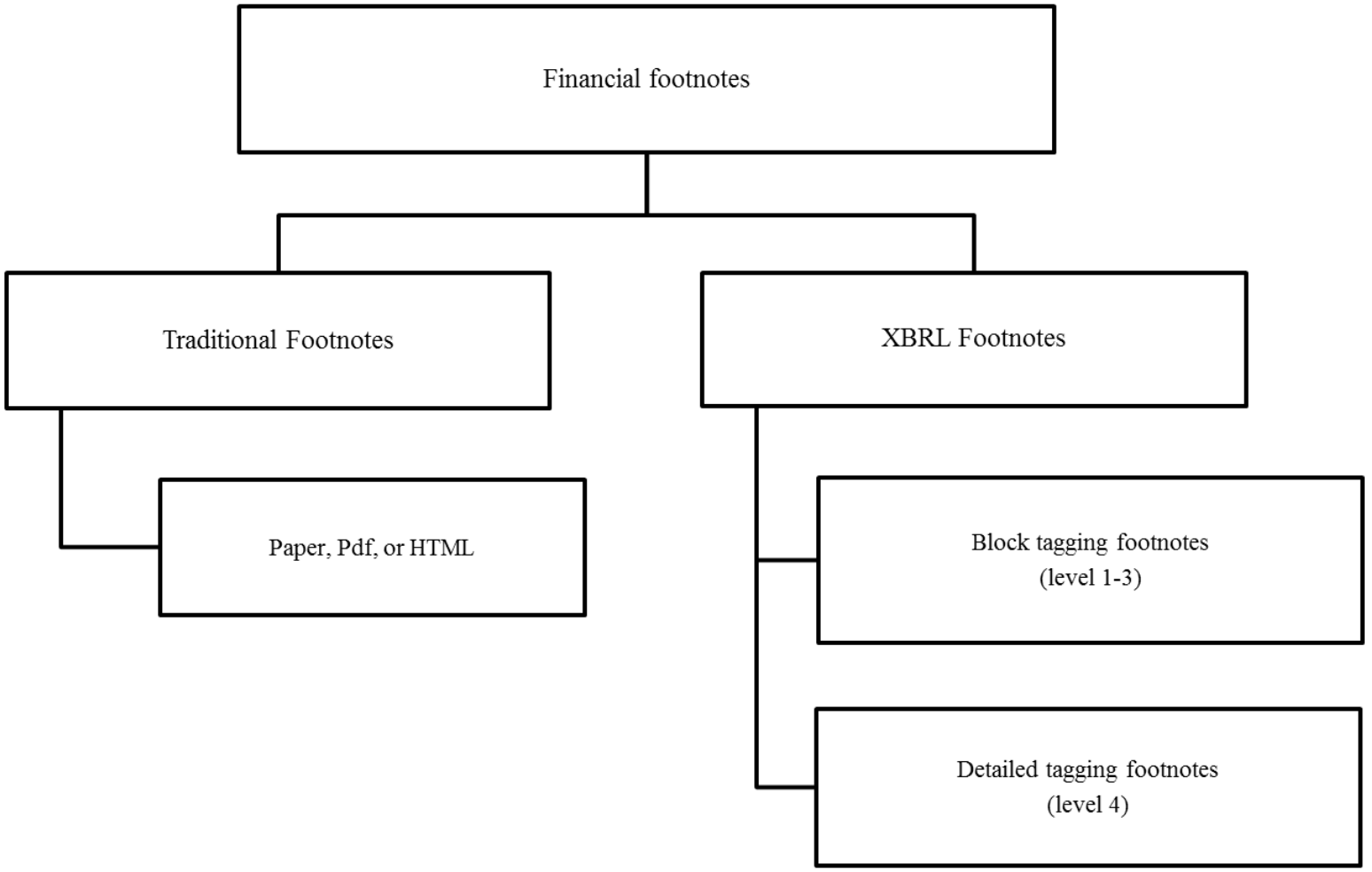
Level 1- Block tagging

Level 2- Block tagging of significant accounting policies footnote

Level 3- Tables block tagging

Level 4- Detailed footnotes tagging

Introduction: Financial footnotes' formats



Research Problem

- Based on studied use cases
- Based on literature review :

1. Financial analysis domain
2. Using Text mining in financial domain

- According to expert interviews

❖ Footnotes information can not be ignored.

❖ No Automatic solution to extract/analysis

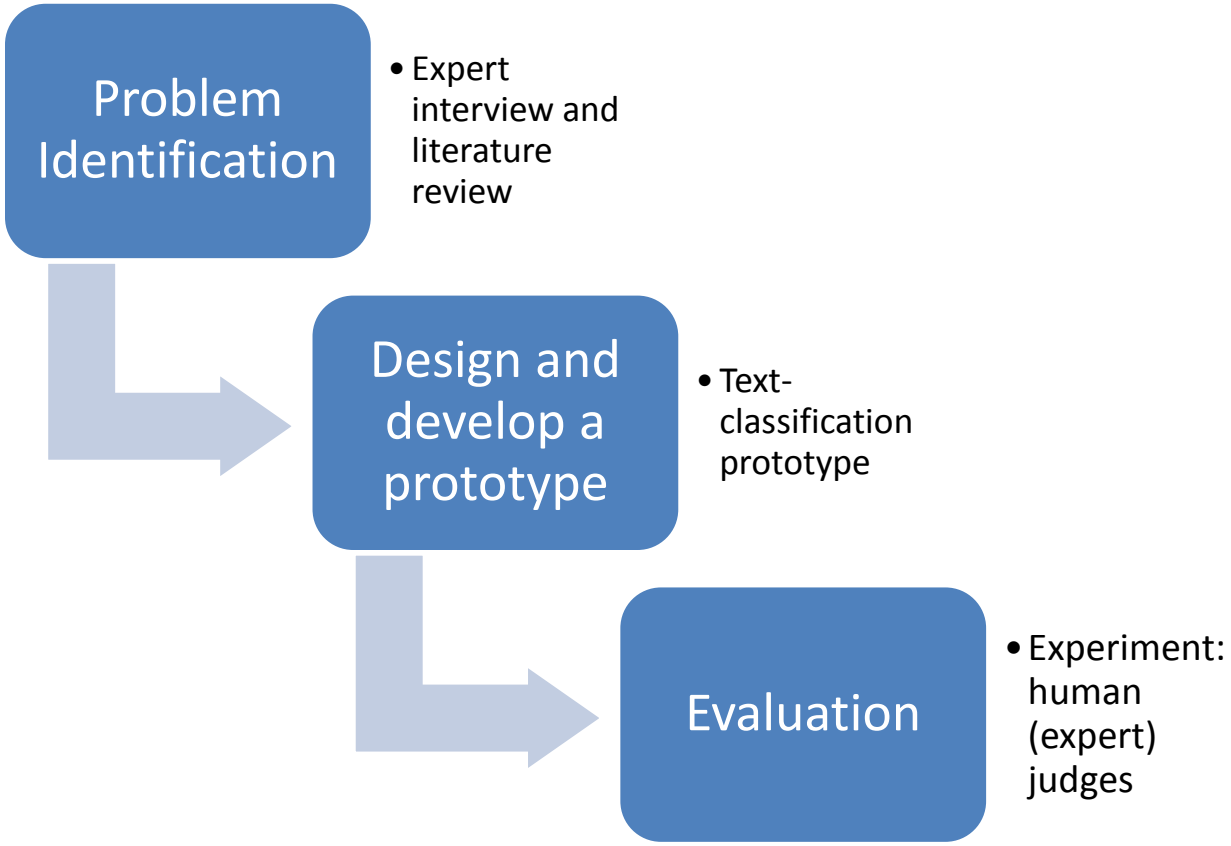
❖ Extreme manual effort is needed

Research Goal

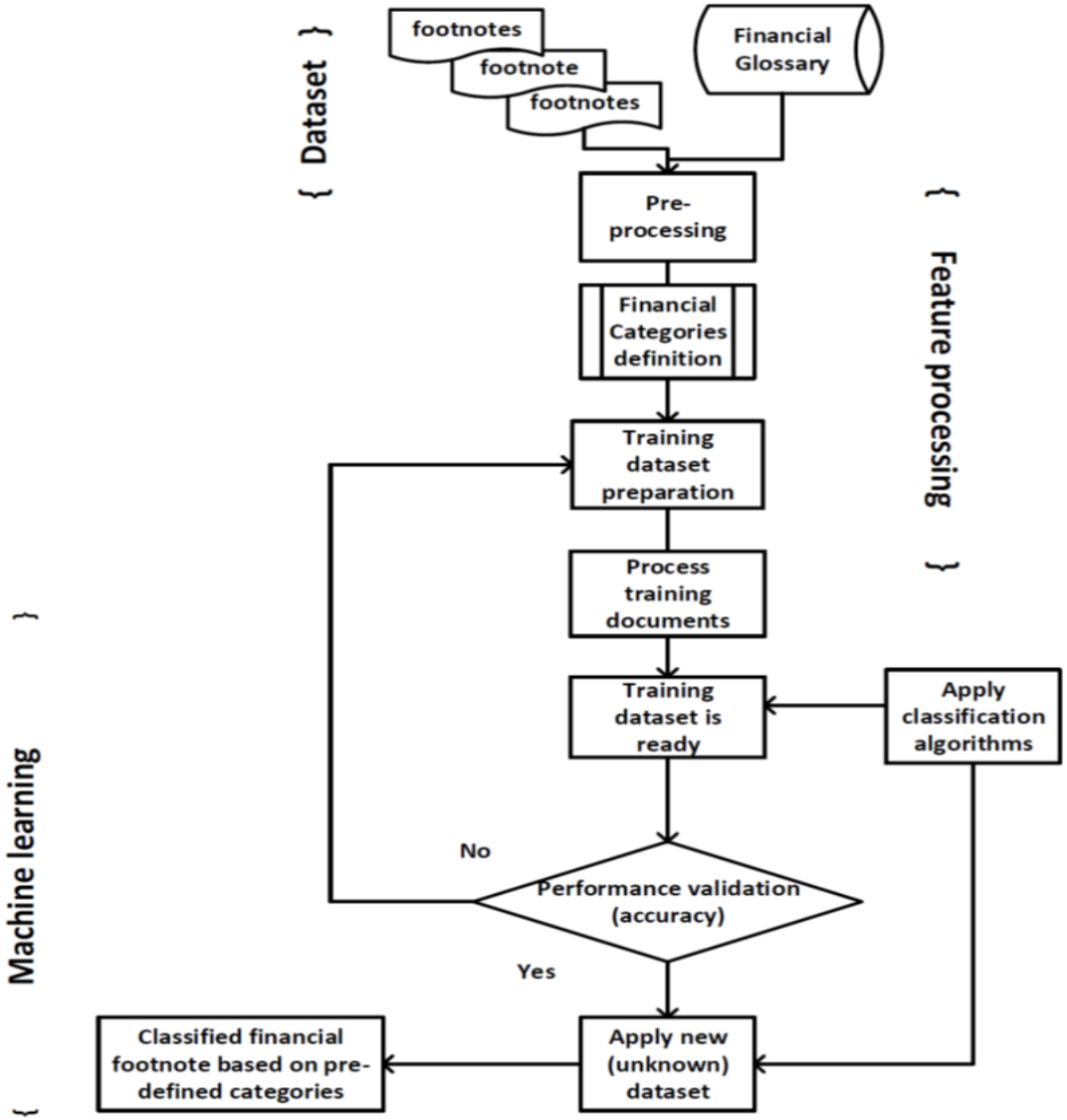
Research aims to design and evaluation of a practically applicable method to facilitate financial footnotes extraction/analysis process.

Research Methodology

Methodology: Design Science Research (DSR) (Hevner, 2004)



Design and Implementation



Design and Implementation

- Tool: **Rapid miner**
- Database: **Edgar online database**
- Examined footnote: **Income tax** (6 categories are defined):

1. Deferred tax asset;
2. Effective tax rate;
3. Net operating loss (NOL);
4. Taxation authority;
5. Unrecognized tax benefit;
6. Valuation allowance

- Different classification algorithms (supervised and unsupervised) are applied.
- Different criteria are observed: accuracy, run time, …
- The best results belongs to **Naïve Bayes** algorithm

The Results of Text Classification Algorithms

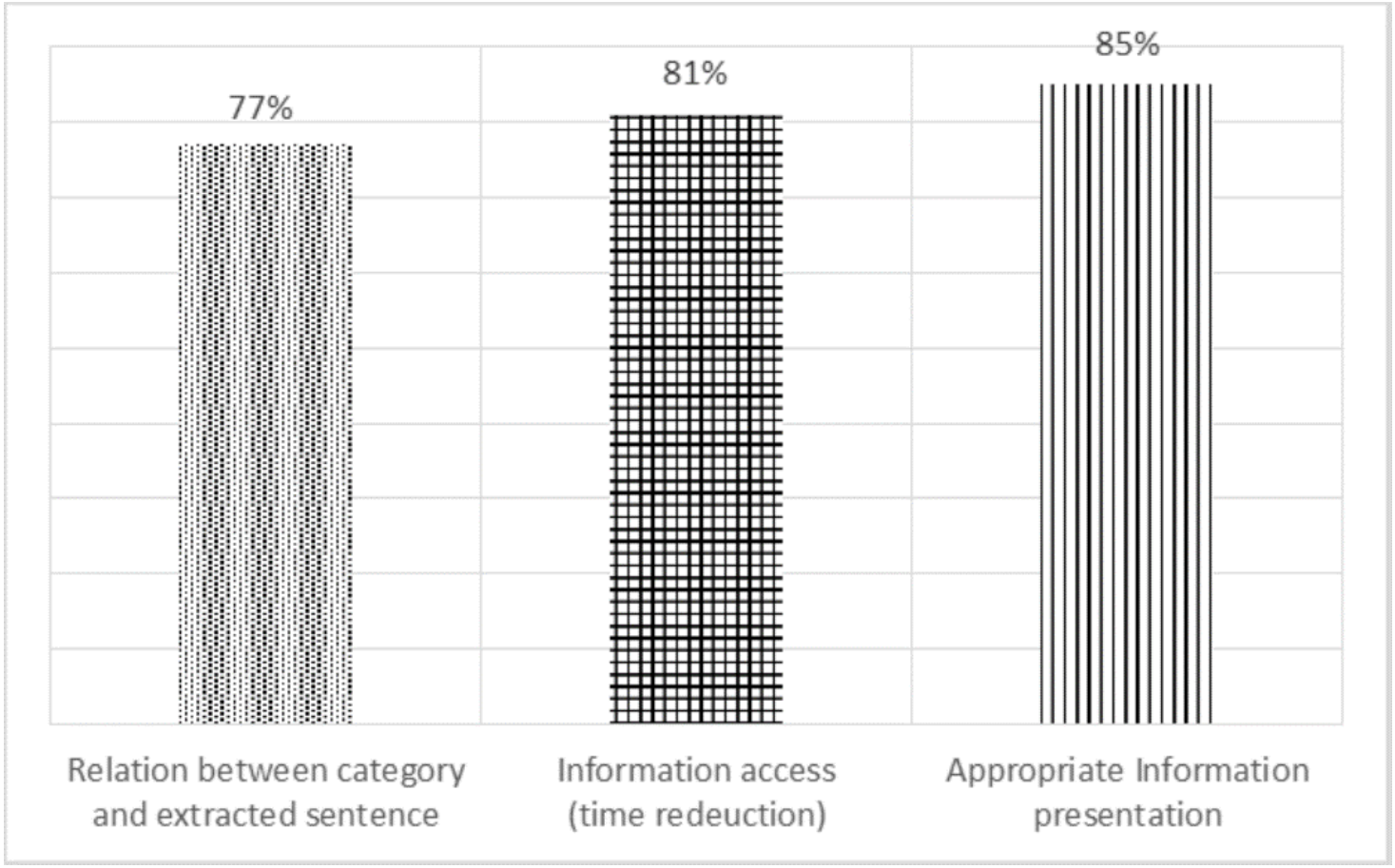
Algorithm	Run time	Accuracy	Absolute error	Precision	Recall	RMSE
K-NN	7s	81.82%	0.183	82.34%	80.92%	0.362
Naïve Bayes	4s	82.86%	0.171	78.48%	77.85%	0.414
SVM	28s	79.22%	0.784	80.37%	78.46%	0.786
Decision tree	1m 45s	90.65%	0.136	91.38%	90.82%	0.280

Unsupervised algorithm	K	Run time	Ave. within centroid distance	Davies-Bouldin
K-means	6	7min 20s	-0.827	-4.763

Qualitative evaluation: Experiment

Goal: to evaluate the efficiency of the text mining prototype on financial footnote analysis.
Judges (experts): ten financial experts in audit and financial advisory domains
Content of Experiment: 12 income tax footnotes from different industries
Minimum length: 3 pages
Experts are given: 1. Plain text of footnotes (input of the prototype) 2. Classified footnotes (output of the prototype)
The experts were asked to read each income tax footnote fully first and then to proceed to the related output table. Subsequently, they were invited to reply to the online questionnaire to rate the quality of the system based on different criteria using a five-point scale ranging from one to five.

Results and Discussion



Results and Discussion

Different approaches to textual part of financial reports	Type of financial report	Description of method	Challenges and benefits
Traditional approach	Traditional reports (Pdf, html, printed reports)	Manual process base on reading whole documents	• Time consuming and error-prone
XBRL (block and detailed tagging)	XBRL reports	Tables and numbers are tagged but narrative information within footnotes lines should be analyzed manually	• Both tagging procedures help just to have a unified structure in financial reports • Soft information are still read manually which it is Time consuming and error-prone
Content analysis based on coding system	Traditional reports (Pdf, html, printed reports)	Manual code assignment to the text	• Codes should be assigned manually to the texts every time for each report • Mistakes of human coders • More accurate in comparison with manual processing
Proposed text classification prototype	Applicable for both traditional and XBRL reports	Automatic classification of financial footnotes based on pre-defined categories	• Footnotes are classified automatically • Textual parts of footnotes are accessible through pre-defined categories • Time saving • More accurate in comparison with manual procedures • Training documents process have been done manually (for training the model) • Increasing the number of categories reduces the accuracy of the prototype

Research Limitation

- Challenge of manual process of training documents
- Focused just on one of the footnote item (income tax). (limitation of the number of footnotes for prototype)
- Mapping financial footnotes into figures and values in financial statements.
- Expert interview and experiment phase conducted in German financial audit and financial advisory companies.

Further Research

Theme 1: An additional study would be necessary to extend the model for more footnotes items such as leases, debt, and etc.
An additional study using different topics in financial footnotes, could significantly add to the presented results.

Theme 2: A complementary study can add more inside to the artefact results by conducting the experiment by different experts in different countries.

Theme 3: Add more mapping capabilities to link some of textual information to their related figures in the main body of financial reports.

Theme 4: Applying not just textual disclosure of financial reports (footnotes) but other existing textual references extracted from internet, new, and etc. to the prototype to be able to increase efficiency and effectiveness of the results.

Fragen?

maryam.heidari@bwl.tu-freiberg.de