CSC 5741
Lecture 4: Data Pre-processing and Transformation

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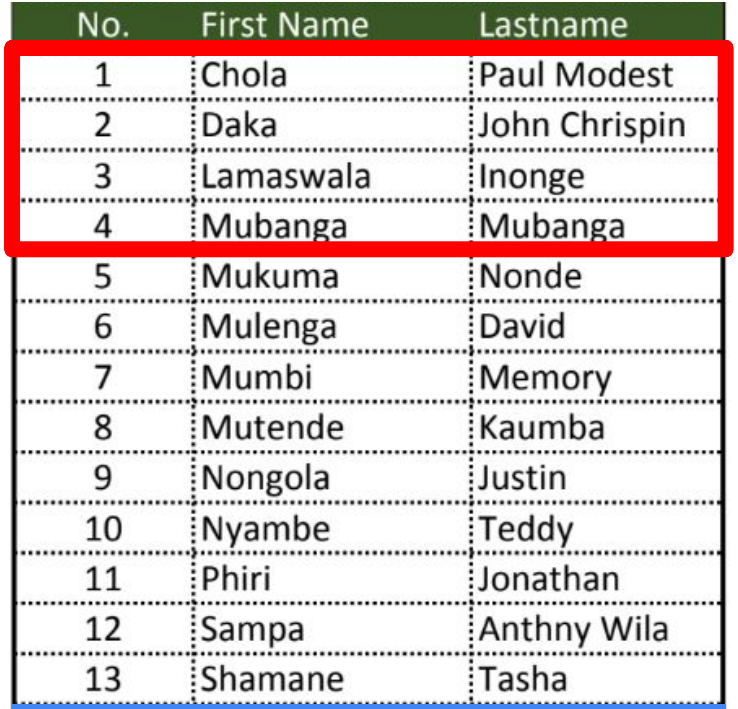
Announcements—April 16, 2019 (1/2)

- **Paper reading suggestions**
  - Accounts towards class participation
  - HINT: Suggest papers you will include in the background section of the Technical Report
- **Grading of assessments**
  - Grading will be finalised before end of this week

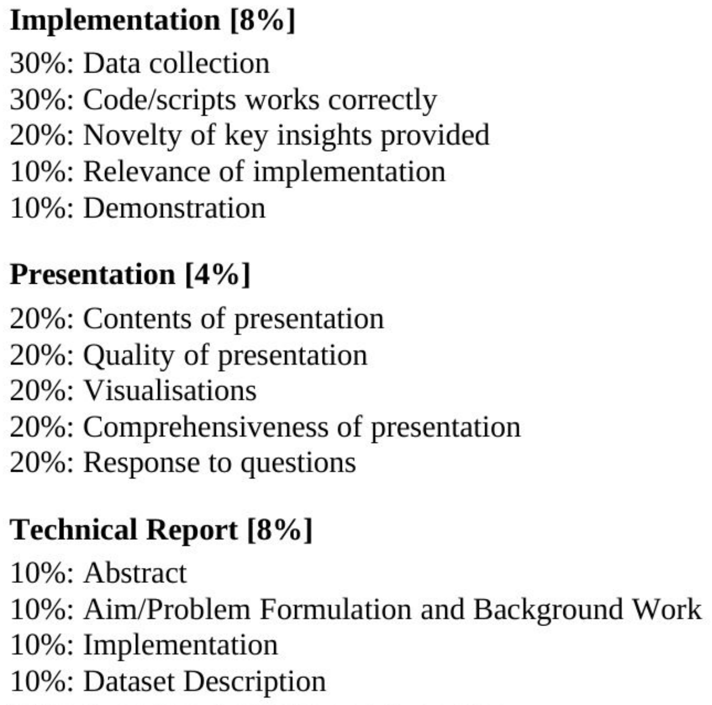


No.	First Name	Lastname
1	Chola	Paul Modest
2	Daka	John Chrispin
3	Lamaswala	Inonge
4	Mubanga	Mubanga
5	Mukuma	Nonde
6	Mulenga	David
7	Mumbi	Memory
8	Mutende	Kaumba
9	Nongola	Justin
10	Nyambe	Teddy
11	Phiri	Jonathan
12	Sampa	Anthny Wila
13	Shamane	Tasha

https://groups.google.com/a/unza.zm/forum/?hl=en#!forum/csc5741

Announcements—April 16, 2019 (2/2)

- **Mini Project progress**
  - Ensure you draw up a plan, with specific details of tasks and activities
  - Get the easy portions of the project out of the way
- **Mini Project data collection**
  - Jupyter Notebook walkthrough



Implementation [8%]

30%: Data collection
30%: Code/scripts works correctly
20%: Novelty of key insights provided
10%: Relevance of implementation
10%: Demonstration

Presentation [4%]

20%: Contents of presentation
20%: Quality of presentation
20%: Visualisations
20%: Comprehensiveness of presentation
20%: Response to questions

Technical Report [8%]

10%: Abstract
10%: Aim/Problem Formulation and Background Work
10%: Implementation
10%: Dataset Description

https://groups.google.com/a/unza.zm/forum/?hl=en#!forum/csc5741

Lecture Series Outline

- Part I: Academic Talk
- Part II: Paper Reading Discussion
- Part III: Data Pre-processing
- Part IV: Data Transformation

Lecture Series Outline

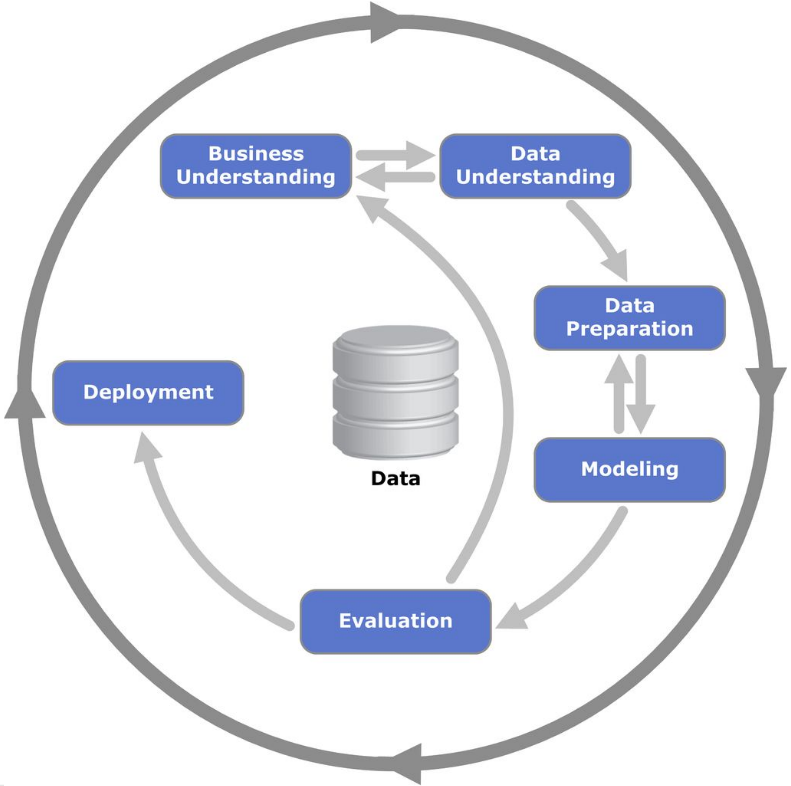
- Part I: Academic Talk
  - Friday Chazanga, University of Zambia
  - Title: “Development of a Two-Factor Authentication for Vehicle Parking Space Control Based on Automatic Number Plate Recognition and Radio Frequency Identification”
- Part II: Paper Reading Discussion
- Part III: Data Pre-processing
- Part IV: Data Transformation

Lecture Series Outline

- **Part I: Academic Talk**
- **Part II: Paper Reading Discussion**
- **Part III: Data Pre-processing**
  - Introduction
  - Text Preprocessing
  - Tokenization
  - Jupyter Notebook Walkthrough
- **Part IV: Data Transformation**

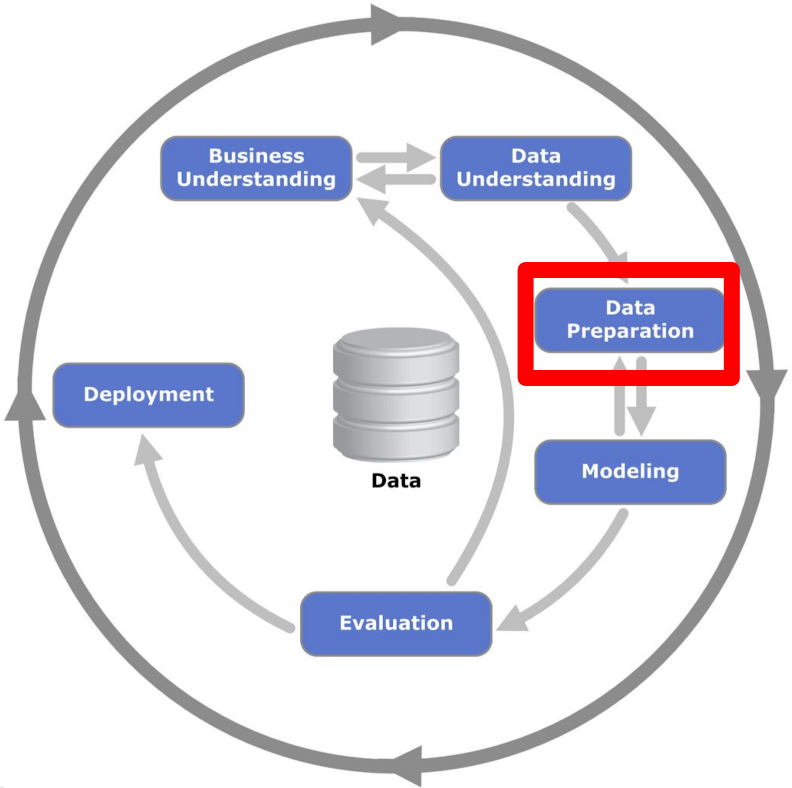
Introduction (1/3)

- **The Cross-industry standard process for data mining (CRISP-DM) is a model commonly used to highlight approaches in data mining**
  - CRISP-DM segments a data mining project into six phases with no strict order of execution
  - Surveys conducted suggest CRISP-DM is the most widely used methodology



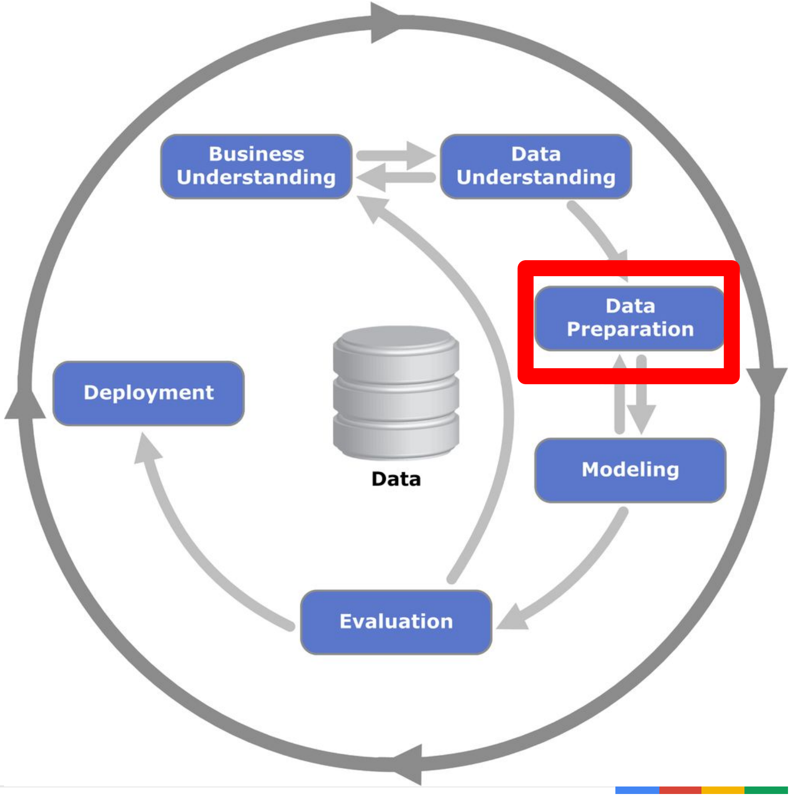
Introduction (2/3)

- Select data required for modeling process/phase
- Clean the data
- Reconstruct the data and derive necessary attributes
- Merge different data sources
- Reformat the data



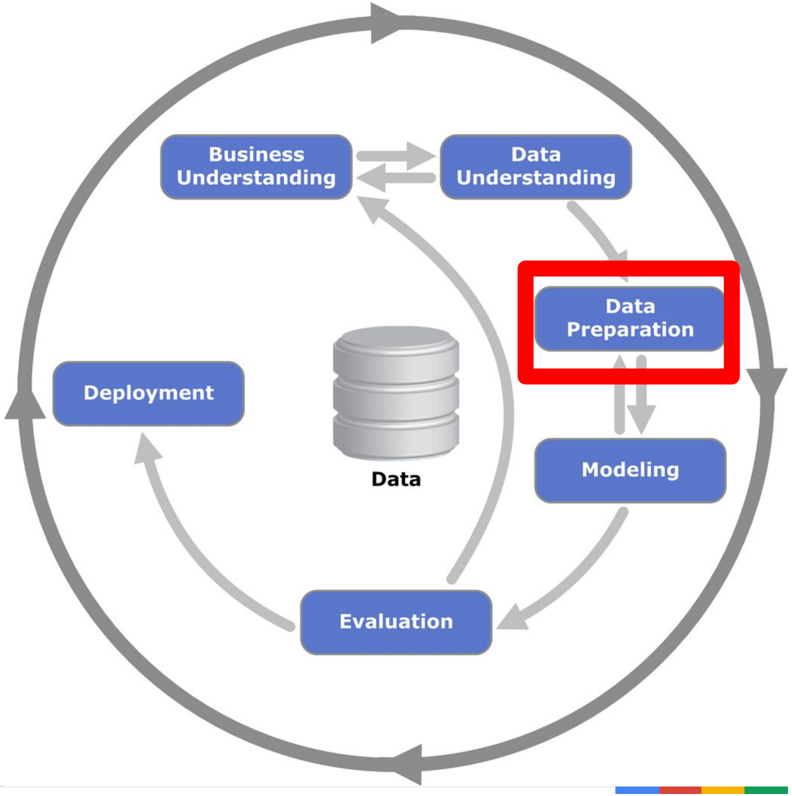
Introduction (3/3)

- Terminologies
  - Document—Set of terms such as a file
  - Term—Individual word contained in a document
  - Corpus—Collection of documents



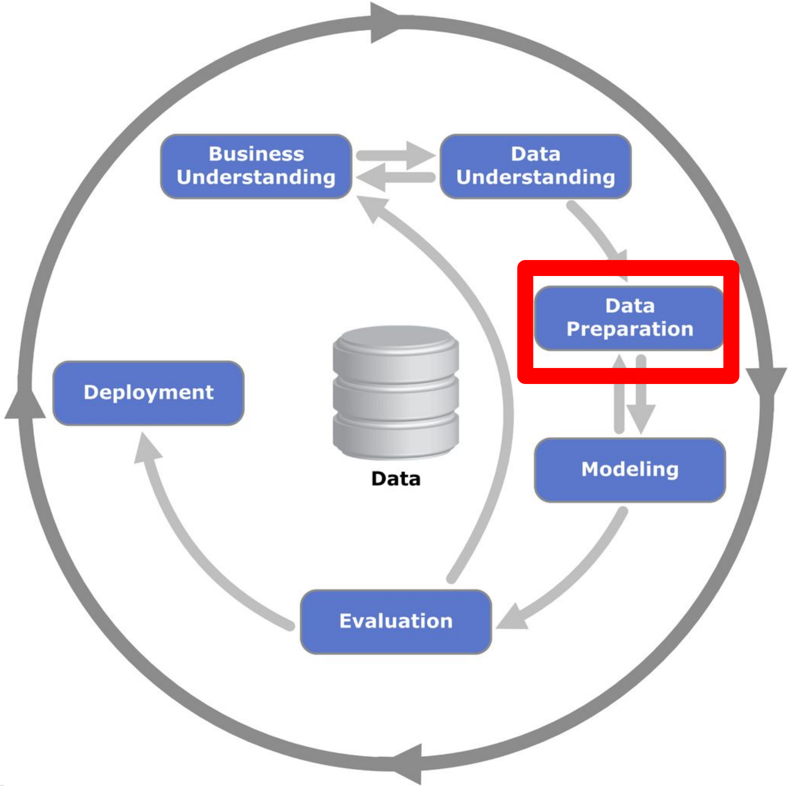
Data Cleaning (1/2)

- Data preprocessing typically involves data cleaning
  - Removing duplicate entries
  - Dealing with null values: removing vs replacing null values
  - Dealing with outliers



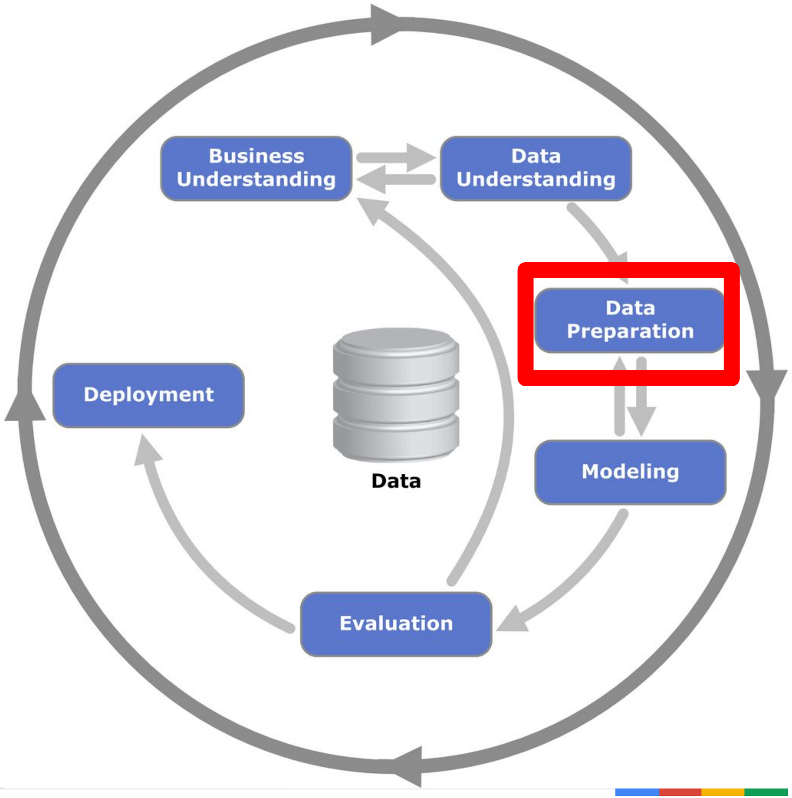
Data Cleaning (2/2)

- Textual content by far involves the most pre-processing steps
- Common text pre-processing techniques generally involve several iterations of cleanup steps
  - Removing duplicate entries
  - Dealing with null values: removing vs replacing null values
  - Dealing with outliers



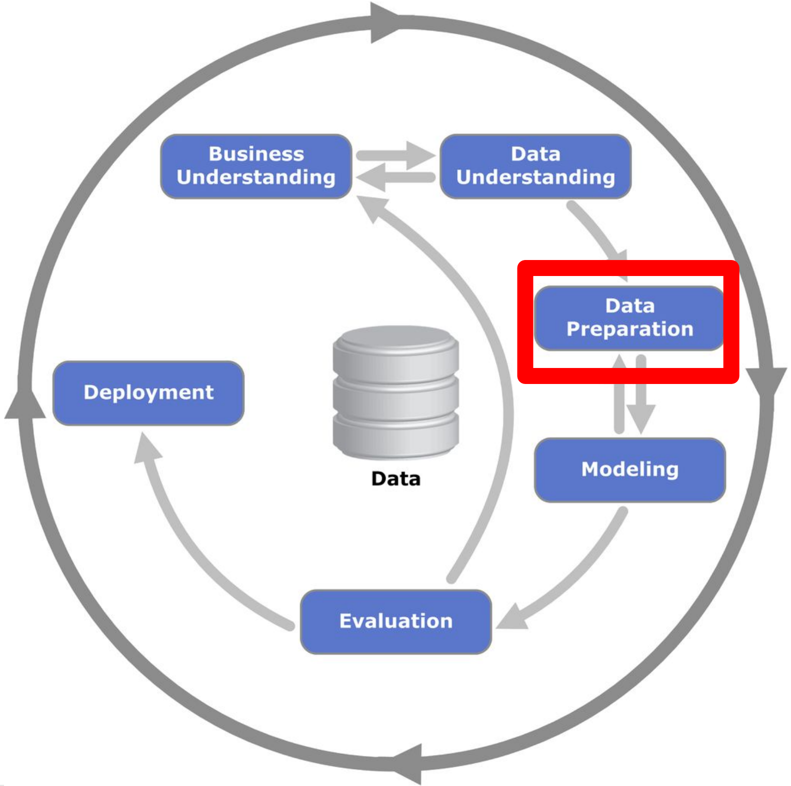
Text Processing (1/10)

- Text processing techniques include
  - Case folding
  - Stemming
  - Stopping
  - Removing Punctuations
  - Deduplication
  - Missing Values
  - Tokenization



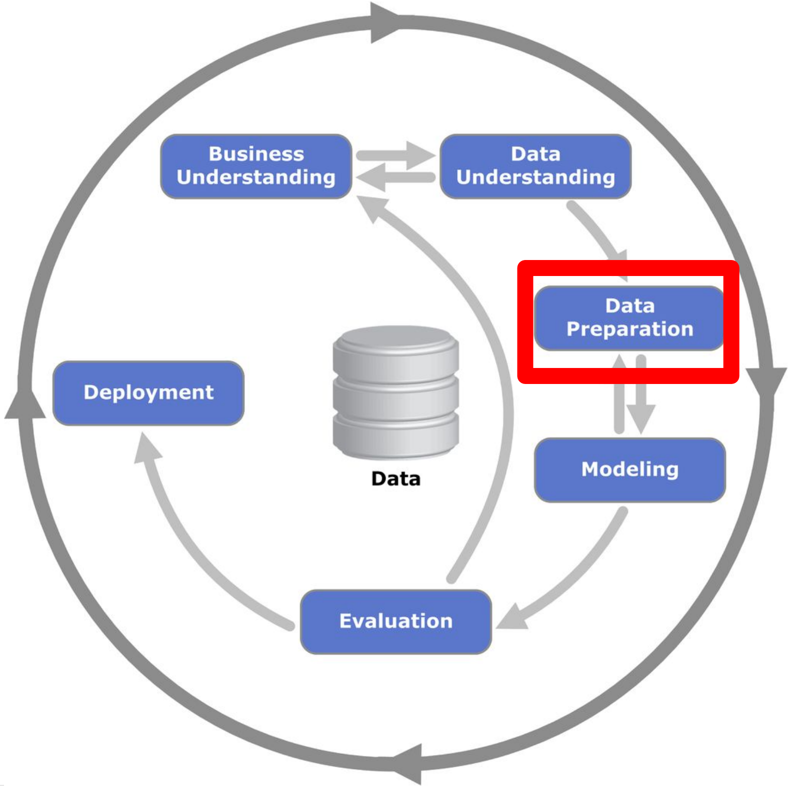
Text Processing (2/10)

- Case folding
  - Textual content is generally case sensitive: e.g. RDBMS
    - Zambia vs ZAMBIA vs ZaMbia
    - **var_x = {“Zambia”, “ZAMBIA”, “ZaMbia”, Zambia}**
    - **len(var_x)**
  - Case folding involves changing all document terms to a standard case, e.g. lower case



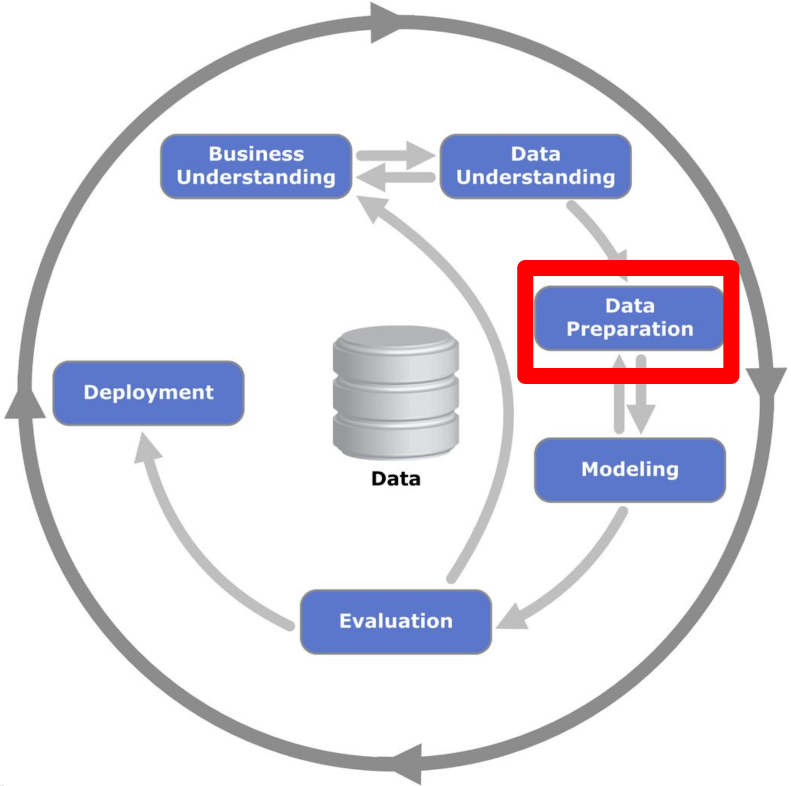
Text Processing (3/10)

- **Stemming**
  - Changing document terms into canonical versions
  - Stemming should avoid mapping words with different roots to the same stem
  - Poster’s Stemming Algorithm applies rules based on patterns of vowel-consonant transition



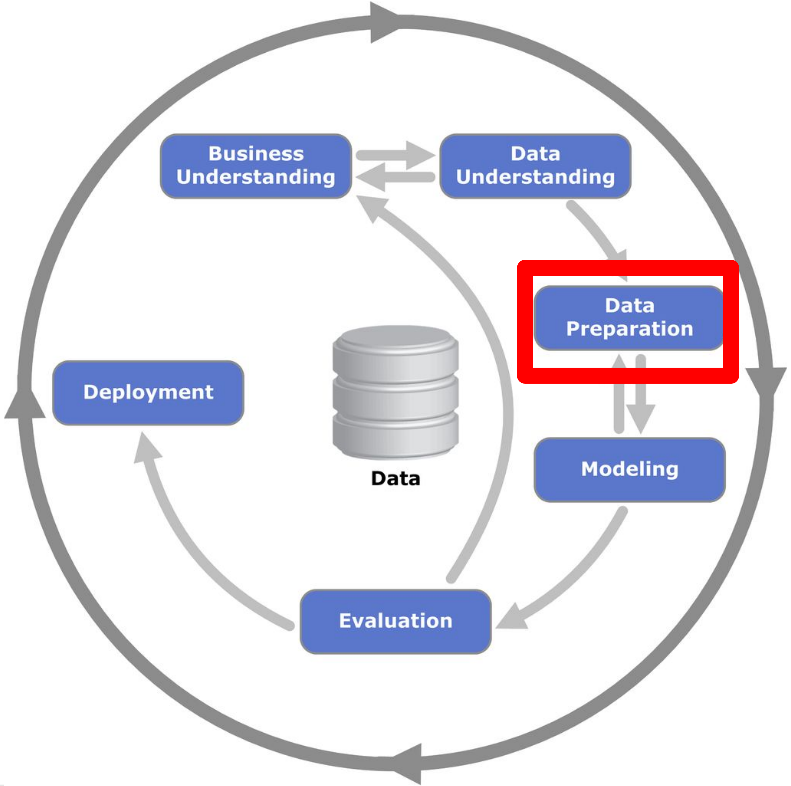
Text Processing (4/10)

- **Stemming**
  - Changing document terms into canonical versions
    - Country vs Countries
  - Stemming should avoid mapping words with different roots to the same stem
  - Poster's Stemming Algorithm applies rules based on patterns of vowel-consonant transition



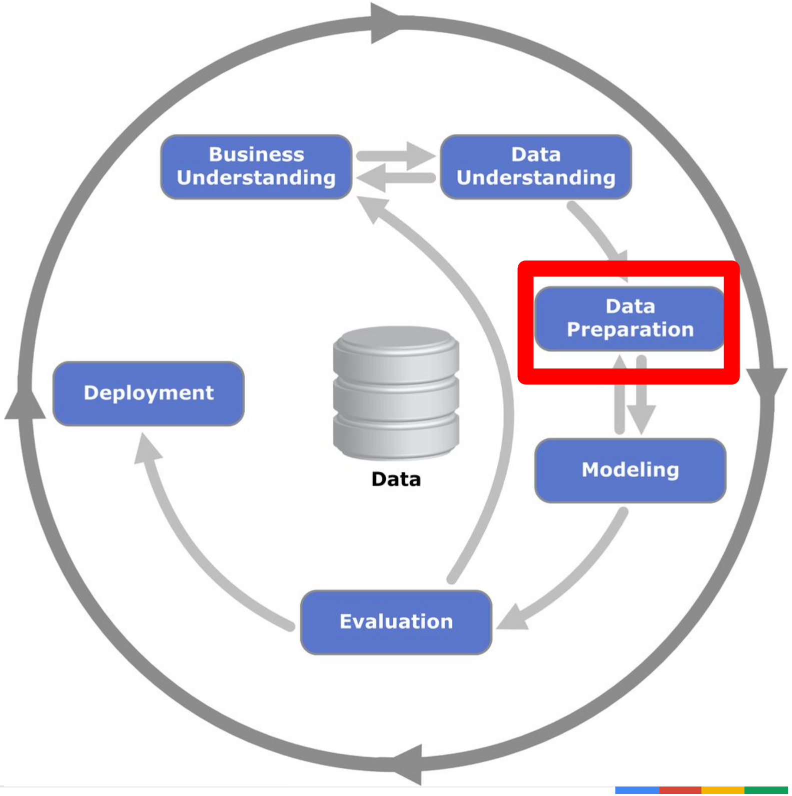
Text Processing (5/10)

- **Stopping**
  - Stopping involves the removal of stopwords
  - Stopwords are common words that do not discriminate in terms of relevance
  - Stopwords are not standard and depend on domain and language
    - Chemestry vs Engineering
    - English vs Lozi



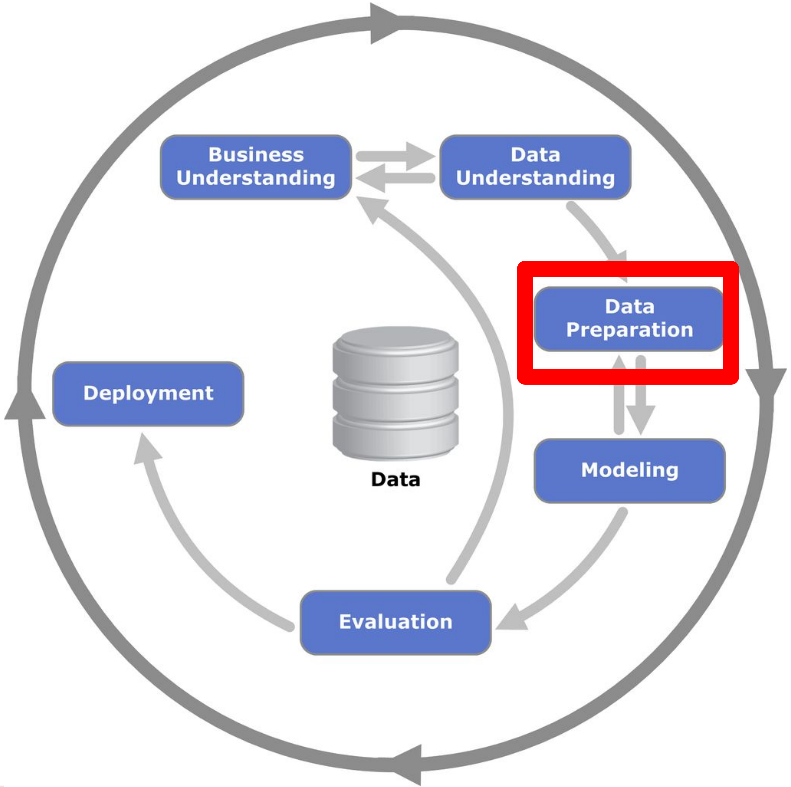
Text Processing (6/10)

- **Removing Punctuations**
  - Open text typically contains punctuation marks that need to be removed



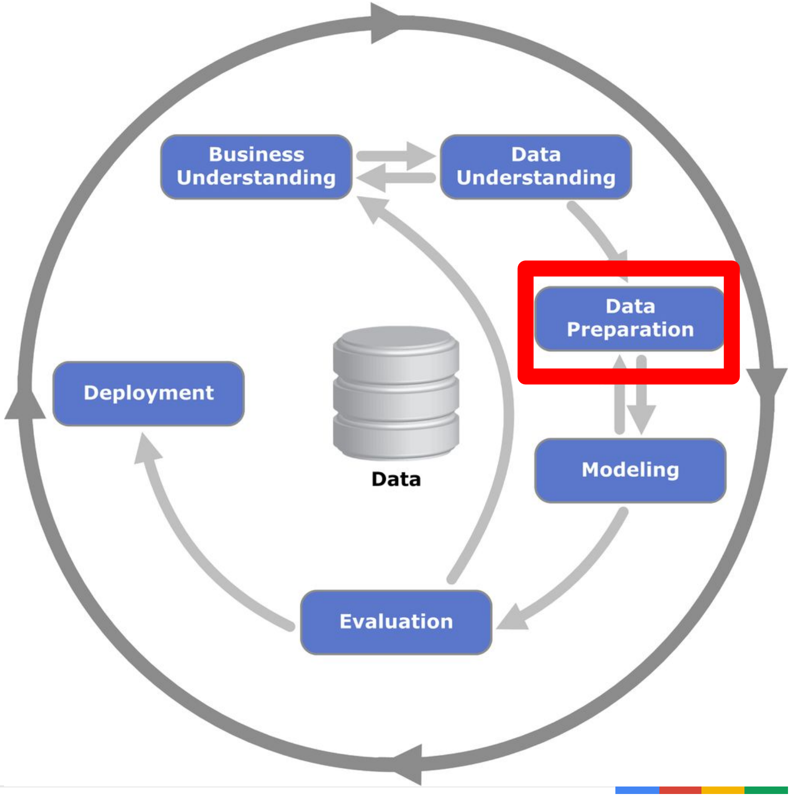
Text Processing (7/10)

- **Deduplication**
  - Duplicate data entries are a common occurance and careful attention must be placed in ensure that entries are unique



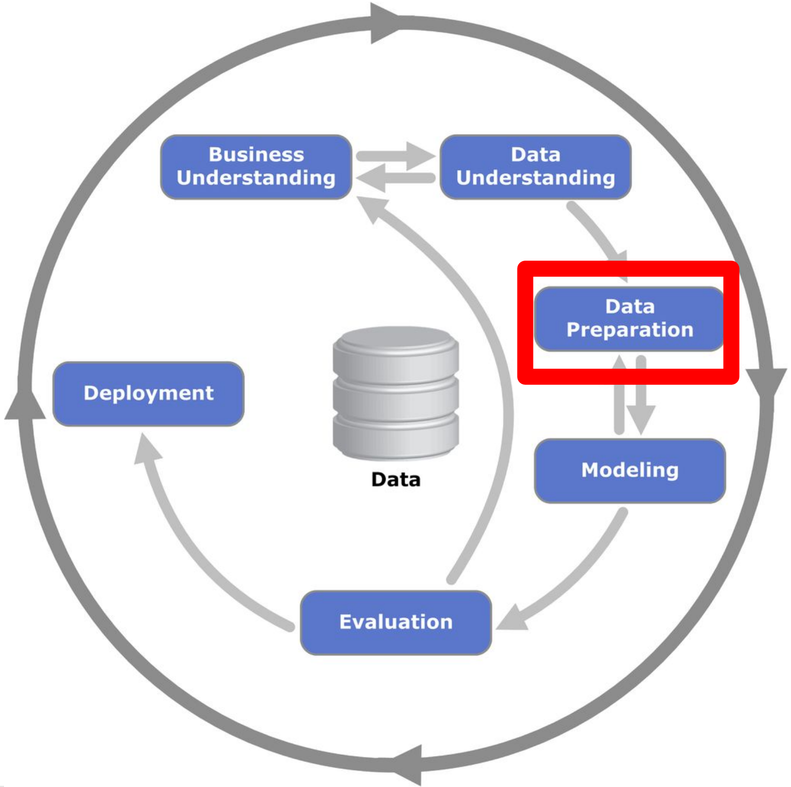
Text Processing (8/10)

- **Deduplication**
  - Duplicate data entries are a common occurance and careful attention must be placed in ensure that entries are unique



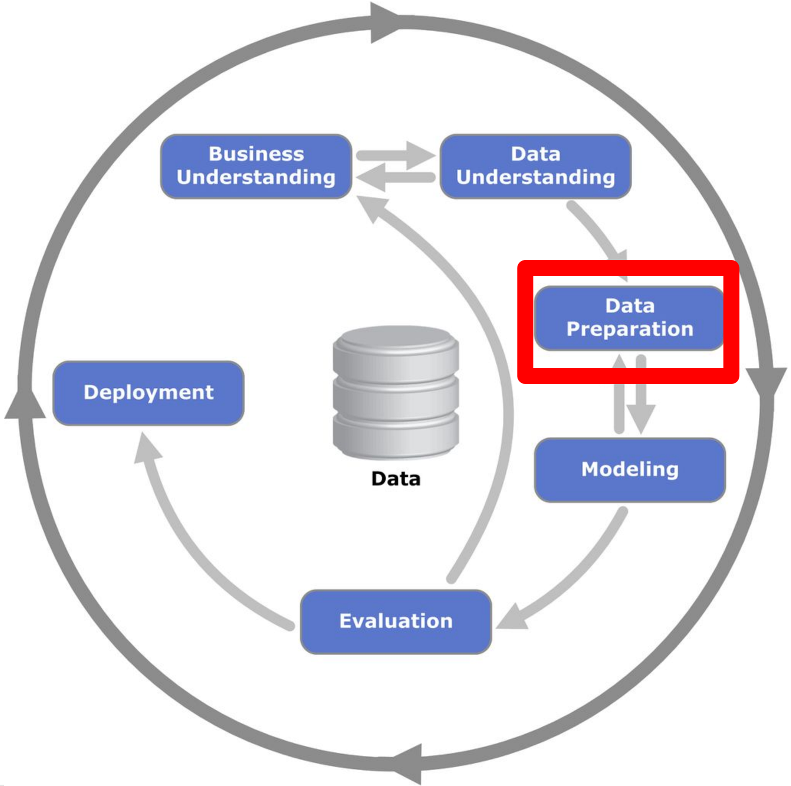
Text Processing (9/10)

- **Missing Values**
  - Careful emphasis must be placed on how to deal with missing and/or null values
  - Depending on the problem, this could involve excluding records with null values or replacing the null values with placeholder text



Text Processing (10/10)

- **Tokenization**
  - Splitting a document up into constituent words is referred to as tokenizing
  - There are a number of strategies for tokenising document
  - Simple strategy: create a vector of all possible words
    - Count number of times word appears in each document

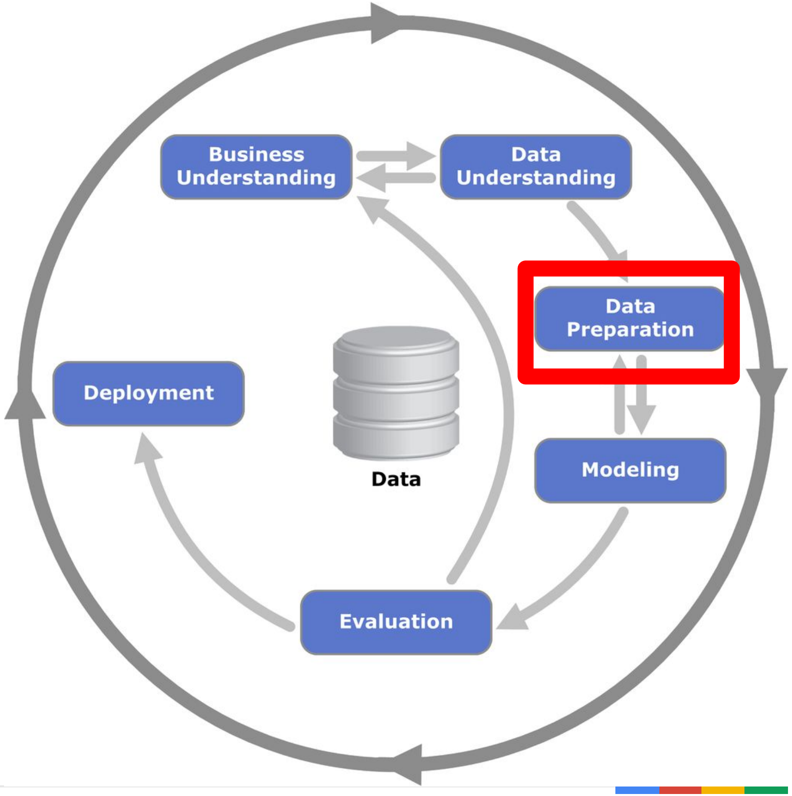


Lecture Series Outline

- **Part I: Academic Talk**
- **Part II: Paper Reading Discussion**
- **Part I: Data Pre-processing**
- **Part II: Data Transformation**
  - Introduction
  - Bag-of-Words Model
  - Term Frequency
  - TF-IDF Vectorising
  - Jupyter Notebook Walkthrough

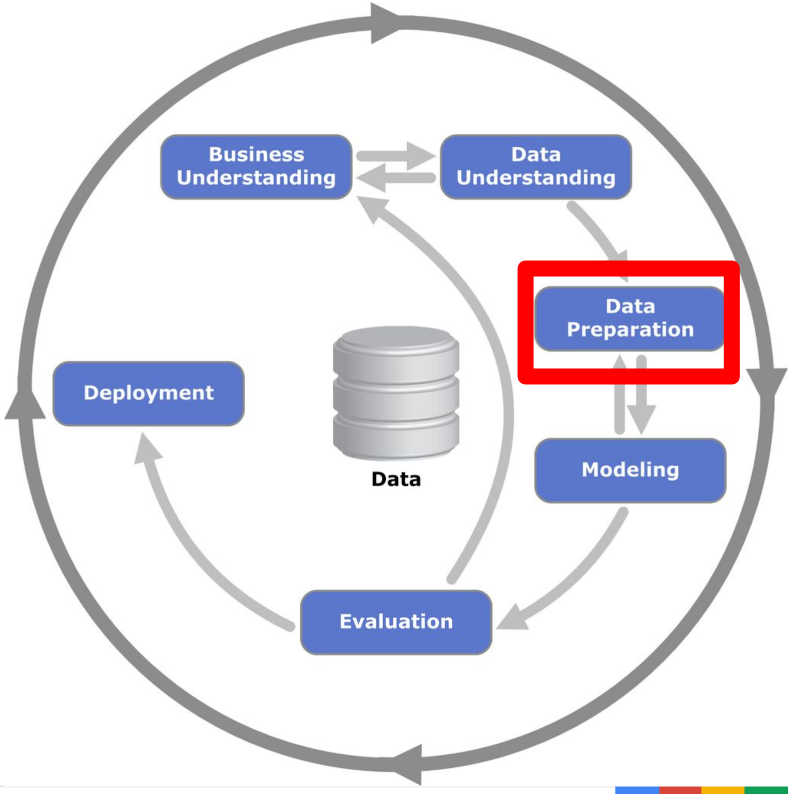
Bag-of-Words Model

- **Bag-of-Words**
  - Computers are generally not good at processing text, however, they are generally good at working with numbers
  - Each document, once tokenised can be thought of as a bag of words.



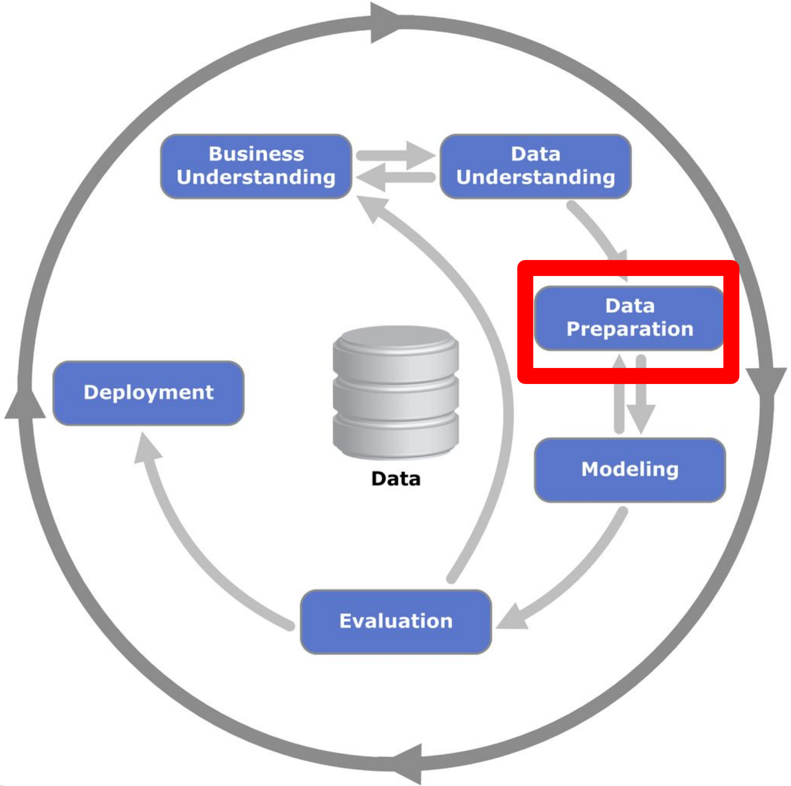
Term Document Frequency

- **Term Document Frequency**
  - Vector representation of document terms, with their corresponding frequency of occurrence
  - Note: Commonly used in Information Retrieval



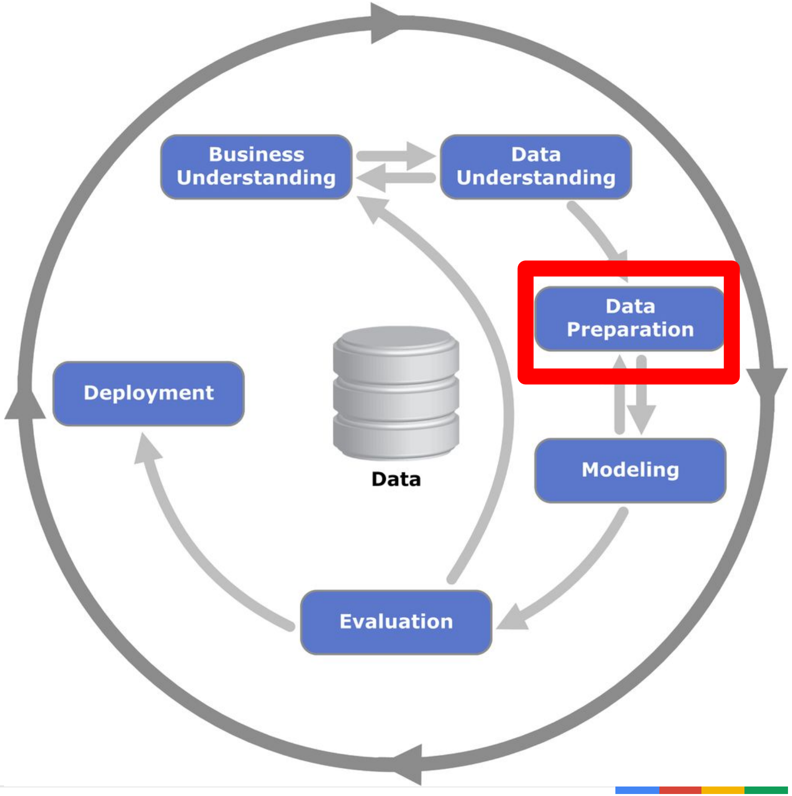
TF-IDF

- **TF-IDF**
  - Frequency distribution of words in a document is not sufficient to rank important of worlds
  - TF-IDF provides a better way of scoring the relative relevant of document terms



TF-IDF

- TF-IDF
  - tf-idf = tf(w) * idf(w)
  - tf(w)— Number of times word appears in a document
  - idf(w)—log(number of documents/number of documents that contain word)



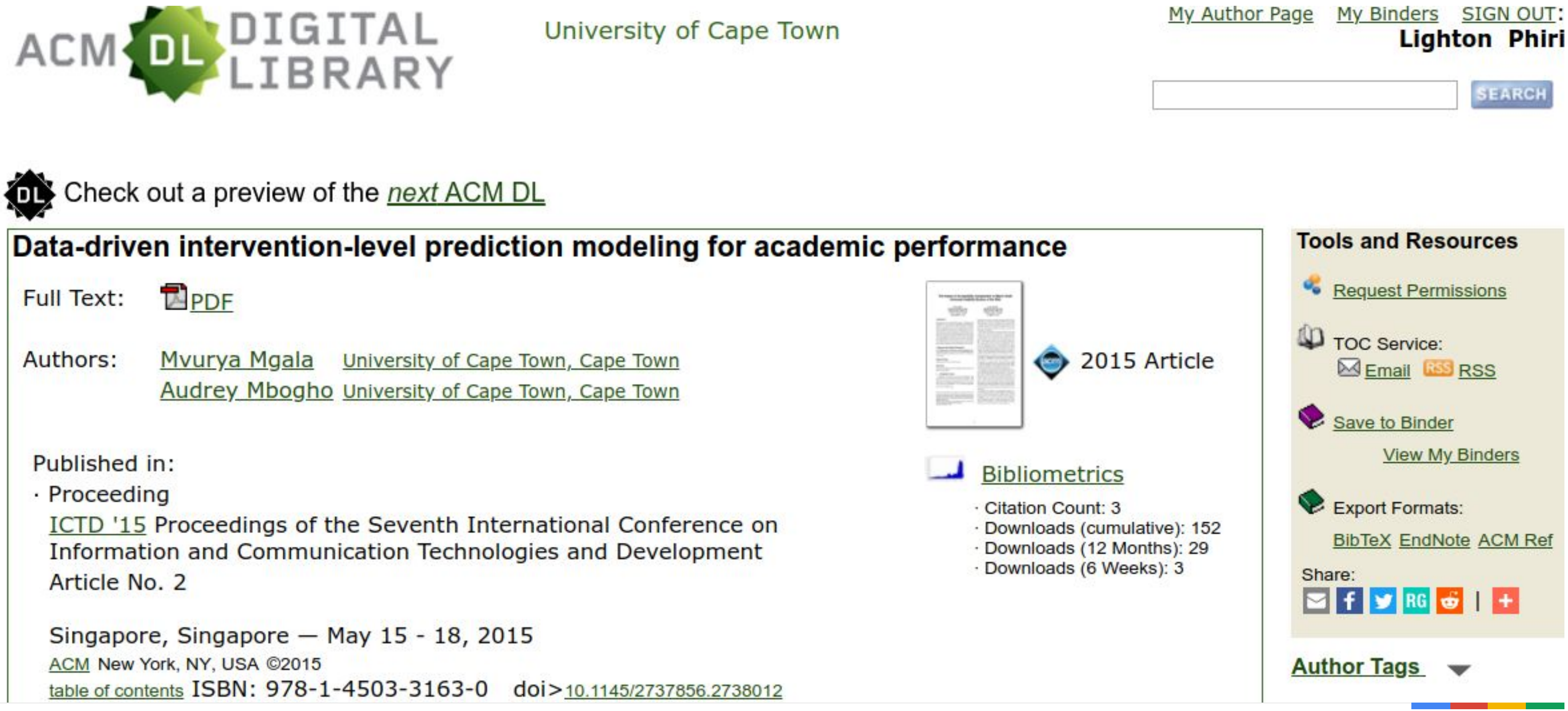
Q & A Session

- Comments, concerns and complaints?

Lecture Series Outline

- Part I: Academic Talk
- Part II: Paper Reading Discussion
  - M. Mgala and A. Mbogho (2015). "Data-driven intervention-level prediction modeling for academic performance"
  - Caragea et al. (2016). "Document Type Classification in Online Digital Libraries"
  - Moro et al. (2011). "Using Data Mining for Bank Direct Marketing: An Application of the CRISP-DM Methodology"
- Part III: Data Pre-processing
- Part IV: Data Transformation

Paper Reading Session (1/3)



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Data-driven intervention-level prediction modeling for academic performance

Full Text: PDF

Authors:	Mvurya Mgala	University of Cape Town, Cape Town
	Audrey Mbogho	University of Cape Town, Cape Town

Published in:

- Proceeding

ICTD '15 Proceedings of the Seventh International Conference on Information and Communication Technologies and Development

Article No. 2

Singapore, Singapore — May 15 - 18, 2015

ACM New York, NY, USA ©2015

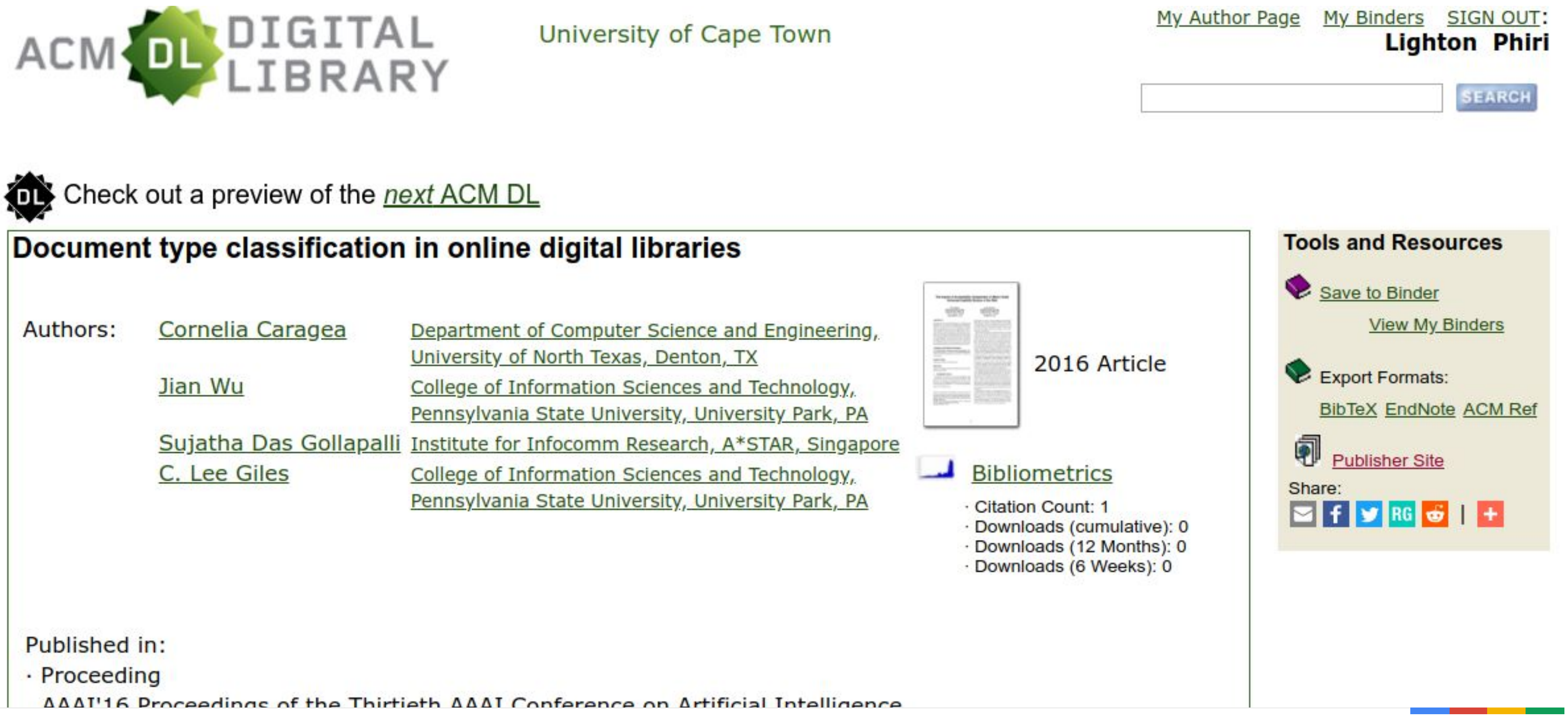
table of contents ISBN: 978-1-4503-3163-0 doi>10.1145/2737856.2738012

2015 Article

Bibliometrics

- Citation Count: 3
- Downloads (cumulative): 152
- Downloads (12 Months): 29
- Downloads (6 Weeks): 3

Paper Reading Session (2/3)



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SEARCH

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Document type classification in online digital libraries

Authors:		
	Cornelia Caragea	Department of Computer Science and Engineering, University of North Texas, Denton, TX
	Jian Wu	College of Information Sciences and Technology, Pennsylvania State University, University Park, PA
	Sujatha Das Gollapalli	Institute for Infocomm Research, A*STAR, Singapore
	C. Lee Giles	College of Information Sciences and Technology, Pennsylvania State University, University Park, PA

2016 Article

Bibliometrics

- Citation Count: 1
- Downloads (cumulative): 0
- Downloads (12 Months): 0
- Downloads (6 Weeks): 0

Published in:

- Proceeding

AAAI'16 Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence

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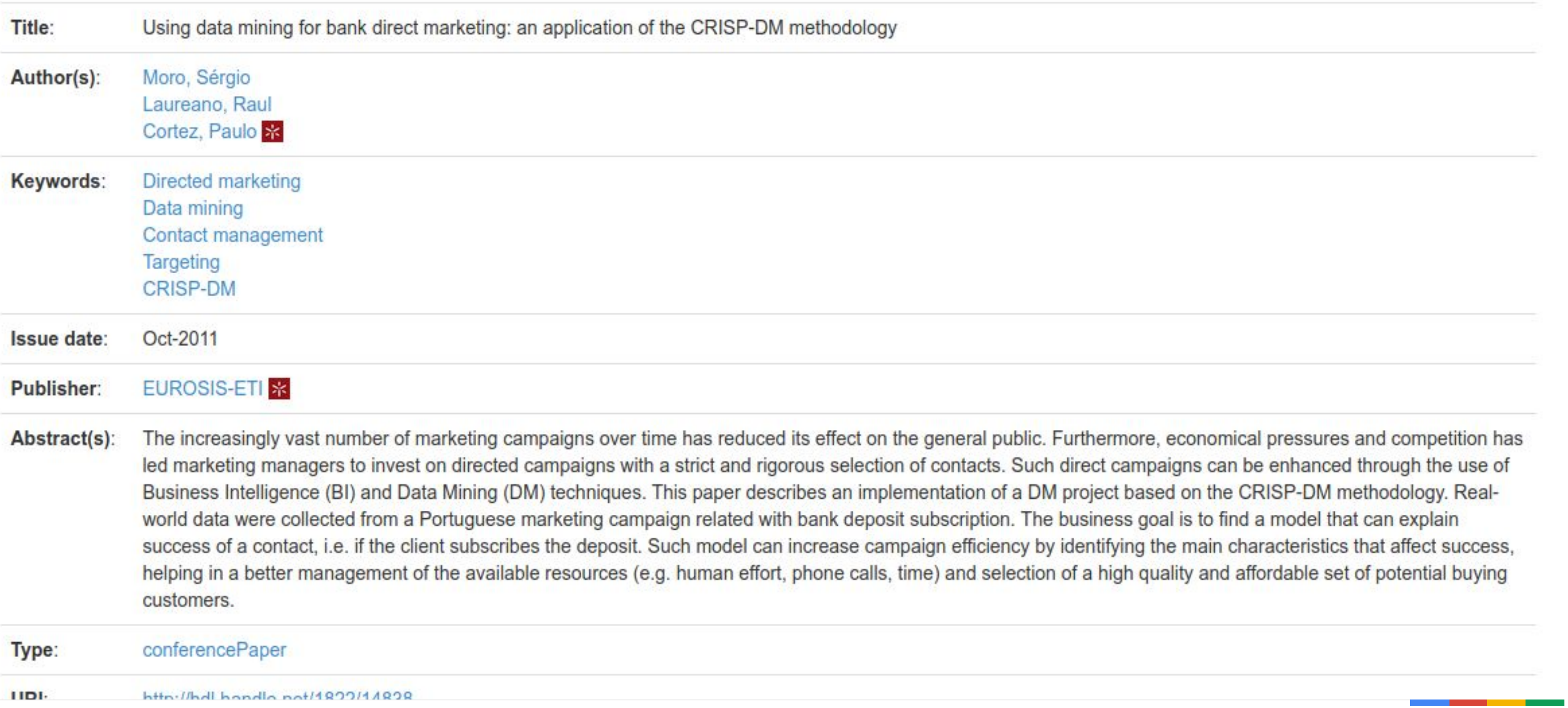
Paper Reading Session (3/3)



Title:	Using data mining for bank direct marketing: an application of the CRISP-DM methodology
Author(s):	Moro, Sérgio Laureano, Raul Cortez, Paulo
Keywords:	Directed marketing Data mining Contact management Targeting CRISP-DM
Issue date:	Oct-2011
Publisher:	EUROSIS-ETI
Abstract(s):	The increasingly vast number of marketing campaigns over time has reduced its effect on the general public. Furthermore, economical pressures and competition has led marketing managers to invest on directed campaigns with a strict and rigorous selection of contacts. Such direct campaigns can be enhanced through the use of Business Intelligence (BI) and Data Mining (DM) techniques. This paper describes an implementation of a DM project based on the CRISP-DM methodology. Real-world data were collected from a Portuguese marketing campaign related with bank deposit subscription. The business goal is to find a model that can explain success of a contact, i.e. if the client subscribes the deposit. Such model can increase campaign efficiency by identifying the main characteristics that affect success, helping in a better management of the available resources (e.g. human effort, phone calls, time) and selection of a high quality and affordable set of potential buying customers.
Type:	conferencePaper
URI:	http://hdl.handle.net/1822/14838

Bibliography

[1] Witten, I. H., Frank, E., Hall, M. A., Pal, C. J. (2017) Data Mining: Practical Machine Learning Tools and Techniques. Chapter 2 https://www.cs.waikato.ac.nz/ml/weka/book.html

[2] Introduction to Information Retrieval. Chapter 2 https://nlp.stanford.edu/IR-book

[3] Regular Expressions Tutorial - Learn How to Use and Get The Most out of Regular Expressions https://www.regular-expressions.info/tutorial.html

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