Natural Language Processing of UK Annual Report Narratives

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Session outline

- What is NLP?
- How we have applied NLP methods to the financial domain in the CFIE project
- Demo of our systems
  - Wmatrix-import
  - Wmatrix

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Natural Language Processing

- ‘getting computers to understand language’ … ‘a branch of computer science dealing with analysing, understanding and generating natural language’

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NLP and Corpus Linguistics @ Lancaster

- Analyzing digital personas behind criminal tactics to provide investigators with clues to the identity of the individual or group hiding behind one or more personas
  - Child sex offenders masquerading as young people to gain their victims' trust
  - Radicalization of youth in online forums through persuasive messaging
  - Online dating sites that gain trust and the exploit users for financial gain
  - Analysis of cyber bullying and online trolling
  - Use textual analysis to predict a persona's key attributes (e.g., age and gender) even where the author is obfuscating the language
- Assist in early diagnosis of dementia and Alzheimer's disease
  - Longitudinal changes in linguistic features (e.g., grammatical complexity and idea density) are associated with degenerative memory conditions

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Corporate Financial Information Environment (CFIE)

- ESRC- and ICAEW-funded project
  - Martin Walker, Manchester Business School
  - Steven Young, Lancaster University Management School
  - Paul Rayson, Lancaster University School of Computing & Communications
  - Mahmoud El-Haj, Lancaster University School of Computing & Communications
  - Vasiliki Athanasakou, London School of Economics
  - Thomas Schleicher, Manchester Business School
- Project seeks to analyse UK financial narratives, their association with financial statement information, and their informativeness for investors
- Automated, large sample analysis of UK annual report narratives represents a cornerstone of the project
- Develop software for general use by academics
- http://ucrel.lancs.ac.uk/cfie/

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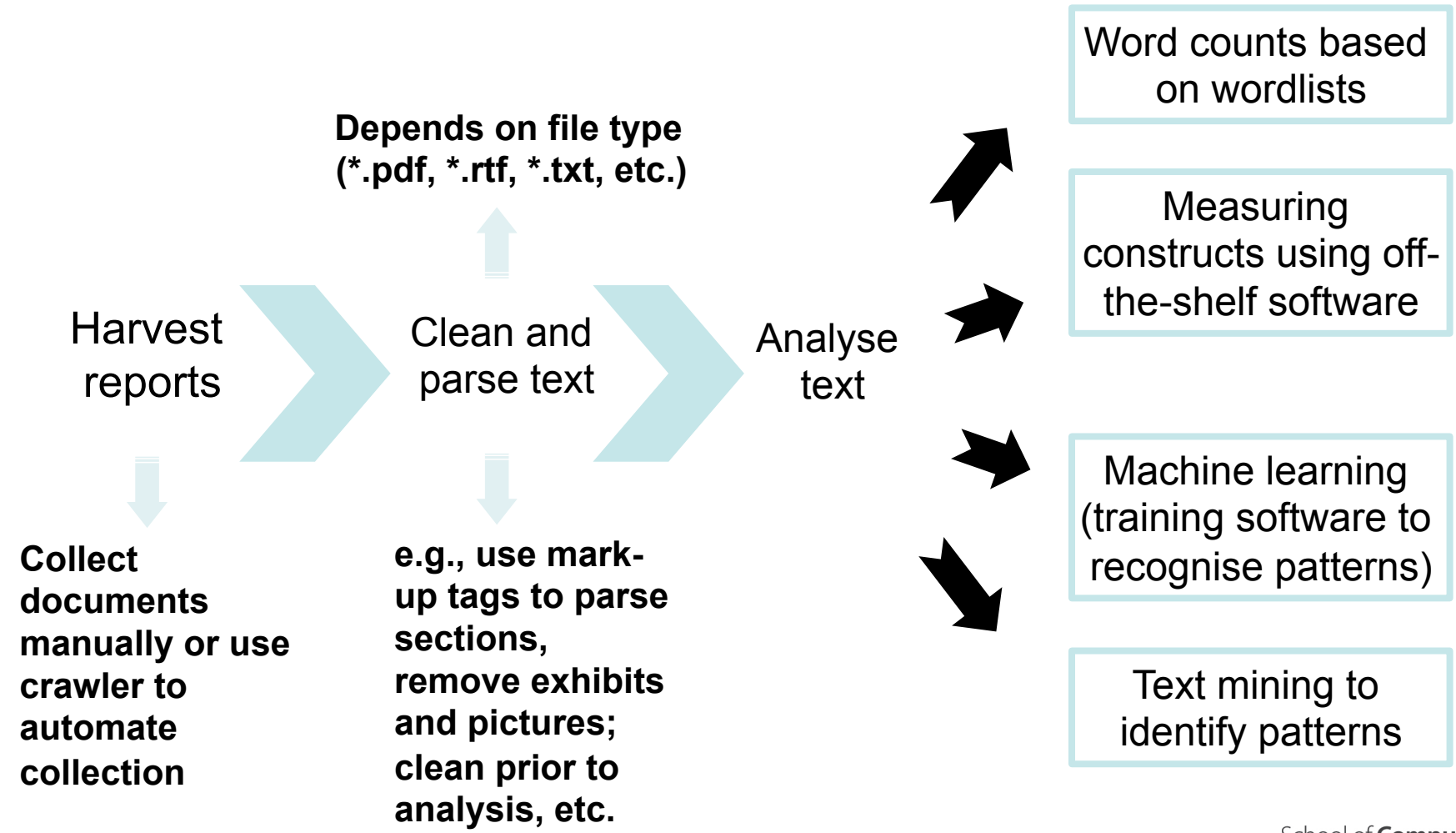
Analysing UK Annual Report Narratives



US Filings: 10-K Annual Form

Each 10-K contains 4 parts and 15 items

- **PART I**
- **ITEM 1.** Description of Business
- **ITEM 2.** Description of Properties
- **ITEM 3.** Legal Proceedings
- **ITEM 4.** Mine Safety Disclosures
- **PART II**
- **ITEM 5.** Market for Registrant's Common Equity….
- **ITEM 6.** Selected Financial Data
- **ITEM 7.** Management's Discussion and Analysis….
- **ITEM 8.** Financial Statements and Supplementary Data
- **ITEM 9.** Changes in and Disagreements ….
- **PART III**
- **ITEM 10.** Directors, Executive Officers and Corporate Governance
- **ITEM 11.** Executive Compensation
- **ITEM 12.** Security Ownership of Certain Beneficial Owners….
- **ITEM 13.** Certain Relationships and Related Transactions….
- **ITEM 14.** Principal Accounting Fees and Services
- **PART IV**
- **ITEM 15.** Exhibits, Financial Statement Schedules….

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c.f. UK Annual Reports

- Free Style (no standard structure)
- Use of Images, Text
- PDF Format
- Content and structure varies across firms.
- Management have more discretion over what, where, and how much information on topics such as risk, strategy, performance, etc. is reported.

- This makes the extraction and analysis task more challenging; but it provides research opportunities.

- Use contents page to extract text by section from digital pdf

Contents

Chairman's Statement	02
Chief Executive's Statement	05
Finance Director's Review	08
Directors	12
Directors' Report	13
Corporate Governance	15
Independent Auditors' Report	20
Consolidated Income Statement	22
Consolidated Balance Sheet	23
Company Balance Sheet	24
Consolidated Statement of Recognised Income and Expense	25
Consolidated Reconciliation of Movements in Equity	25
Company Statement of Recognised Income and Expense	25
Company Reconciliation of Movements in Equity	25
Consolidated Cash Flow Statement	26
Company Cash Flow Statement	26
Notes to the Financial Statements	27
Board Report on Directors' Remuneration	54
Notice of Annual General Meeting	58
Shareholder Information	59
Group Five Year Record	60
Corporate Information	Inside Back Cover

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Contents

IFC Financial and operating highlights
02 Chairman's statement
04 Chief executive's report
08 Performance review
26 Corporate social responsibility report
32 Board of directors and company secretary
33 Directors' report
36 Corporate governance report
42 Directors' remuneration report
54 Statement of directors' responsibilities
55 Independent auditors' report – Group
56 Consolidated income statement
57 Consolidated balance sheet
58 Consolidated cash flow statement
59 Reconciliation of net cash flow to movements in net debt
Consolidated statement of recognised income and expense
Consolidated statement of changes in equity
60 Notes to the consolidated financial statements
99 Independent auditors' report – Company
100 Company balance sheet
101 Company cash flow statement
Company statement of recognised income and expense
Company statement of changes in equity
102 Notes to the Company financial statements
112 Five year record
113 Shareholder analysis
114 Financial calendar
Company information
115 Investor information
116 Principal operations

Financial highlights:

- Continuing profit before taxation* up 25.3% at £50.1m (2006/07: £40.0m)
- Profit for the period £34.5m (2006/07: loss £22.5m)
- Adjusted EPS[1] 20.9% ahead at 7.88p (2006/07: 6.52p)
- Strong cash management continues to drive low net debt[2] at £200.2m (2006/07: £174.2m)
- Robust balance sheet – continuation of share buy-back programme in 2008/09
- Proposed dividend up 5.9% at 4.50p (2006/07: 4.25p)

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What's in our report

Features

Sir Ian Gibson
We are committed to making food shopping fresh, friendly and affordable.
Page 2

Dalton Philips
A clear strategy is in place that is delivering our objectives.
Page 4

Richard Pennycook
Our strong financial performance positions us well for sustainable long term growth.
Page 8

Johanna Waterous
A strong performance culture, long term shareholder value and competitive positioning remain key principles.
Page 46

Also see...

Corporate responsibility review 2011/12

Annual review 2011/12

Investor relations website
www.morrisons.co.uk/corporate

Directors' report and business review

Introduction
2 Chairman's statement

Business and strategy review
4 Chief Executive's business and strategy review
8 Group Finance Director's financial review
12 Our strategic objectives

Performance review
26 Key performance indicators
28 Risks and uncertainties
30 Corporate responsibility
33 Our people

Governance
36 Board of Directors and Management Board
40 Corporate governance report
46 Directors' remuneration report
56 General information
59 Statement of Directors' responsibilities

Financial statements
60 Group financial statements
- 60 Independent auditor's report
- 61 Consolidated statement of comprehensive income
- 62 Consolidated balance sheet
- 63 Consolidated cash flow statement
- 64 Consolidated statement of changes in equity
- 65 Group accounting policies
- 70 Notes to the Group financial statements

95 Company financial statements
- 95 Company balance sheet
- 96 Company accounting policies
- 99 Notes to the Company financial statements

Investor information
108 Five year summary of results
109 Supplementary information
110 Investor relations and financial calendar

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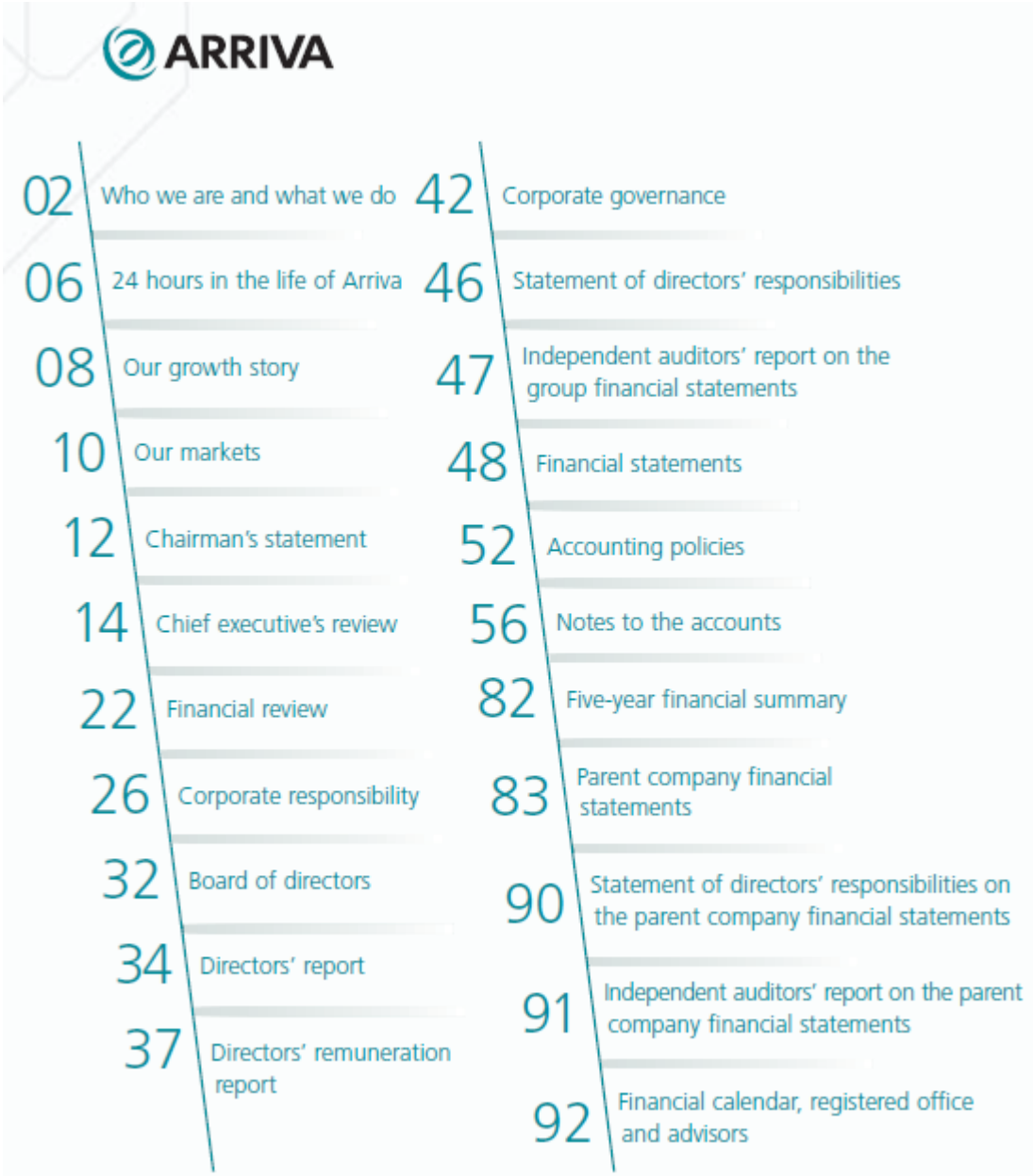

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- Steps in extraction process:
  - Detect contents page
  - Parse contents page
  - Detect page numbering to determine section start/end
  - Add headers as bookmarks to pdf
  - Extract text for each section
- Analyse extracted text by section and for entire document

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- In addition to performing text extraction, the tool provides a range of text analysis options:
  - Readability metrics
  - Word counts using pre-determined lists (e.g., forward looking, uncertainty, tone, etc.)
  - Word counts based on user-defined wordlists
  - Comparison with reference corpus (word, parts of speech and semantic level)
  - Concordance and collocates
  - Upload and analyse user-defined text file

- Overview (wordlists, readability metrics) and interface with Wmatrix
- Uploading one or more annual reports and generating output
- Uploading and analysing with a user-defined key word list
- Uploading and analysing a user-defined text file
- Examples of further analysis in Wmatrix:
  - Cloud for chairman's statement vs. standard reference corpus: word level
  - Cloud for chairman's statement vs. to standard reference corpus: semantic level
  - Cloud for chairman's statement vs. chairman's statement corpus: word level
  - Cloud for chairman's statement vs. chairman's statement corpus: semantic level
  - Concordance/collocation

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Case study: Strategic content

- Measure strategic content of annual reports by automatic analysis of words and phrases in financial commentary and business strategy sections
- Prior UK studies: manual, 300 reports
- 60,000 sections in 10,000 reports
- 1156 key words and phrases
- Clear evidence of doubling of strategic content since 2002

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Future developments

- Choice of different readability metrics
- Text re-use metric to detect boilerplating and incremental changes
- Reference corpora for:
  - Full Annual Report and Accounts
  - Chairman's Statement
  - CEO Review/Business Review/Operating Review/Financial Review
  - Highlights
  - Corporate Governance
  - Directors' Remuneration
- Readability scores for all UK annual reports for the period 2003-2013
- Further methods for representing key themes (e.g., strategy, risk, CSR and governance, etc.) by section