MSc Data Science at the University of Sheffield

Started in September 2014

The University Of Sheffield.

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- Lecturer in Data Science at the Information School since 2014
  - Ph.D. in Computer Science at U. Hannover, Germany
  - M.Sc. in Computer Science at U. Udine, Italy
- Worked at UC Berkeley (USA), Yahoo! Research (Spain), L3S Research Center (Germany), U. Fribourg (Switzerland)
- Teaching *Social Computing* in Fribourg
- Tutorials on Entity Search at ECIR 2012, on *Crowdsourcing* at ESWC 2013 and ISWC 2013
- Research Interests
  - Entity-centric Information Access, Semantic Search, Human Computation and Crowdsourcing

What is Data Science?

- An emerging field that seeks to discover and explore new ways of **exploiting data to support decision-making** for a range of domains and problems
- Data Science has the *"potential to be a deep and profound research discipline **impacting all areas** of our lives"* (O'Neil & Schutt, 2013)
- Most organisations, including health care, the public sector, local government, retail and manufacturing, are amassing vast amounts of heterogeneous data in real-time (i.e. "Big Data")
- There is greater demand than ever before to **manage, analyse and use data effectively**, ethically and in a rigorous and scientific manner – need to seize the data opportunity

"In the information economy, the ability to handle and analyse data is essential for the UK's competitive advantage and business transformation."

https://www.gov.uk/government/publications/uk-data-capability-strategy

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Commentary

Hal Varian on how the Web challenges managers

Google's chief economist says executives in wired organizations need a sharper understanding of how technology empowers innovation.

January 2009

More than ten years into the widespread business adoption of the Web, some managers still fail to grasp the economic implications of cheap and ubiquitous information on and about their business. Hal Varian, professor of information sciences, business, and economics at the University of California at Berkeley, says it's imperative for managers to gain a keener understanding of the potential for technology to reconfigure their industries. Varian, currently serving as Google's chief economist, compares the current period to previous times of industrialization when new technologies combined to create ever more complex and valuable systems—and thus reshaped the economy.

Varian spoke with McKinsey's James Manyika, a director in the San Francisco office, in Napa, California, in October 2008. Watch the video or read the transcript of his comments below.

Interactive

Hal Varian on how the Web challenges managers

Google's chief economist on how technology empowers innovation.

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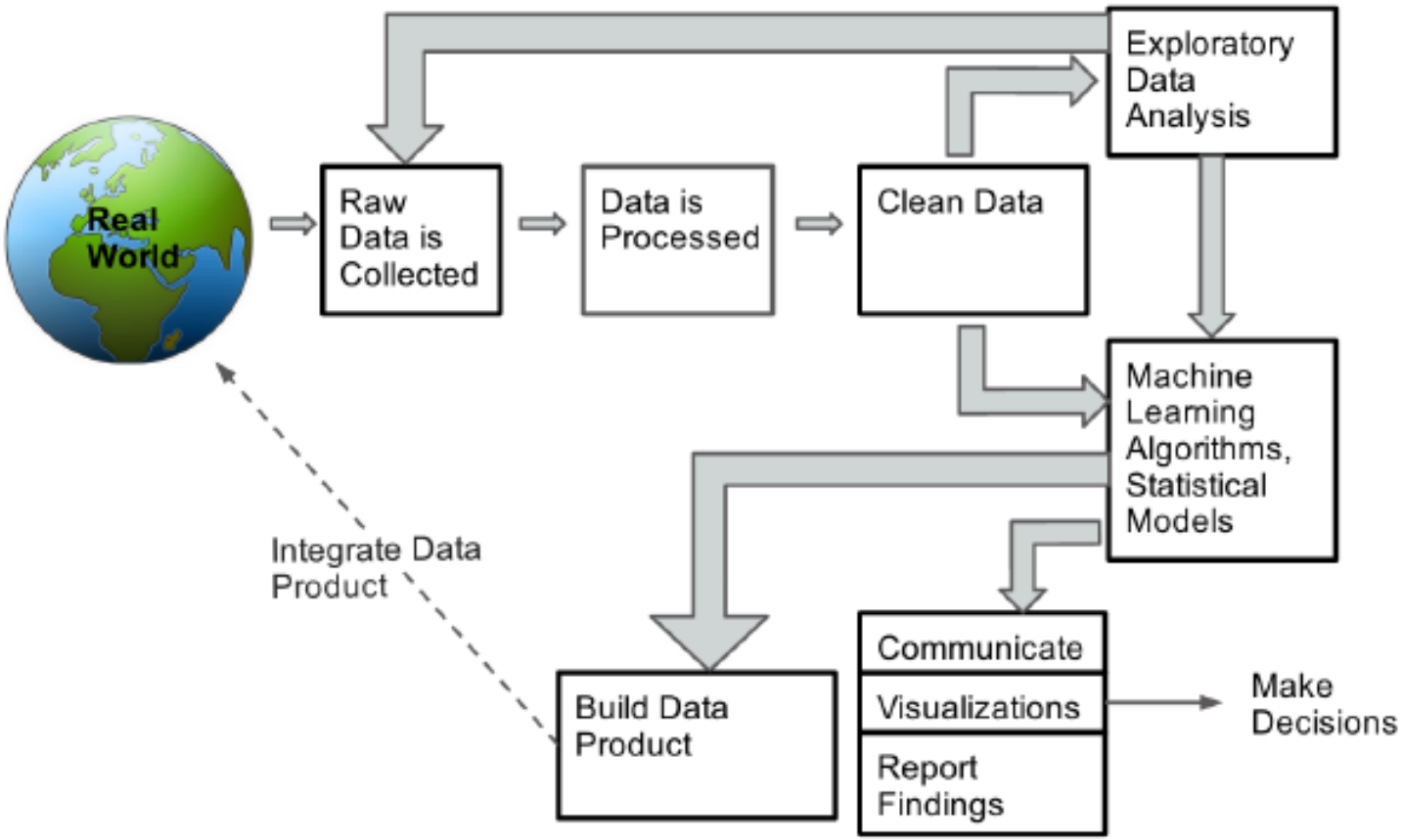
*"The ability to take data — to be able to **understand** it, to **process** it, to **extract value** from it, to **visualize** it, to **communicate** it — that's going to be a hugely important skill in the next decades." (Hal Varian)*

The Data Science Process

In reality



Copyright: O'Neil, C. & Schutt, R. (2013) *Doing Data Science*. O'Reilly. (p. 35)

"Data is the new product". Forrester: Top IT Predictions For 2015

Example Data Science problems

- **Supermarkets** identifying trends in shopper buying patterns *(e.g., people who bought X also bought Y)*
- **Universities** predicting whether students are likely to leave degree programmes before completion
- **Banks** wanting to identify fraudulent behaviour (e.g. anomalous spending patterns)
- Financial organisations predicting **stock market** changes based on analysis events reported in the news
- Organisations characterising user groups and analysing **opinions from social media** sites for market intelligence
- **Local government** analysing and monitoring use of public resources
- …

Data science skills

- *"The UK requires a strong skills base, able to **manage, analyse, interpret and communicate data**, in order to extract insight and value" Seizing the Data Opportunity (HM Government, 2013)*
- Data Science solutions involve knowledge and understanding of
  - Technologies (e.g., data warehousing, Hadoop)
  - Data modelling (e.g., representing and aggregating multiple datasets)
  - Data standards (e.g., open data and Linked Data)
  - Data analysis (e.g., data mining)
  - Communication (e.g., data visualisation, generate data reports)
  - Wider context (e.g., business processes, governance and ethics)

Type II Data Scientist is a *"data-savvy manager"* who is able to communicate with the Type I Data Scientist, is familiar with the technologies and processes involved, can manage **cross-disciplinary teams**, but also understands how to **interpret and communicate results** from analysing the data in the context of the **organisation as a whole**.

The Type II Data Scientist will understand the activities involved in **the broader data lifecycle**, such as data generation, adding metadata, data storage, data presentation, data access, the use and re-use of data, data governance and the strategic implications of data-driven decision making.

Source:
http://www.oralytics.com/2013/03/type-i-and-type-ii-data-scientists.html

Job opportunities

- A recent report by the e-Skills UK and SAS highlight that the demand for Big Data skills is expected to rise 92% between 2012-2017
  http://www.e-skills.com/research/research-publications/big-data-analytics/
- Organisations require 'data savvy managers' to manage and support **data-driven decision-making** built on three core skills
  - Data management (storage and linking), data analysis (including data literacy) and business and policy insight (context awareness)
- Potential job roles beyond IT and management include
  - 'Big Data' jobs, Business Analyst, Business Intelligence Analyst, Data Analyst, Data Architect, Data Mining Engineer, Data Scientist, Data Warehousing Manager

The Sheffield perspective

- Provide an Information Science perspective on the field rather than, e.g. Computer Science
  - Develop understanding of **Data Science in the wider business and societal contexts**, e.g. governance, security, data management, organisational decision making, literacy
  - Focus on **how people interact with data** and technology to perform tasks, solve problems and make decisions
- Utilise multiple research methods to analyse and interpret data (**quantitative and qualitative**)
- Experience with handling multiple forms of data
  - e.g. unstructured vs. structured; social media; multilingual and audiovisual

Programme team

http://www.sheffield.ac.uk/is/pgt/courses/data_science/dsteam

The University Of Sheffield.

Paul Clough
(Programme Coordinator)

Gianluca Demartini
(Deputy Programme Coordinator)

PEAK indicators

Helping Your Business Intelligence Journey

Andrew Ball
(CEO, Peak Indicators)

Amy Balmain (Solutions Architect, Peak Indicators)

Target audience

- Home and overseas students with no requirement to have a background in Computer Science or Mathematics
  - Should appeal to a wider range of students
  - Differentiates this from many existing Data Science courses (i.e. more similar to iSchool programmes in the US)
- In the future we plan to target the professional market
  - e.g. through distance learning and/or part-time routes

Skills and other attributes

- Tools used by Data Scientists, such as **R and R Studio, SPSS, WEKA, Tableau, Oracle and Amazon AWS**
- Analyse **datasets of various sizes** to gain insights and extract information (and knowledge) following principled and structured methodologies
- Skills relevant to their potential future employment, together with an understanding of how to apply these **ethically**
- Acquire **research skills** relevant to their chosen field of work
- Develop **communication** and interpersonal **skills** that will complement their subject knowledge

Curriculum

- A candidate shall take (bold indicates new modules)
  - **INF6027 Introduction to Data Science** S1 15
  - **INF6029 Data Analysis** S1 15
  - INF6060 Information Retrieval: Search Engines and Digital Libraries S1 15
  - **INF6028 Data Mining and Visualisation** S2 15
  - INF6050 Database Design S2 15
  - INF6340 Research Methods and Dissertation Preparation S2 15

- (b) units to the value of forty five credits from the following
  - INF6110 Information Systems Modelling S1
  - INF6320 Information systems in Organisations S1 15
  - INF6022 Research Data Management S2 15
  - INF6040 Business Intelligence S2 15
  - INF6025 Information Governance S2 15
  - INF6024 Researching Social Media S2 15
- (c) INF6000 Dissertation S3 45

NB: datasets being compiled from data.gov.uk and from specific organisations as part of case studies (e.g. Peak Indicators)

Current status

- Full-time programme has started in September 2014.
  - 20+ students, ~50% home/overseas, 57% ladies 43% gentlemen
  - 58% never used a programming language
- Peak Indicators is closely involved in programme development (e.g. curriculum, advertising)
- External organisations contributed to the programme during the "Data Science industry day"
  - IBM, SY Police, Sheffield City Council
  - More to come: Barclays, PwC, UK Data Archive Centre, Findwise, Information Commissioner's Office
- Marketing and curriculum development activities are now underway
  - 50+ applicants for Sept 2015

Highlights

- Both quantitative *and* qualitative methods for research and data analysis
  - Important in interpreting data accurately and gaining deep insights
- "Industry days"
- Gain hands-on experience with a range of tools (mainly open-source) that are commonly being used by Data Scientists
  - e.g. R, SPSS, Oracle, WEKA, Amazon AWS
  - Give students skills that are directly relevant to future employment and provide them a competitive advantage
- The programme is designed around the "type II" Data Scientist