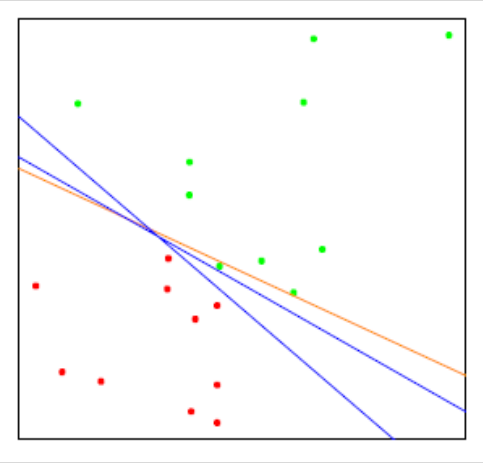

Big Data Analytics

Basic concepts of analyzing very large amounts of data

Dr. – Ing. Morris Riedel
Adjunct Associated Professor
School of Engineering and Natural Sciences, University of Iceland
Research Group Leader, Juelich Supercomputing Centre, Germany

LECTURE BDA4

Research Challenges

2014-01-27 (v1)
Online Material

UNIVERSITY OF ICELAND
SCHOOL OF ENGINEERING AND NATURAL SCIENCES
FACULTY OF INDUSTRIAL ENGINEERING, MECHANICAL ENGINEERING AND COMPUTER SCIENCE

JÜLICH
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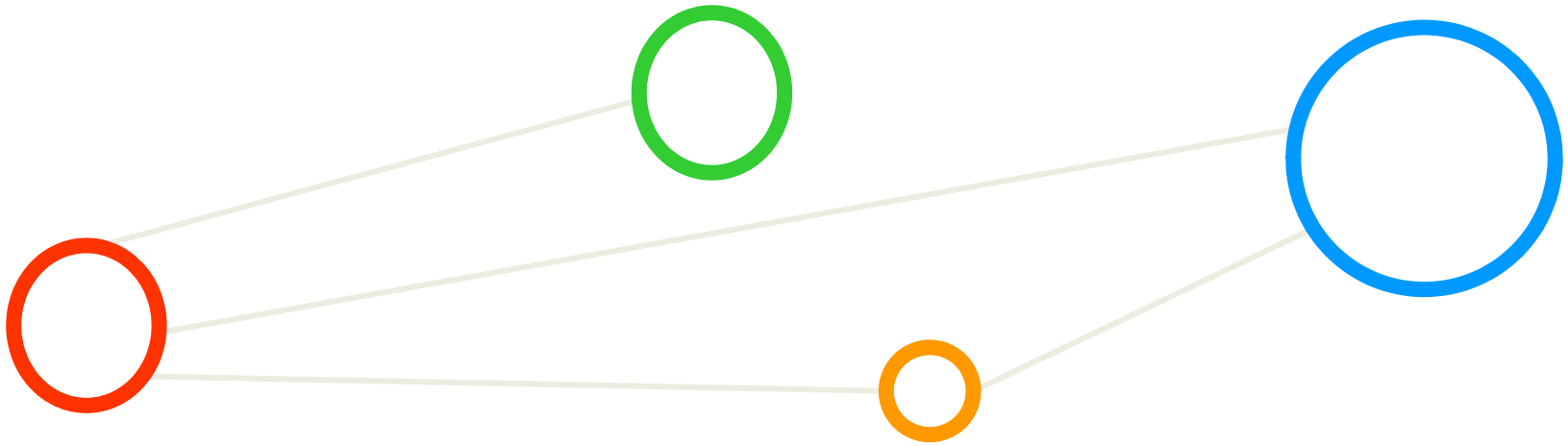
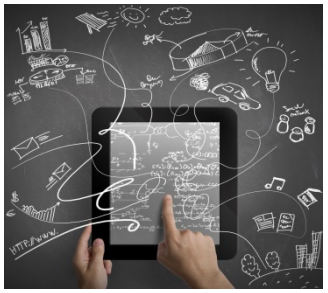
Outline

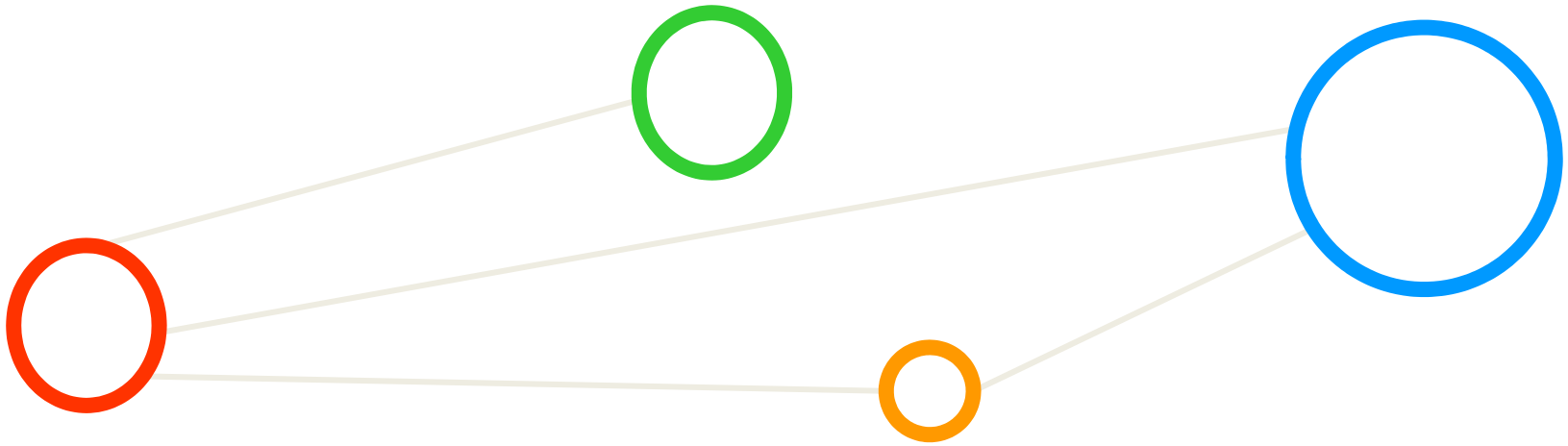


Outline

- Classification
  - RDF Documents and Linked Data



Classification



RDF Documents and Linked Data (1)

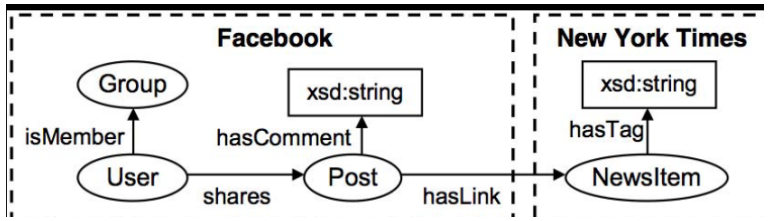
- Data: Resource Description Framework (RDF) Stores
  - Interlinked, physically distributed, and autonomously maintained
  - Community-driven Linked Open Data (LOD) effort allows structured data to be represented using RDF using subject-predicate-object 'RDF triples'
  - Associated query languages such as SPARQL offer the means to store and query large amounts of RDF data
- Goals: Predictive modeling and knowledge discovery
- 'Limited applicability' of existing machine learning techniques
  - Neither desirable nor feasible to have all data in a centralized location
  - Analysis problematic due to access, memory, bandwidth, computational restrictions, privacy/confidentiality constraints

- **Problem statement: Learning predictive models from multiple interlinked RDF data stores**
- **Technique for learning predictive models (e.g. classifiers) from multiple interlinked RDF stores that support only indirect access to data (e.g. via a query interface like SPARQL)**

[1] H. Lin et al., 2013

RDF Documents and Linked Data (2)

- Predictive modelling example
  - Instance of ‘node prediction problem‘:
  - ‘One might want to use data from Facebook and New York Times to predict the interest of a user in belonging to a Facebook group, based on the distribution of tags associated with the New York Times news stories that the user has shared with her social network on Facebook.’



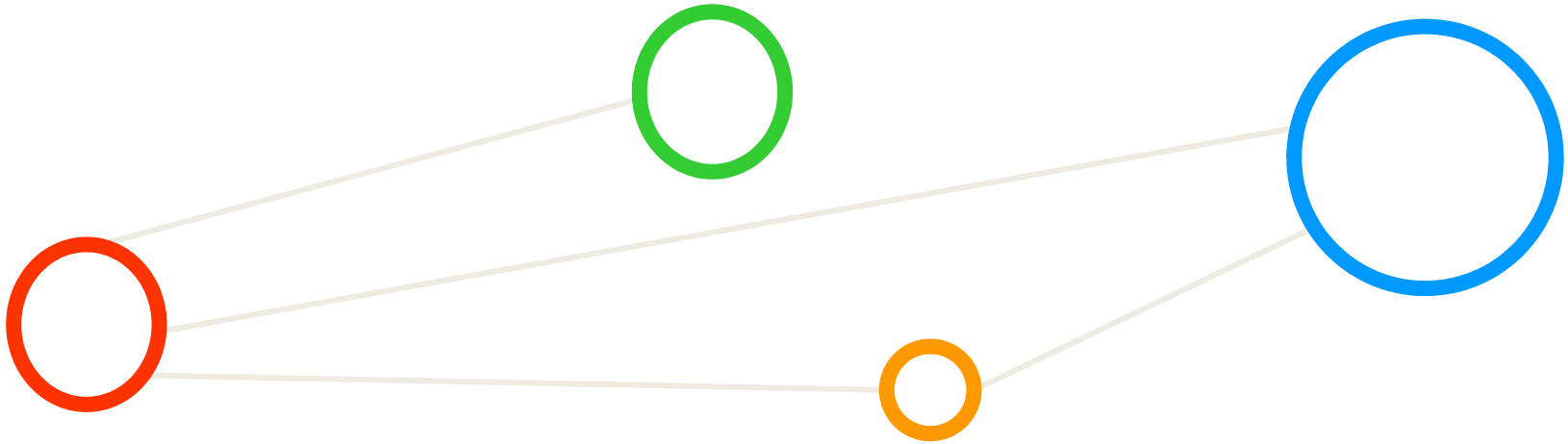
- Research challenges, approaches, and contributions
  - ‘Statistical query based formulations‘ of several learning algorithms
  - ‘Distributed learning framework‘ to learn from interlinked RDF stores
  - Three special cases of ‘RDF data fragmentation‘
  - ‘Matrix reconstruction technique‘ from field of Computerized Tomography (to reduce the amount of information transmitted from remote sources)
  - Experiments with ‘real-world social networking data set‘ ***[1] H. Lin et al., 2013***

RDF Documents and Linked Data (3)

- Learn from RDF data
  1. Approaches that rely on *aggregation* to encode nodes to be classified as 'tuples of attribute values' (instances that can be handled by traditional supervised machine learning algorithms)
  2. Approaches that are based on generative models of data
- Approach 1 – Aggregation
  - Represent each bag of attributes by a single value
  - Apply a suitable aggregation function (e.g., min, max, average for continuous values and mode for discrete values
  - Reduce the data set into a traditional attribute-value data set
  - Each instance is represented by a finite number of attributes
  - Each attribute takes a single value from the set of possible values
- Applying an aggregation scheme to each of the instances can effectively reduce the problem of learning from an RDF data set to the well-studied problem of supervised learning

[1] H. Lin et al., 2013

Lecture Bibliography



Lecture Bibliography

- [1] H. Lin et al., 'Learning Classifiers from Chains of Multiple Interlinked RDF Data Stores', 2013 IEEE International Congress on Big Data, DOI 10.1109/BigData.Congress.2013.22,
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