Introductional Presentation

"Graph Kernels for RDF Data"*- Summary and implementation ideas

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5. Dezember 2017

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- **Graph kernels for RDF data.**
  Lösch, U., Bloehdorn, S., & Rettinger, A. (2012).
  The Semantic Web: Research and Applications, 134-148
  10.1007/978-3-642-30284-8_16
  2012

Content Overview

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Combining RDF with Machine learing

Goal

We want to apply Machine learning algorithms on RDF.

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Problem!

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We want to apply Machine learning algorithms on RDF.

- Rescource Description Frameworks (RDF) impose a Graph structure on the Data
- Machine learning algorithms are optimzed on certain Data Structures (Tables etc.)

Problem!

Solutions:

1. Rewrite the ML-Algorithms for RDF Data
2. Try to transform the RDF Data that it suits ML-Algorithms

Kernels mathematically

Definition

Let D be the Space of Data, $\psi : D \to F$ a mapping representing the Data as $F \subset \mathbb{R}^n$. A function K with a represenation

$$K : D \times D \to \mathbb{R}$$
$$K(d_1, d_2) = < \psi(d_1), \psi(d_2) >$$

is called Kernel.

Short version:

1. We take our Data d_1, d_2
2. We transfer them to real-valued vectors $\psi(d_1), \psi(d_2)$
3. We apply a scalar product.

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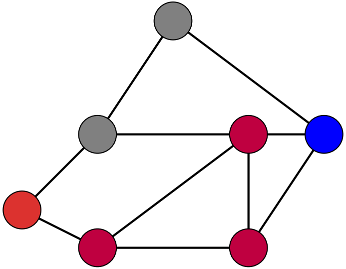
What Kernels can we define for Graphs? Lösch et al. proposed for different suitable kernels.

1. Walk Kernel
2. Path Kernel
3. Full Subtree Kernel
4. Partial Subtree Kernel

Example: The path kernel



$$\kappa_{l,\lambda} = \sum_{i=1}^{l} \lambda^{i} |\{p | p \in paths_i(G_1 \cap G_2)\}|$$

Content Overview

1. RDF-Kernels
   - Motivation
   - Kernels for RDF
   - Relevance

Example

Why this approach ?

Example

Why this approach ? Lösch U., Bloehdorn, S., Rettinger, A. showed that this approach of applying Graph Kernels to RDF show almost the same peformance as retailoring ML algorithms to RDF structure.

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  - Give the possibility to use User defined Update/Deletation algorithms and kernels.
  - Provide the defined example Kernels with efficient implementation of Update/Deletation

Content Overview

2 Implementation
- General Concept
- Ideas for Implementation

Computation of Predefined Kernels

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+ Faster than Sparks RDD querying.
+ Computational Performance will scale up with SANSA's performance.

Value Storage

Two ideas:

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1. Store Kernel-Values directly in original RDF
   - + All information is provied in Consistent Format.
   - + Induces a Distance Graph on Original RDF.
   - + Can be used for further analysis outside of Sansa

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   - \- What size ? (Has to be Scalable, e.g updates)
   - \- What structure ? (f.e Distance Matrix: Inefficient if Sparse)
   - \- Has to be a know format ! Otherwise not user friendly.

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+ Same implementation for both variants. Only different target for saving the values
+ User can pick which one he favours.
+ In each way the user is familiar with the storage format.
+ A posteriori the RDFs can still be merged.