Mögliche Themen

* Second order optimization methods to accelerate learning of knowledge graph embeddings [Caglar Demir]
  + Basic implementation: <https://github.com/dice-group/Stochastic-L-BFGS-Boost>
* Bayesian Optimization for Hyperparameter Optimization [Caglar Demir]
  + [**https://www.cs.cornell.edu/courses/cs4780/2018fa/lectures/lecturenote15.html**](https://www.cs.cornell.edu/courses/cs4780/2018fa/lectures/lecturenote15.html)
* Generation of hard negative examples for knowledge graph embeddings [Caglar Demir]
  + Generate negative examples which are very similar to positive examples
  + Ideas: natural language processing, page rank, ...
* Type Prediction in Knowledge Graphs [Hamada Zahera]
  + ConnectE: <https://arxiv.org/abs/2007.10873>
  + Directions: Semi-Supervised Learning (idea: teacher student model)
* Use contrastive learning for machine learning on knowledge graph
  + Suggested title: Contrastive Learning for Explainable Anomaly Detection in Time-series Data [Hamada Zahera]
  + References:
    - [Adversarial Self-Supervised Learning for Out-of-Domain Detection](https://aclanthology.org/2021.naacl-main.447.pdf)
    - [Anomaly Detection on Attributed Networks via Contrastive Self-Supervised Learning](https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9395172)
    - [A Survey on Contrastive Self-Supervised Learning](https://www.mdpi.com/2227-7080/9/1/2)
    - [cutpaste self-supervised learning for anomaly detection and localization](https://arxiv.org/abs/2104.04015)
    - [Masked Contrastive Learning for Anomaly Detection](https://www.ijcai.org/proceedings/2021/0198.pdf)
    - [Contrastive Self-Supervised Learning for Commonsense Reasoning](https://arxiv.org/pdf/2005.00669.pdf)
    - [Multi-view Knowledge Graph Embedding for Entity Alignment](https://www.ijcai.org/proceedings/2019/0754.pdf)

Benchmarking Datensätze für Knowledge Graph Embeddings

* FB15k-237
* WN18RR
* YAGO3-10

Knowledge Graph Embedding Verfahren

* TransE
* DistMult
* ComplEx

OLD

Mögliche Richtungen für Themen

* Rule Learning for Knowledge Graphs  
  (geht in Richtung Explainable Machine Learning)
  + **DL-Learner:** <https://dl-learner.org/>
  + <https://github.com/dice-group/Ontolearn>
  + Lehmann, Jens, and Pascal Hitzler. "Concept learning in description logics using refinement operators." Machine Learning 78.1-2 (2010): 203. <https://jens-lehmann.org/files/2014/pol_concept_learning.pdf>
  + Learning Neo4J / Cypher Query Language
  + Given positive/negative examples
  + Evolutionary Algorithm / Reinforcement Learning
  + For industrial time-series data
  + [Temporal description logics: A survey](https://ieeexplore.ieee.org/abstract/document/4553284/?casa_token=UTAqfT8n_BYAAAAA:OXSbXoO7Y00qH2l5RmwrXUj9WMrejB3ZEadhCYKAp3HAyIRMjSueJA-9PMSYLvTt8CoZv14)

<https://ieeexplore.ieee.org/iel5/4553273/4553274/04553284.pdf?casa_token=PskQb0i3slwAAAAA:pFfQBNE4SAWFaaRjeFVvV9CmYdZd4qcEPrp4AMItoCXCHNy6BxIaiYI1W83mrV5hCZpUlK4>

* Knowledge Graph Embeddings  
  (geht in Richtung Deep Learning)
  + **Libraries supporting KGE: OpenKE, PyKeen, LibKGE, …**
  + Problem: Only consider graph structure (but not attribute values)
  + AutoML for Embeddings: Learn Scoring function
    - AutoSF+: Towards Automatic Scoring Function Design for Knowledge Graph Embedding. <https://arxiv.org/pdf/2107.00184.pdf>
    - Idea: Extend this paper to support literals/attribute
  + AutoML for Knowledge Graph Embeddings with Literals (LiteralE, etc.)
* Causal Question Answering with CauseNet  
  (geht in Richtung Natural Language Processing)
  + Different distance metrics: Graph-based/word-based/…
  + <https://causenet.org/>
  + <https://dl.acm.org/doi/abs/10.1145/3340531.3412763>