



Project A6 Resource-Efficient Graph Mining

3

Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Resource-efficient analysis of complex and large networks and sets of graphs



- Learning based on predetermined features
- Learning on static graphs
 without spatial embeddings
- Feature learning on graphs will be part of the problem
- Learning on spatio-temporal graphs that change their structure and location (2D/3D) through time





Focus on (soft) real-time resourceconstraints and mobile deployment

Optimal assignments

Graph similarity for kernel learning from vertex assignments



- $S_t(V, W) = \max_{B \in \mathcal{B}(V, W)} \sum_{(v, w) \in B} t(v, w)$
- Vertex similarities, *e.g.*, based on neighbourhood aggregation
- Relation between properties of

Geometric deep learning

Graph convolution as learnable neighbourhood aggregation





- Attention mechanisms to score importance of information
- (Differentiable) pooling for hierarchical feature learning
- Graph synthesis via unpooling

Spatio-temporal graphs



Graph kernels

- Graph kernels tracking spatial and structural changes
- Efficient kernel recomputation for dynamic graphs
- Kernel-based stream analysis

Recurrent Graph-CNNs

Combination of



the graph and vertex similarity

- (End-to-end) feature learning for vertex similarities
- Explicit feature maps for learning under resource-constraints



Graph-CNNs and sequence learning

Novel operators for additional consideration of spatial and structural changes

- Analysis of the expressivity of neighbourhood aggregation models (e.g., Weisfeiler-Lehman, Graph-CNNs)
- Randomised sampling techniques with performance guarantees for large-scale networks
- Graph-based data augmentation schemes for learning from restricted amount of labelled training data

Integration within the Collaborative Research Centre



Analysis of spatio-temporal data

A4



Analysis of high-dimensional and high-frequent data

C1 Dependency graphs between molecular features and dynamics
 C3 Learning on hexagonally sampled data
 C5 Link prediction of vertices in different layers



