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

Problem

Phase 2
- Learning based on predetermined features
- Learning on static graphs without spatial embeddings
- Development of resource-efficient graph algorithms

Phase 3
- 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 resource-constraints and mobile deployment

Optimal assignments
- Graph similarity for kernel learning from vertex assignments
- Vertex similarities, e.g., based on neighbourhood aggregation
- Relation between properties of the graph and vertex similarity
- (End-to-end) feature learning for vertex similarities
- Explicit feature maps for learning under resource-constraints

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

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6

General concepts for graph mining

Analysis of spatio-temporal data

Analysis of high-dimensional and high-frequent data

Phase 2

Phase 3

Problem

Optimal assignments

Geometric deep learning

Spatio-temporal graphs

Integration within the Collaborative Research Centre

General concepts for graph mining
- A2: Data reduction techniques for graph streaming
- A3: Distributed analysis of concept drifts and limited samples
- B2: Parallelisable learning techniques for irregularly structured data

Analysis of spatio-temporal data
- A4: Collision forecasting for unmanned air vehicles
- B4: Prognosis and optimisation of vehicular traffic flow

Analysis of high-dimensional and high-frequent data
- C1: Dependency graphs between molecular features and dynamics
- C2: Learning on hexagonally sampled data
- C5: Link prediction of vertices in different layers

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

Planned Research

Resource-Efficient Graph Mining
Dr. Nils M. Kriege, Prof. Dr. Petra Mutzel, Dr. Frank Weichert

H"ochstleistungsrechner GmbH, Germany

We declare that the information regarding our work in this document is accurate and complete.

Project A6