Name	Junichiro Mori, Associate Professor	Location	Hongo	Research Area	Large-scale Graph Mining

Graph Mining Approach for Large-Scale Data Analysis

Our research group is studying graph mining methods for large-scale data analysis and their social applications. As the basis of large-scale graph mining, we are currently developing several embedding methods on a large-scale graph, which potentially gives a vector representation of each node or the entire graph to solve machine learning tasks on a graph originated from large-scale data. We are also applying our methods to developing systems which would solve several social issues. Those applications include mining large-scale scholarly data, supply chain network data, human mobility data. Employing the graph mining-based methods and their applications for large-scale data analysis, we are aiming at supporting human decision making. Our research outcomes have been widely used for evidence-based policy making and strategic planning in research and development. Our research group is also working on educational contents and tutoring systems for student learning in informatics. We welcome those who try to tackle issues with their creative ideas.

Network Representation Learning

The structure of a network or graph is generally comprised of set of nodes and edges, in which each node represents an entity and each edge represents a relation between nodes. According to recent representation learning approaches in deep learning, we are working on developing several embedding methods on a large-scale graph, which potentially gives a vector representation of each node or the entire graph to solve machine learning tasks on a graph originated from large-scale data.
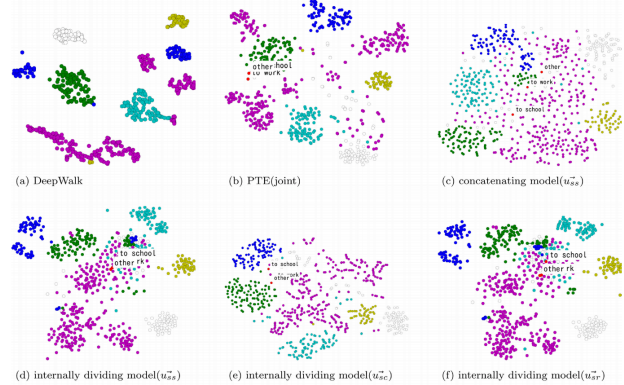
Mining Large-scale Graph Data

Mining Large-scale Scholarly Data

Big scholarly data includes a large amount of academic papers and their citation networks. We are developing the novel system which automatically analyzes big scholarly data, including large citation networks, to identify current research trends and predict future emerging technologies in the research fields. The system is currently used in several applications: technology road mapping and horizontal scanning for science and technology policy, strategic planning in research and development.
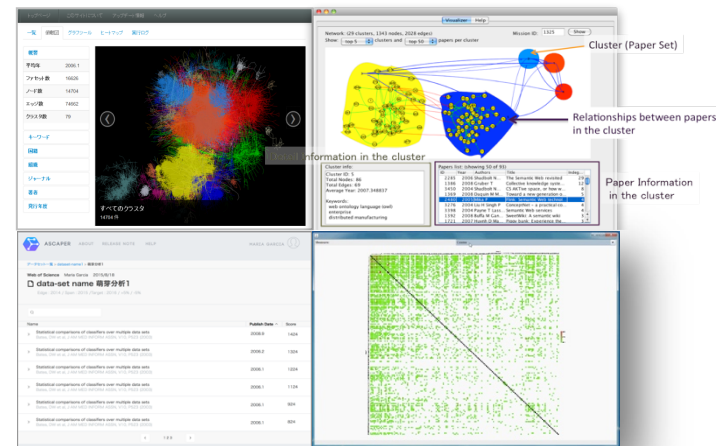
Mining Large-scale Supply Chain Network

Aiming at designing a supply chain network, supporting small and medium-sized enterprises (SMEs), and promoting regional economy in Japan, we are developing the method to analyze a large-scale supply chain data with a network analysis approach. We are also developing the system for SMEs to find their business partners. Our study has contributed to regional revitalization in the disaster area of the Great East Japan Earthquake by supporting evidence-based policy making.
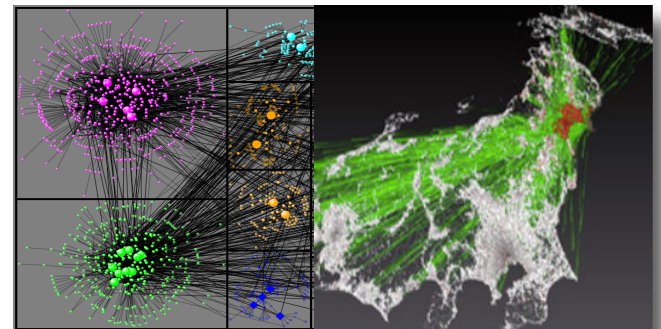
Mining Large-scale Human Mobility Data

We are collaborating with public and private sectors which operate public transportation systems in a metropolitan area. We are developing the method to analyze large-scale human mobility data from the public transportation systems to help the sectors design and operate their systems effectively. The key idea is to generate a human mobility graph from the data and apply our graph mining methods. We are also conducting social experiments to implement our data-driven improvement plan.

Mathematics and Informatics Education

We are designing a curriculum for learning mathematics and informatics in higher and recurrent education, which are foundations for recent data science and artificial intelligence technologies. We are also developing educational contents and tutoring systems for student learning in the disciplines

(a) DeepWalk (b) PTE(joint) (c) concatenating model($u_{se}^{\rightarrow}$)

(d) internally dividing model($u_{sr}^{\rightarrow}$) (e) internally dividing model($u_{sc}^{\rightarrow}$) (f) internally dividing model($u_{sr}^{\rightarrow}$)

Figure 1: Network Representation Learning Methods

Figure 2: Mining Large-scale Scholarly Data

Figure 3: Mining Large-scale Supply Chain Network