



# SUMMER SCHOOL

on Data Science Tools and  
Techniques in Modelling  
Complex Networks

## AUGUST 19- 23, 2019

Simply stated, data mining is the process of answering questions by analyzing data sets from different perspectives using algorithms which run on a mathematical representation of the data. The most commonly used data representation is the data matrix, where each row corresponds to an observation and each column represents a feature. In the special case where all features are numerical, this is called a vector space representation. A large number of algorithms can be applied to such data, including sampling and dimension reduction methods.

Not all data types naturally fit in the data matrix representation. In a relational data set, an observation involves two or more entities. Such data sets are often modeled via graphs or hypergraphs. A graph is a collection of vertices representing the entities, connected via edges, each of which represents a relationship between two vertices. Hypergraphs are used to model relations involving an arbitrary number of entities. Exploratory data analysis over relational data can be challenging. Slicing or sampling a relational data set tends to destroy its structure and not much can be learned from it. The missing or noisy data problem is also more problematic with relational data. For example, the addition or removal of an edge in a graph can considerably change properties such as the diameter.

We will explore various theoretical and practical aspects of relational data representation and mining. The format of the course will be a mix of lectures and demonstrations of various techniques over relational datasets using Python, Julia and Jupyter Notebooks.

## SPEAKERS

**François Thériberge** - Tutte Institute for Mathematics and Computing

**Pawel Pralat** - Ryerson University

**Bogumil Kaminski** - SGH Warsaw School of Economics

**Przemyslaw Szufel** - SGH Warsaw School of Economics

Additional financial support provided by:



Register at: [http://www.fields.utoronto.ca/cgi-bin/register?form\\_selection=complex-networks](http://www.fields.utoronto.ca/cgi-bin/register?form_selection=complex-networks)