

Regional Standardization Forum
Emerging Economic,
Regulatory and Policy Trends
in a Fast-Changing Digital World

Xi'an, China, 27 August 2018

Big Data and Graph Mining

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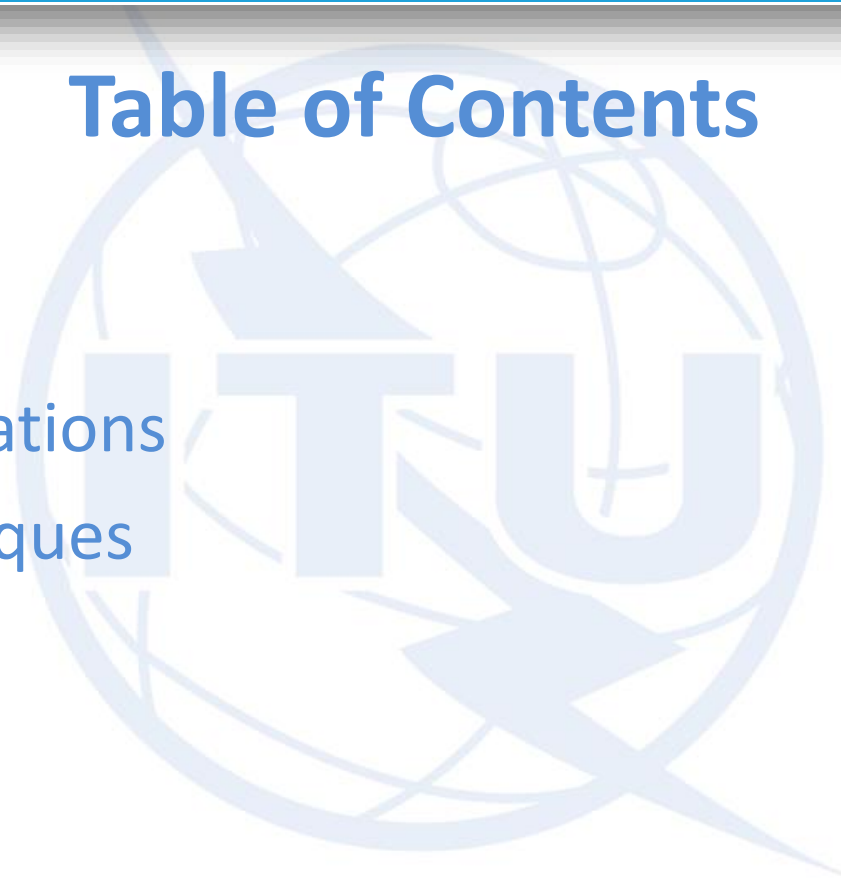
- Graph Mining
- Graph Mining Applications
- Graph Mining Techniques



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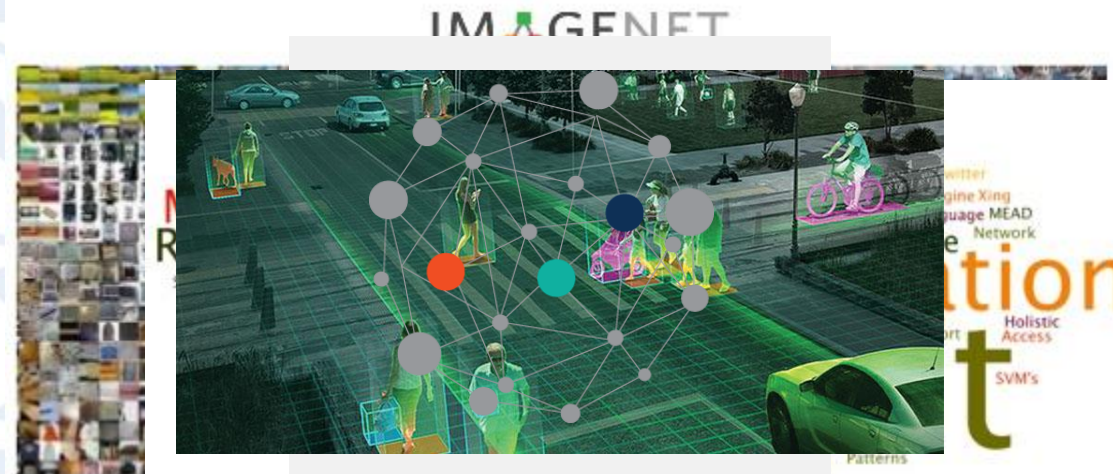
✓ Graph Mining

- Graph Mining Applications
- Graph Mining Techniques



Machine Learning Data Structures

- Data structures in machine learning
 - Structured Data
 - Images
 - Text
 - Audio
 - Video
 - **Graph**



Graph

- Definition

- Graph

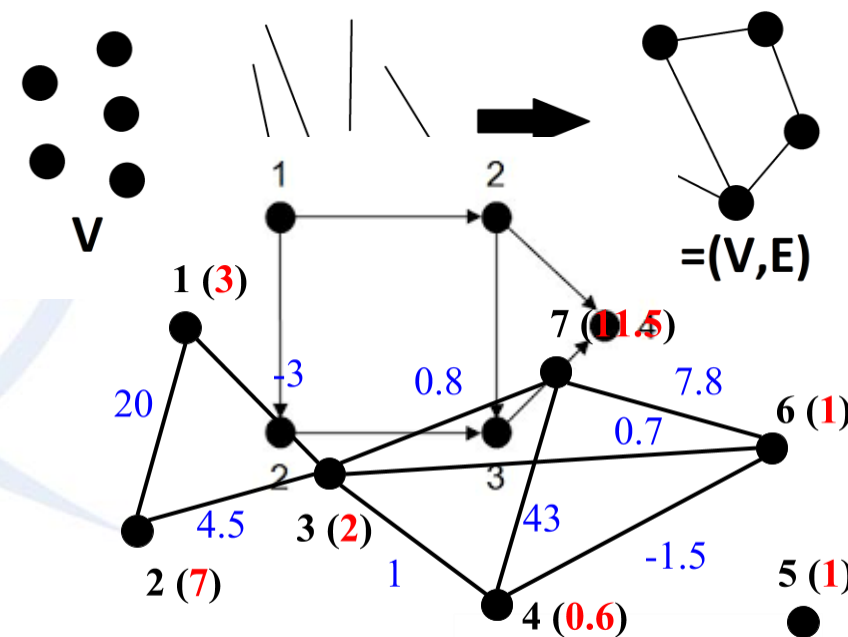
- A graph G is composed of two sets: a set of vertices and a set of edges.

- Directed Graph

- Each edge in graph is an ordered pair of vertices.

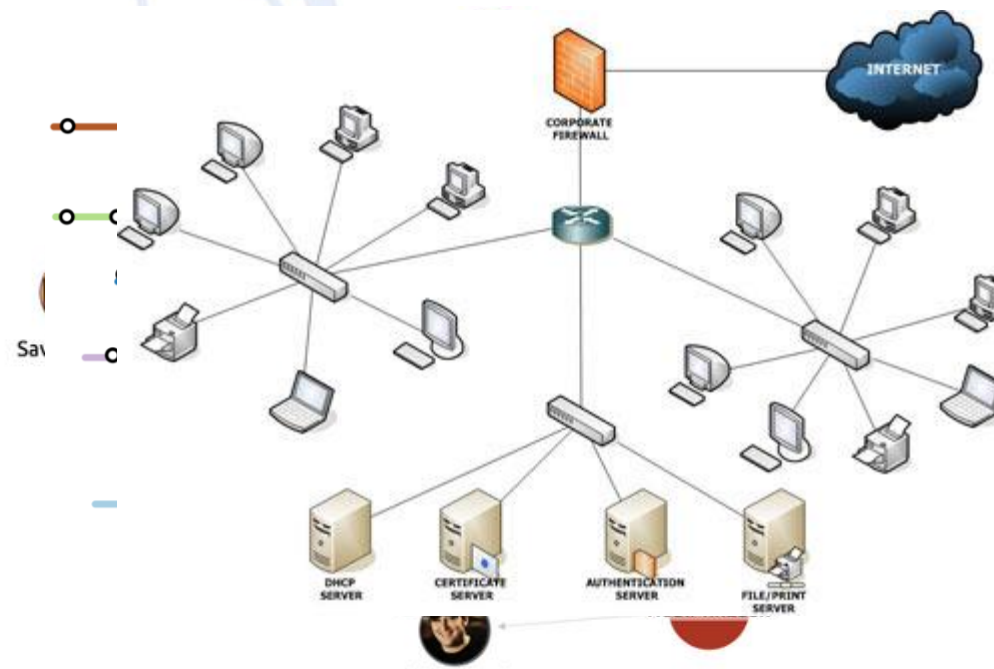
- Weighted Graph

- Each edge in graph has a numeric weight w .



Graph Examples

- Examples
 - Web pages
 - Social networks
 - Computer Networks
 - Transportation Networks
 - Power Network



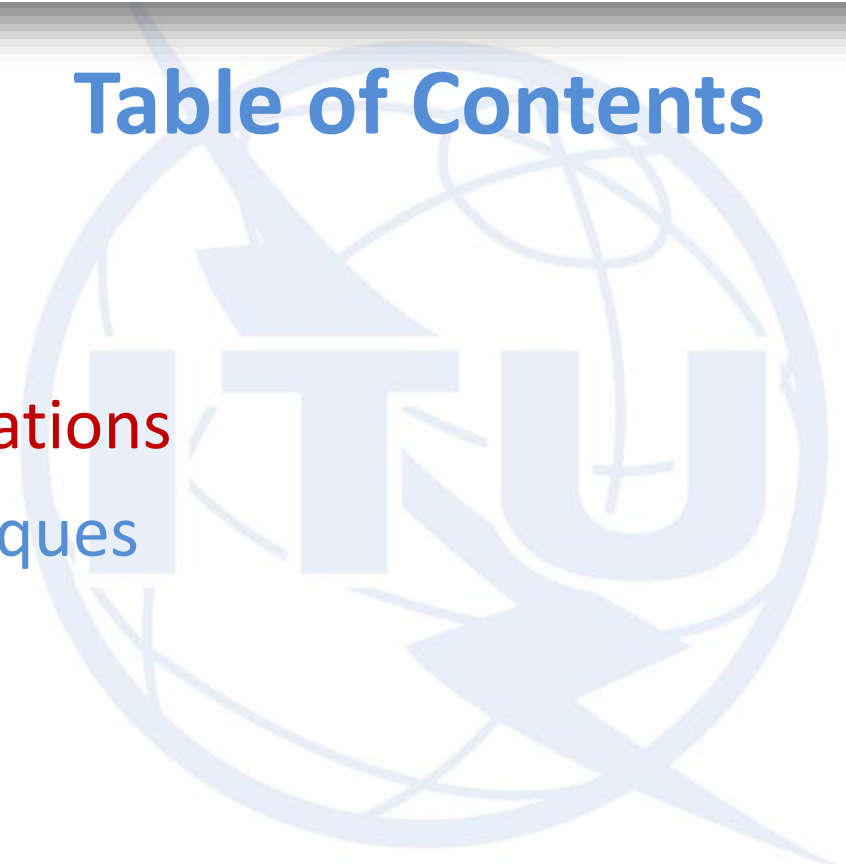
Graph Mining

- Graph Mining
 - Extraction of insightful and actionable knowledge from graph data



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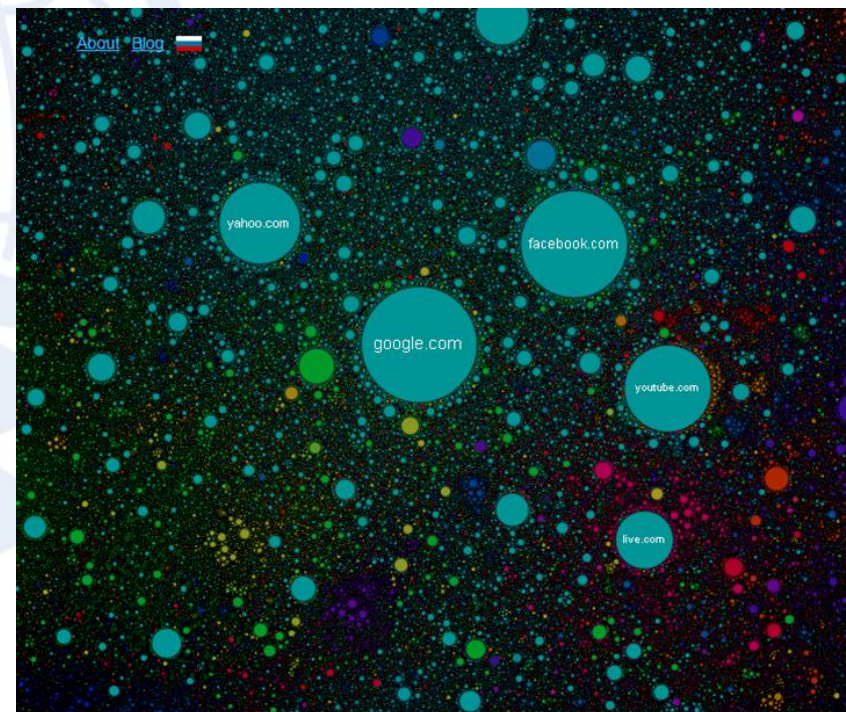
Graph Mining Applications

- Applications
 - Web Graph
 - Social Network Graph
 - Cybersecurity Graph
 - Healthcare Graph
 - Entertainment Graph



Web Graph

- Web Graph
 - Node
 - web pages
 - Edge
 - hyperlinks
 - Application
 - Identify authorities and hubs
 - Provide more accurate search services



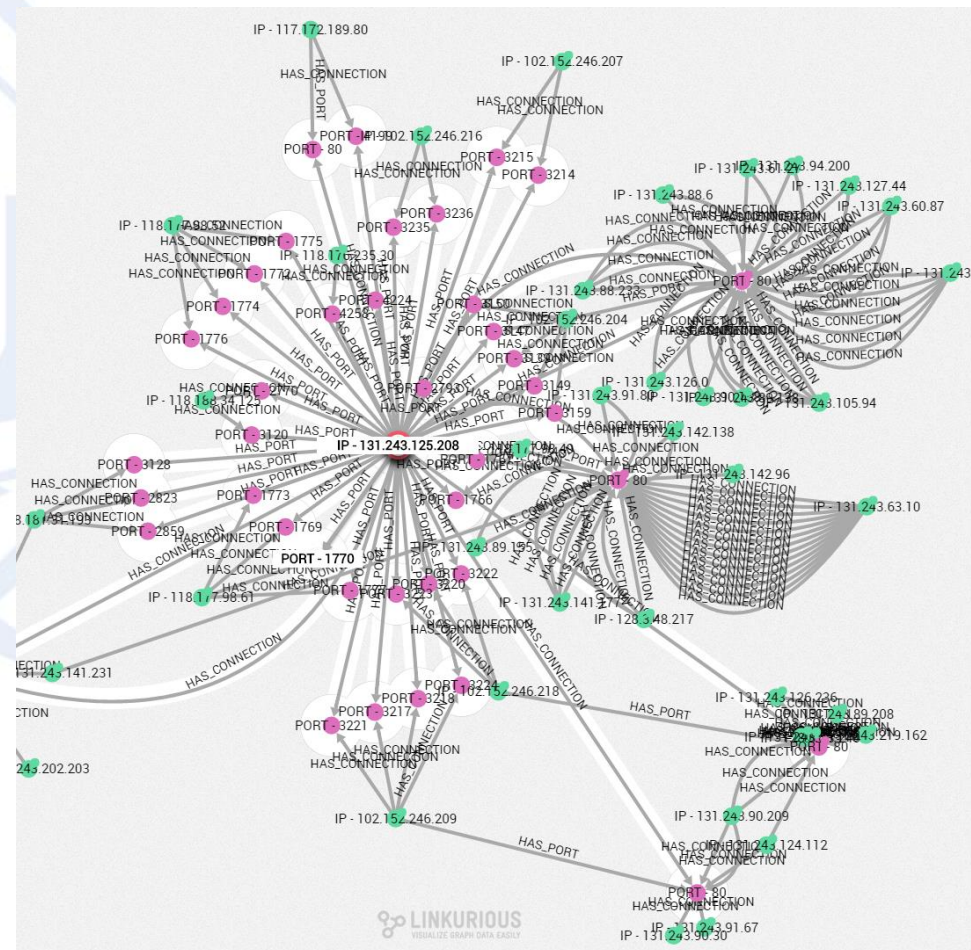
Social Network Graph

- Social Network Graph
 - Node
 - people or accounts
 - Edge
 - friendship
 - Application
 - Identify the most influential people
 - Recommend friends
 - Conduct political campaigns



Cybersecurity Graph

- Cybersecurity Graph
 - Node
 - computers
 - Edge
 - message traffic
 - Application
 - Provide knowledge of computer viruses propagation
 - Identify intruder machines
 - Predict computers without proper authorization



Healthcare Graph

- Healthcare Graph

- Node

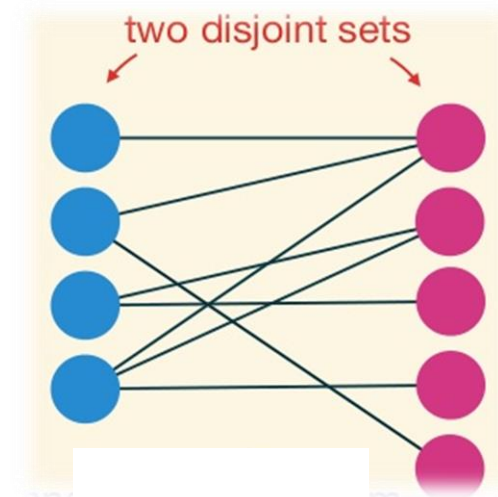
- people(lawyers, customers, doctors, etc.)

- Edge

- names being present together in a claim

- Application

- Detect groups of people collaborating to submit fraudulent claims



Entertainment Graph

- Entertainment Graph
 - Node
 - Actors / movies
 - Edge
 - attributes describing the movie
 - Application
 - Predict of upcoming movie popularity
 - Distinguish popular movies from poorly ranked movies
 - Discover the key factors in determining whether a movie will be nominated for awards

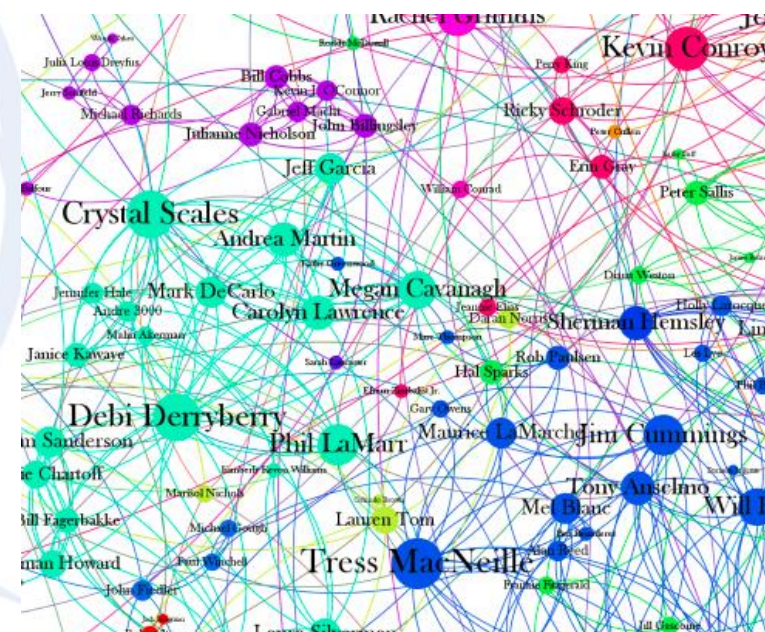
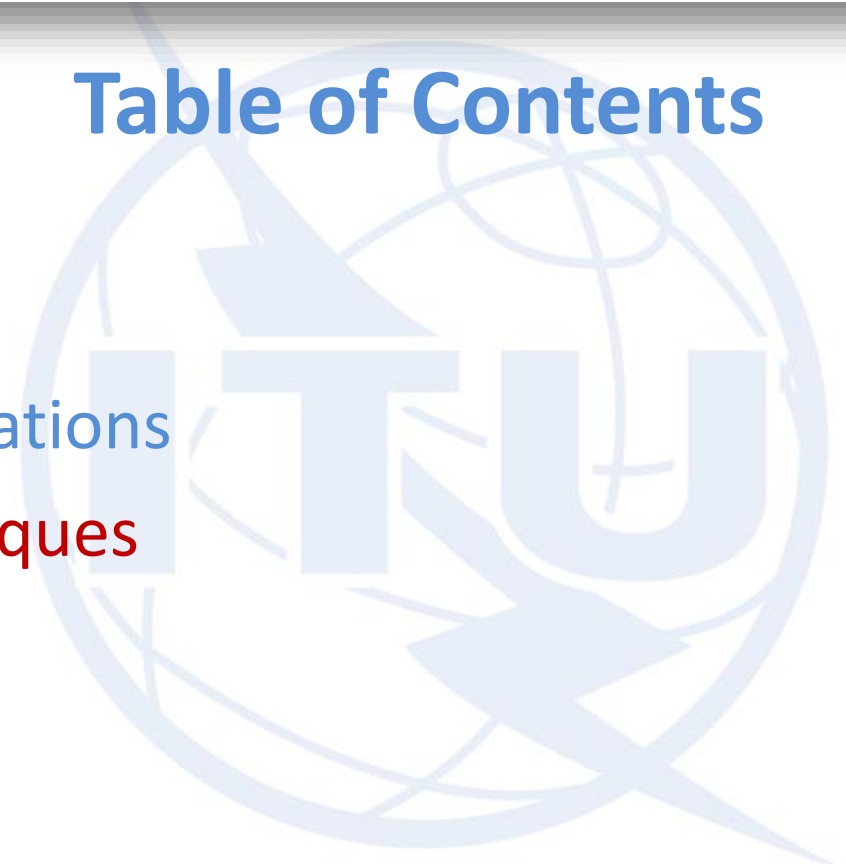


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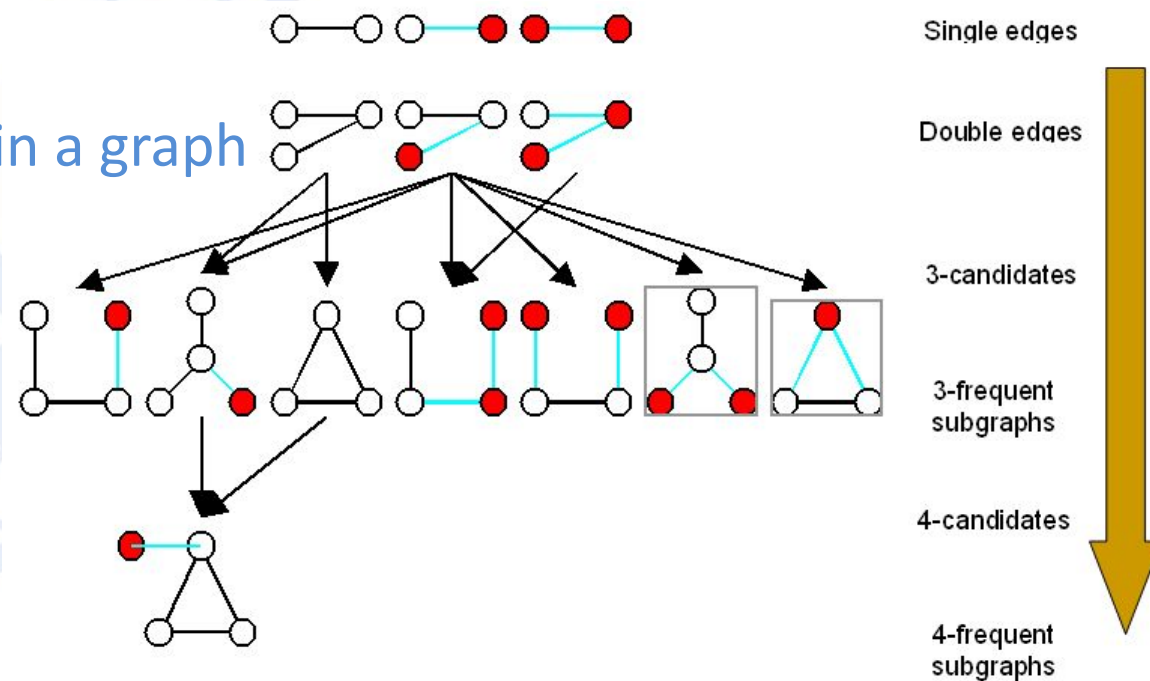
Graph Mining Techniques

- Graph Mining Techniques
 - Frequent Subgraph Mining
 - Link Prediction
 - Classification
 - Clustering



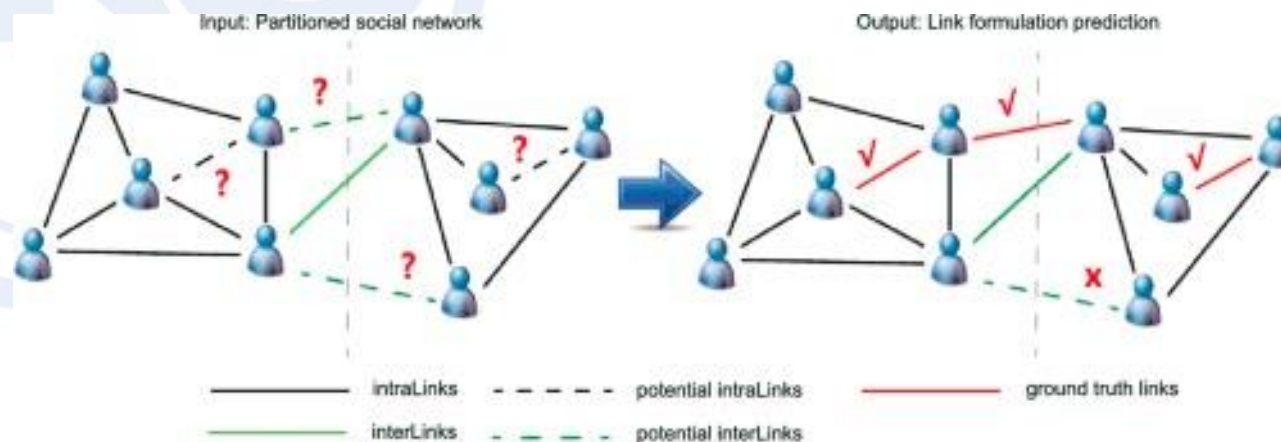
Frequent Subgraph Mining

- Frequent Subgraph Mining
 - Discovering subgraphs that occur often in a graph
- Algorithm
 1. Candidate generation
 2. Candidate pruning
 3. Support counting



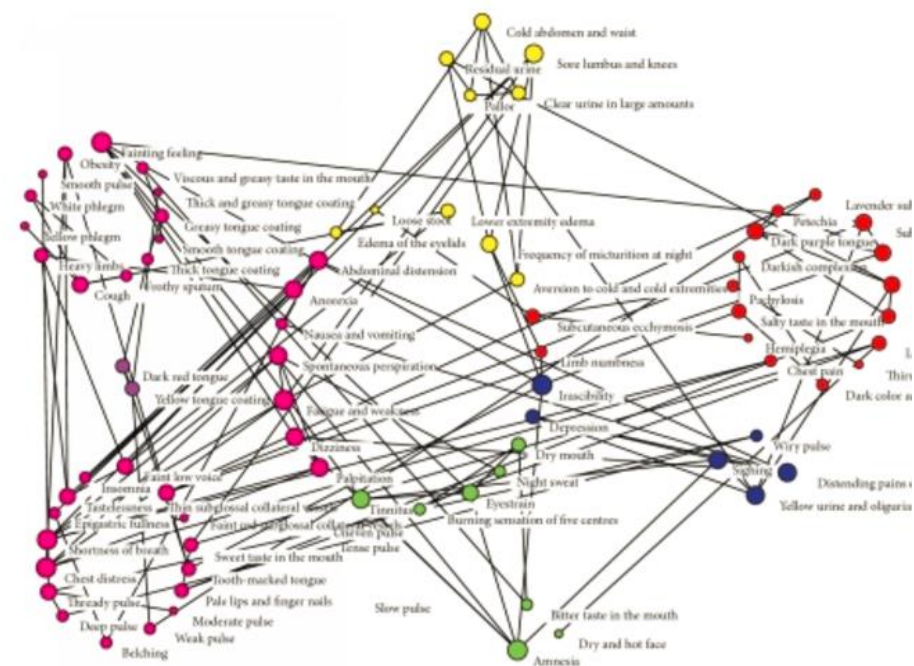
Link Prediction

- Link Prediction
 - Predict the edges that will be added to the graph during the future interval
- Algorithm
 - Node neighborhood based
 - Ensemble of all path-based



Classification

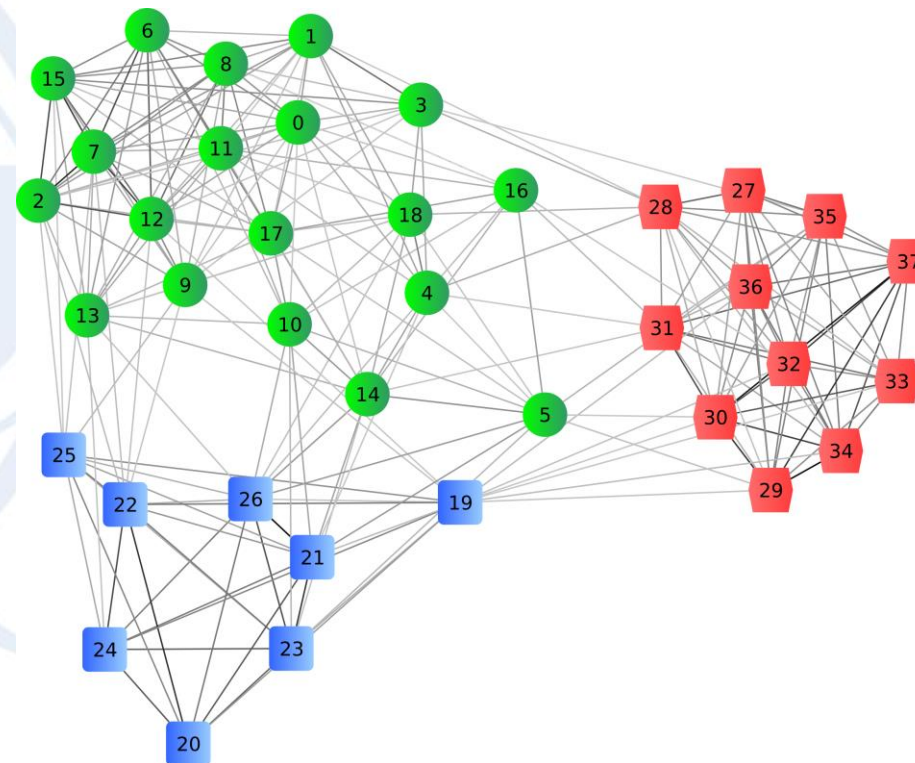
- Classification
 - Graph classification
 - The classification of individual graphs
 - Vertex Classification
 - The classification of individual vertices within a graph



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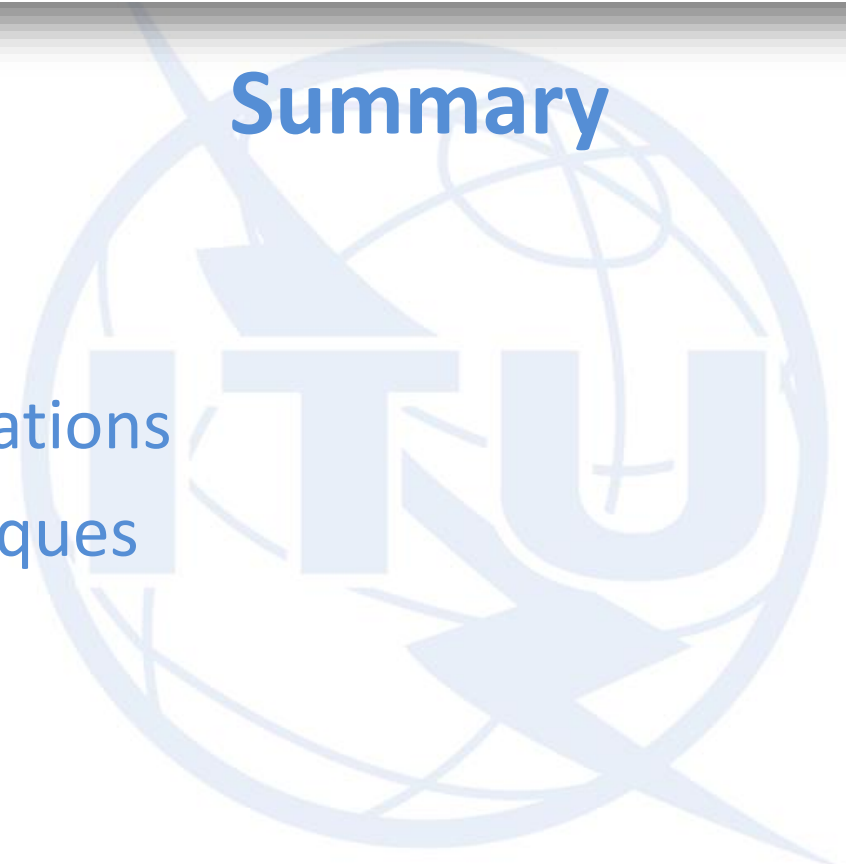
Clustering

- Clustering
 - Clusters the vertices within an individual graph
 - graph partitioning algorithm



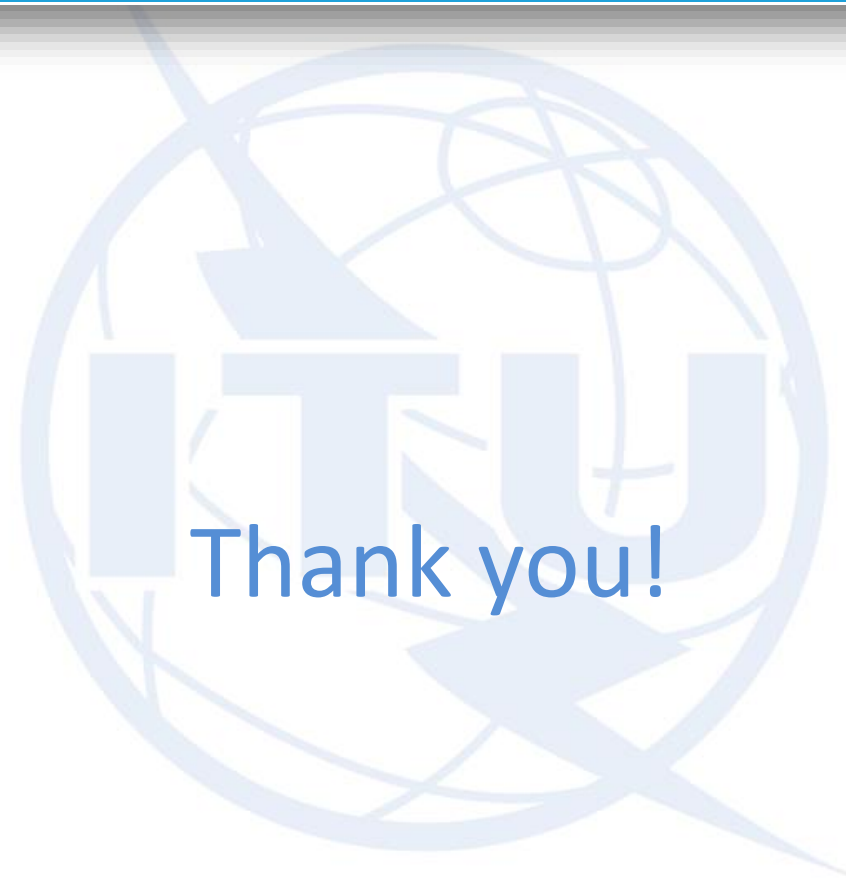
Summary

- Graph Mining
- Graph Mining Applications
- Graph Mining Techniques



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Thank you!

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