AI for Social Networks

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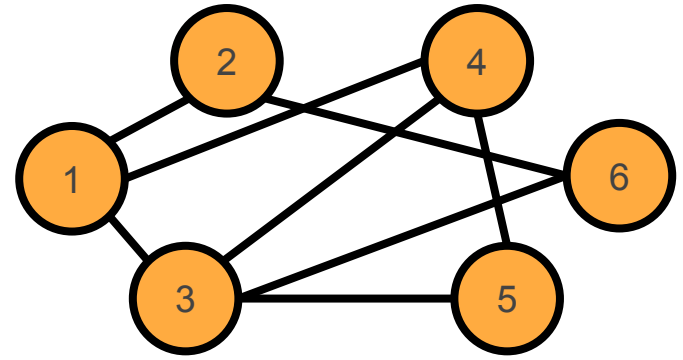
Social Networks: People and Relationships

Today, we say a social network consists of:

1. A set of people

2. Certain pairwise relationships between people (e.g. friendship, Twitter following, coworkers)

Answer in chat: Examples of social networks? Please list in-person and online social networks!

Graphs:
Nodes and Edges

Graphs are more abstract / general type of data: objects (nodes) and pairwise relationships (edges) between nodes.

E.g. the top-right graph has nodes 1,2,3,4,5,6. Edges include (1,2), (3,6), etc.

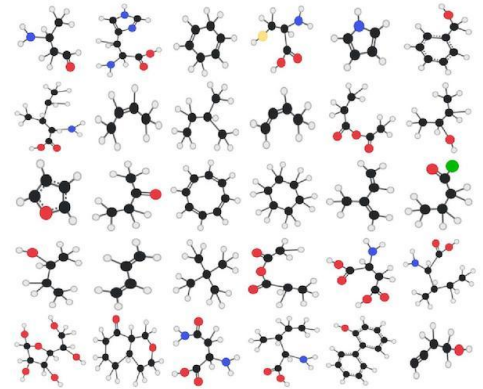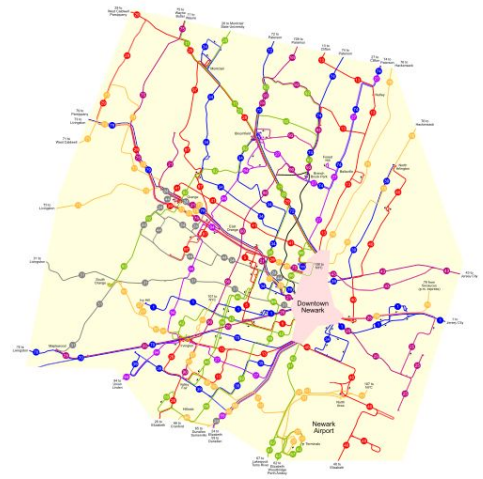Insights for Graphs → Insights for Social Networks

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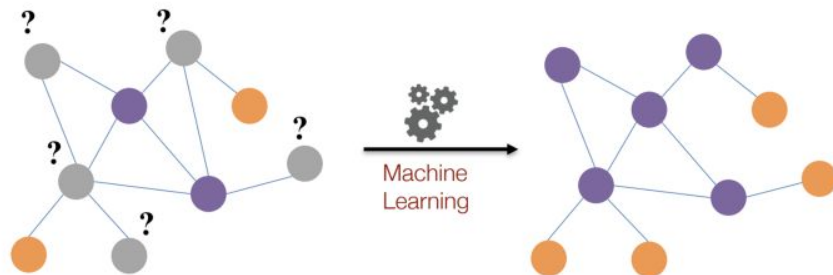
More Examples of Graphs

Type in chat: What kind of edges could a graph with Instagram photos as nodes have?

More examples:

- Webpages and links between them

- Transportation networks

- Molecules

Node Classification

Given: graph where some nodes are labeled in certain categories

Predict: categories of unlabeled nodes

Examples:

- Predict whether Facebook friends of known terrorists are also terrorists
- Predict what brands a Twitter user likes based on their followers / following
- Predict location of a person if they do not give it to you, based on location of their friends (scary!! Also for other sensitive attributes.)
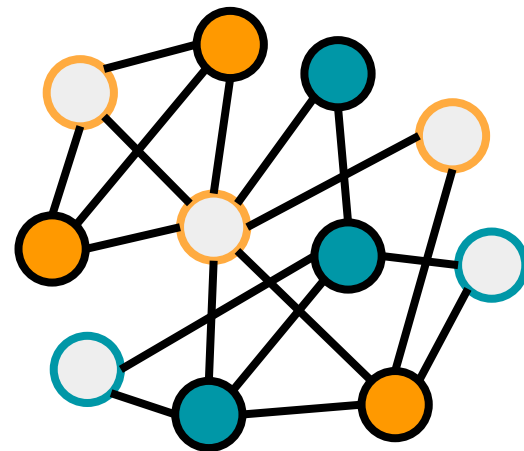
Node Classification Pipeline
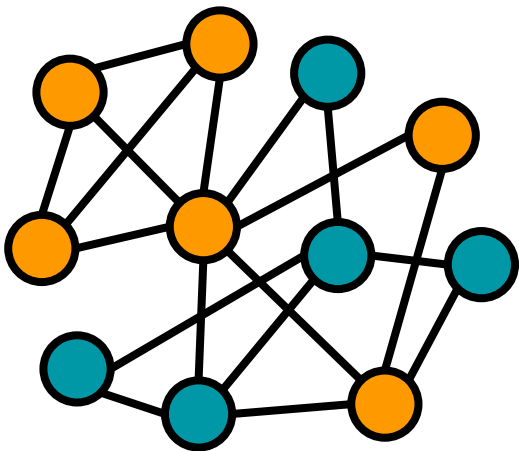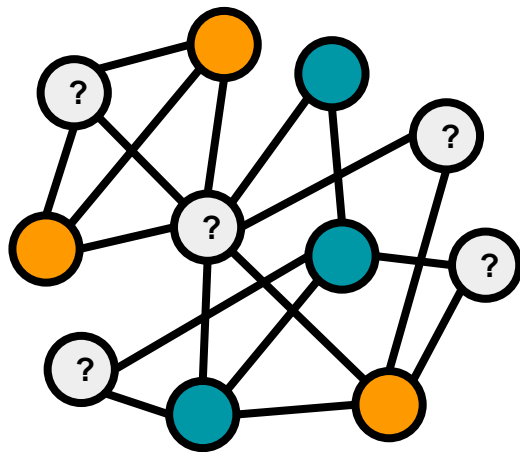

True → Training → Predictions

Train machine learning classifier on nodes with labels, use to make predictions on nodes without labels

# If we have good node features . . .

- Often graphs have informative node features
  - E.g. age, interests, biography word vectors (use NLP!), image features (use CV!)
- Can directly use these with supervised classification algorithms!
  - e.g. logistic regression, neural networks
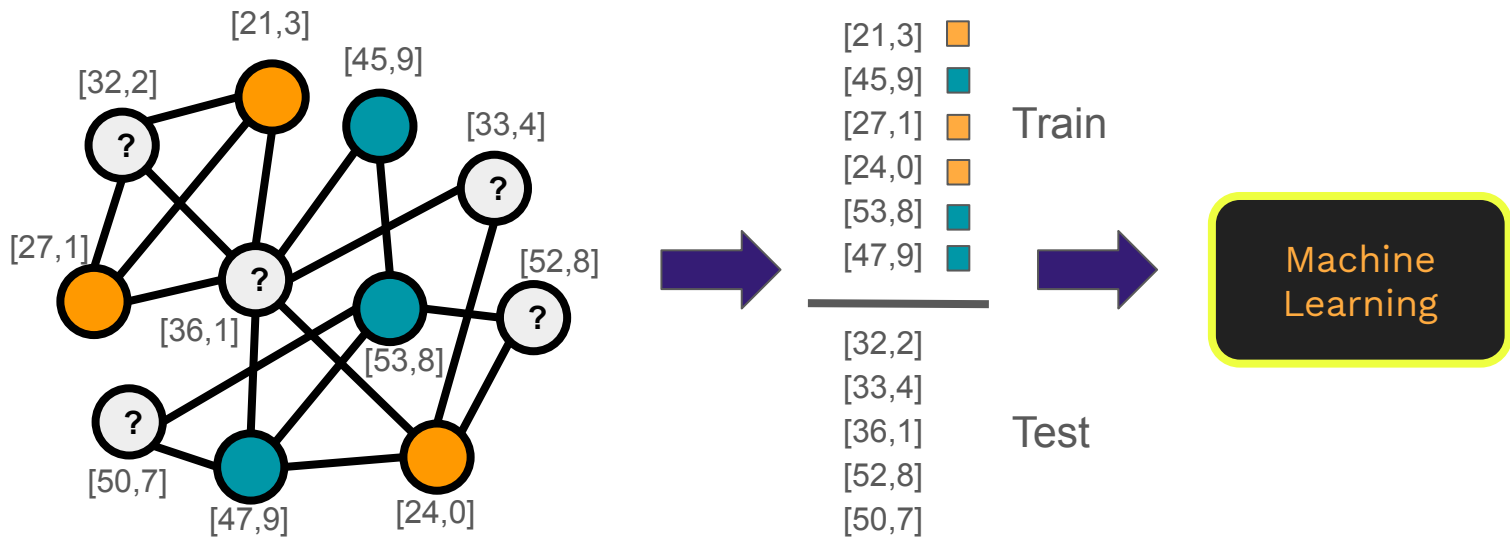
But we want to use the graph edge information as well ...

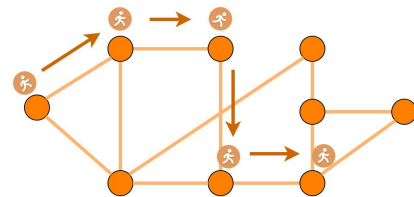Relationships from edges can be very informative !!

Learning Node Features
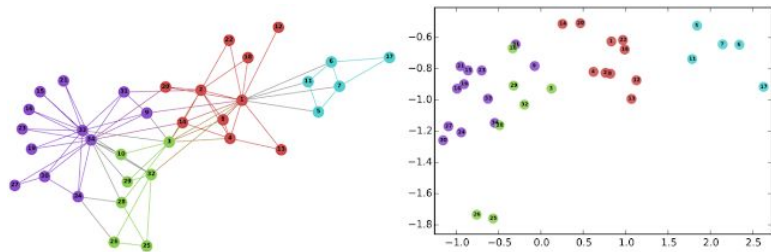
We can use graph information to learn feature vectors for nodes!

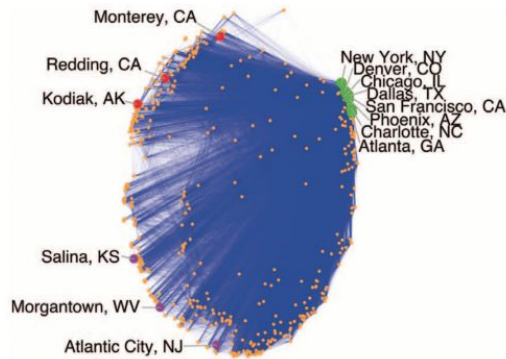**Word2vec:** **Words** that are close in **texts** get similar features

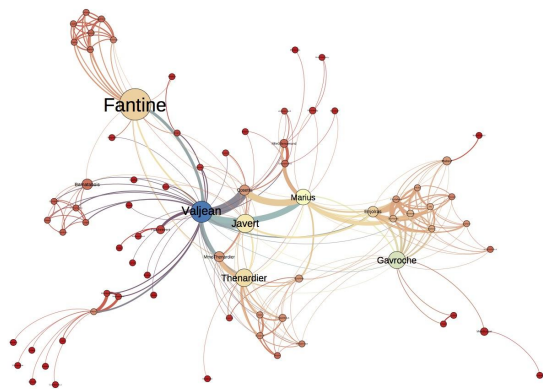**Node2vec:** **Nodes** that are close in **graphs** get similar features

Closeness of nodes: how many edges to get from one to another

- friends have distance 1, friends-of-friends have distance 2
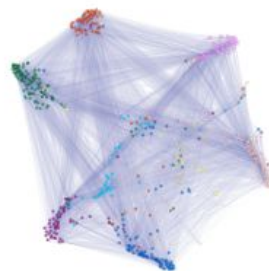
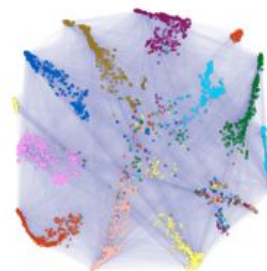# 2D Node Features for Visualization of Graphs

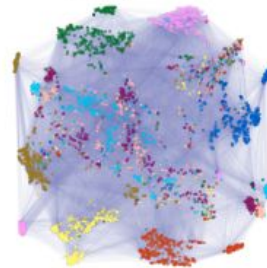Airport networks

Les Misérables network

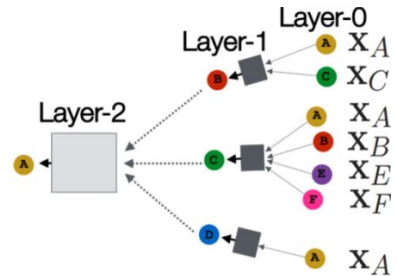Caltech36, GLANCE

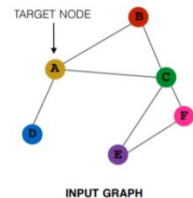Rice31, GLANCE

Caltech36, spectral embedding

Rice31, spectral embedding
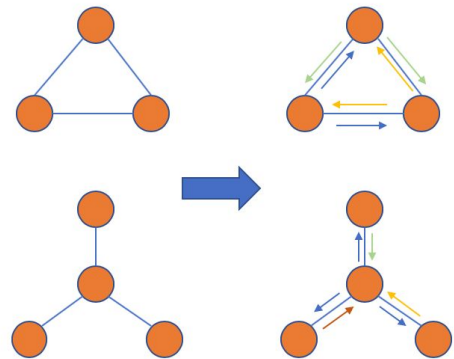
Color of node: college dorm

Graph Neural Networks

Many neural network models developed for graphs!

Basic idea - in each layer, each node:

1. Receives information (messages) from neighboring nodes
2. Aggregates this information to keep for the next round
3. Transform this information by some neural network with learnable weights

Goal: learn weights to make good predictions

Conclusion, Questions, Etc!