Node2Vec

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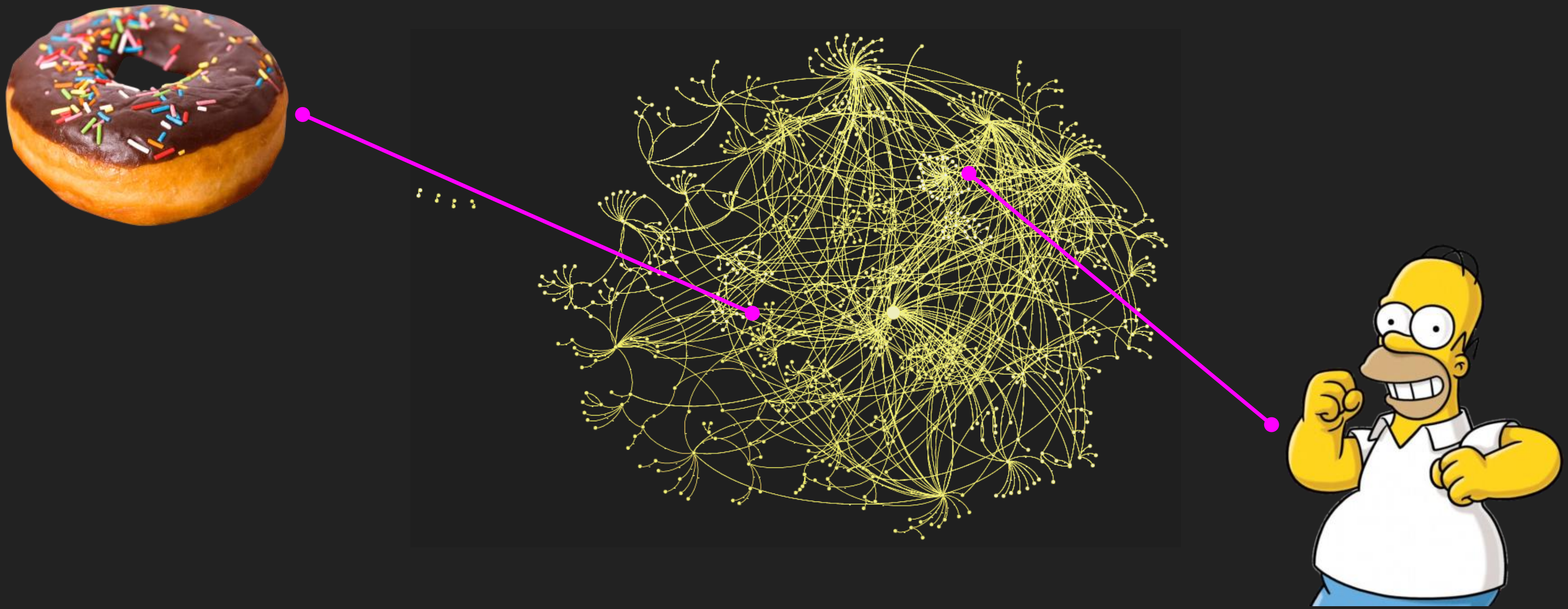
aggregate intellect

Why study graphs for recommender?

- Graphs encode underlying structure of the data
  - Modeling interactions between interactions

- Data can contain more than one underlying graph structure.

Getting info from graphs



Getting info from graphs

- Usual feature generation:

  Number of neighbors, sum of weights, cluster size, etc.

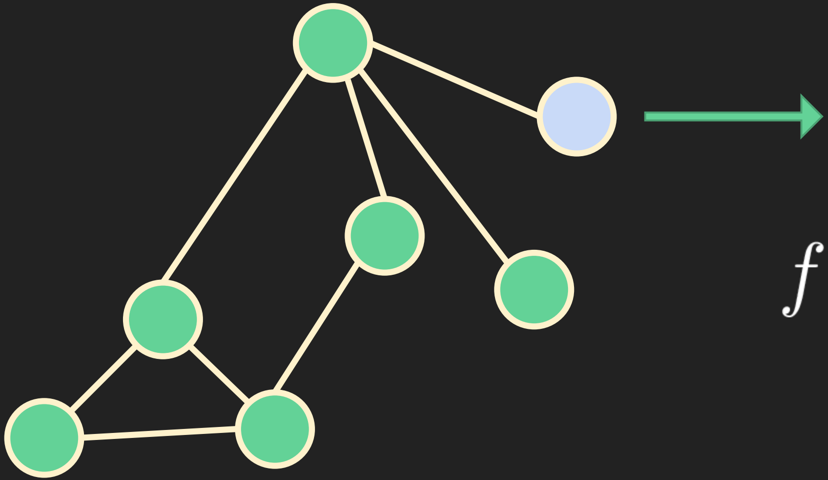
- Algorithmic approaches, (e.g. PageRank):

  Unsupervised way to get a feature (that we can describe)

- Automatic feature generation:

  Node2vec

Node2vec



1	2	1	4	1	2	9	6

$$f : \text{Nodes} \to \mathbb{R}^n$$

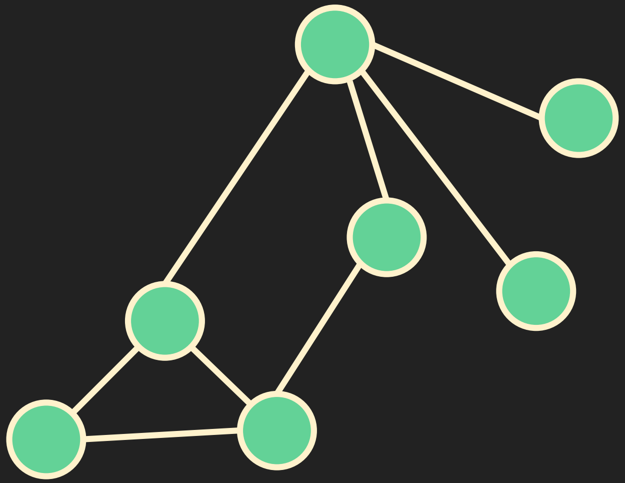
Node2vec - Difficulties

- What is the right dimension to choose?

- Do we want the embedding to preserve/encode a particular property of the graph (local density, long paths, sparsity, etc.)?

- Scalability.

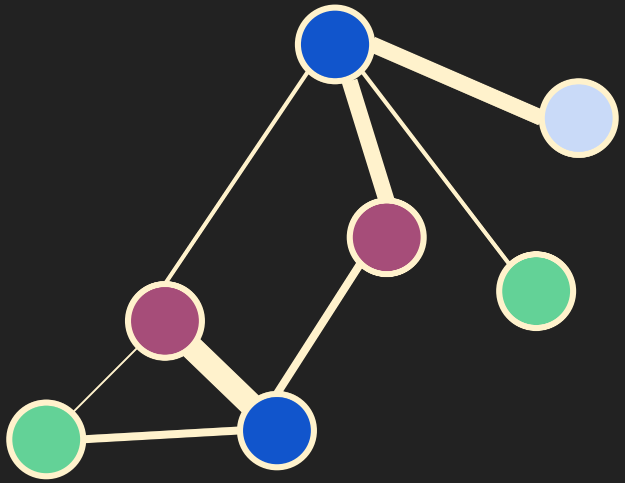
Node2vec



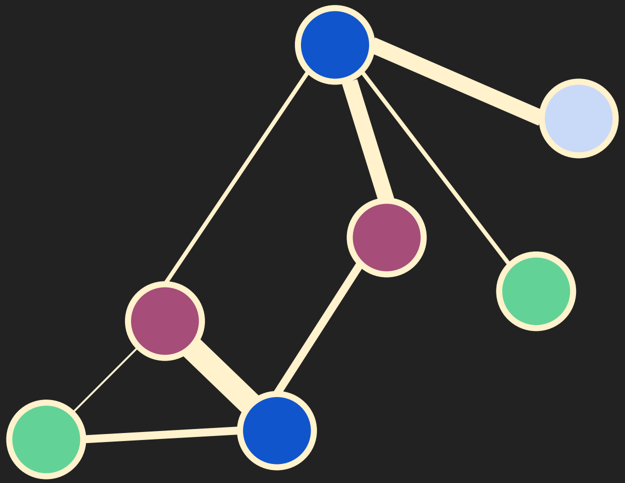
Graphs have properties:

- Nodes represent different identities.
- Edges can represent strength of the relation.

Graph Properties to use



A node is known by its neighbors



$$P(\text{Node } a \text{ is neighbour}|_{\text{staying at } b})$$

$$= \frac{e^{a_c \cdot b_n}}{\sum_{b'} e^{a_c \cdot b'_n}}$$

This is similar to Word2Vec!

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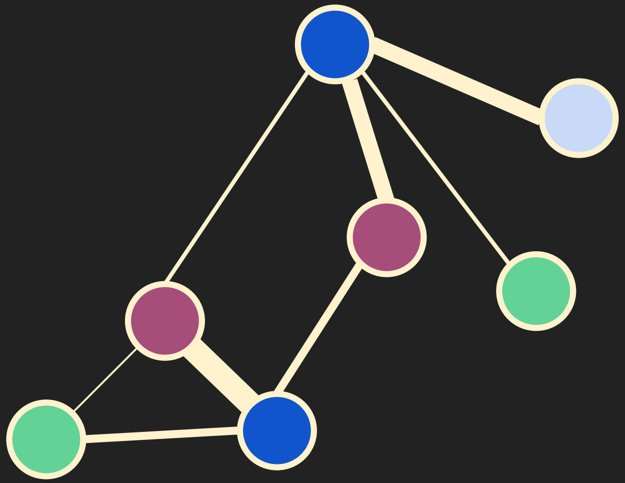

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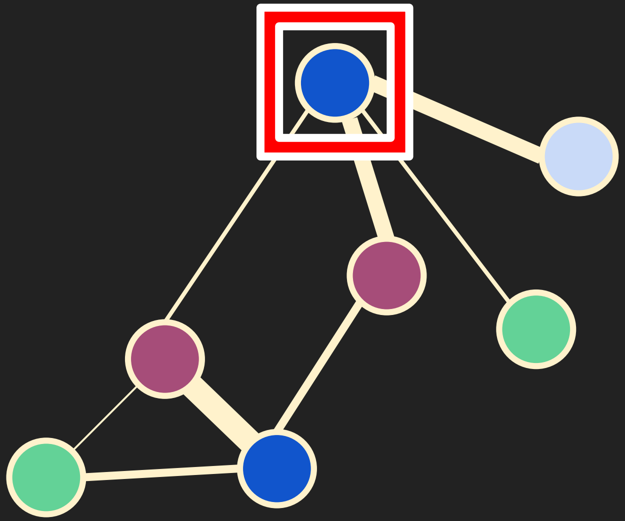
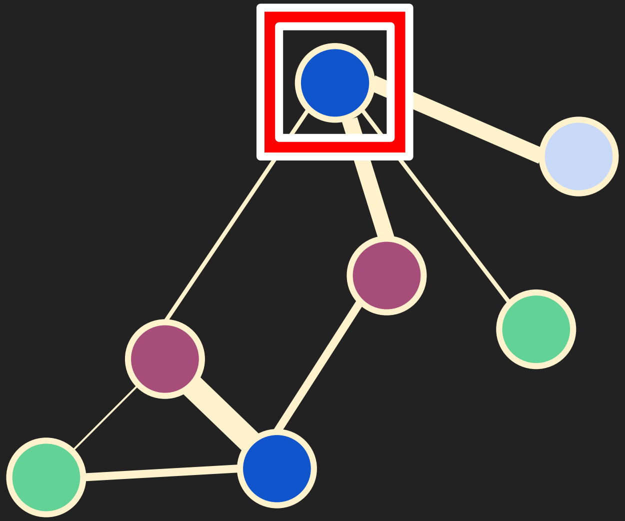
WHAT DOES IT MEAN TO BE A NEIGHBOUR?

A node is known by its neighbors



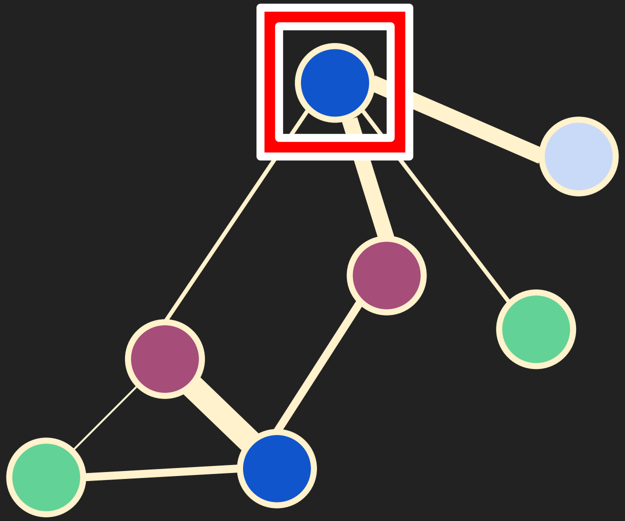
- What are the neighbours of this node?

A node is known by its neighbors



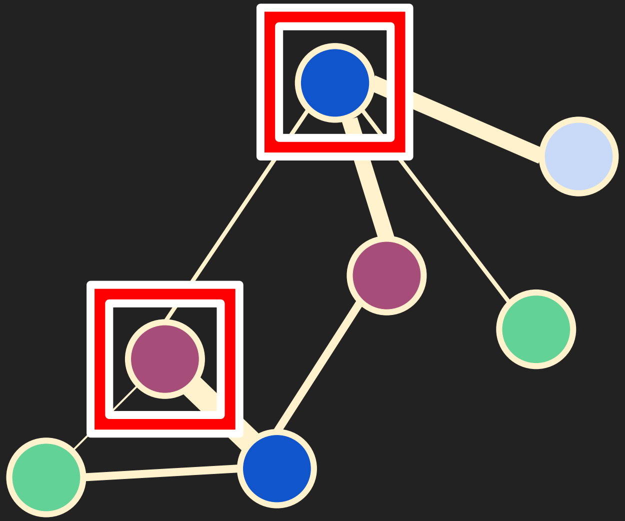
- What are the neighbours of this node?
- Are there some nodes that are more neighbours than others?

A node is known by its neighbors



- What are the neighbours of this node?
- Are there some nodes that are more neighbours than others?
- How to encode the node properties into the neighbours?

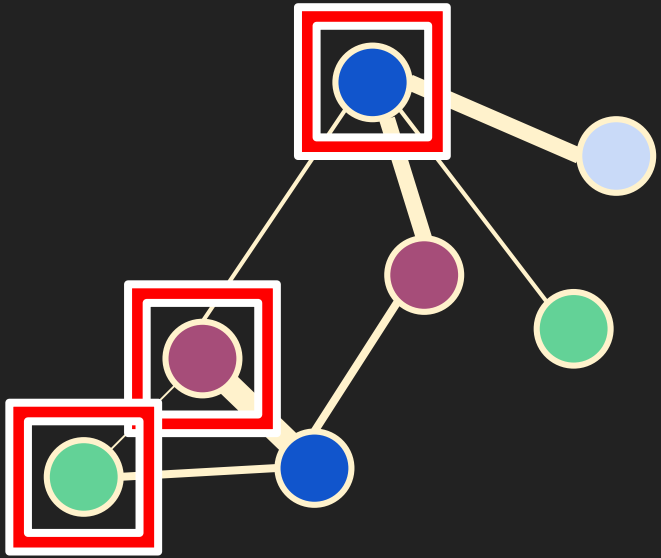
Knowing the neighbors by walking around



Random walk:

- Start at node and walk around by using local info as probabilities.

Knowing the neighbors by walking around



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Knowing the neighbors by walking around

Walk = Sentences:

- Make the walks into sentences and apply word2vec