Graph Embeddings

Development Workshop

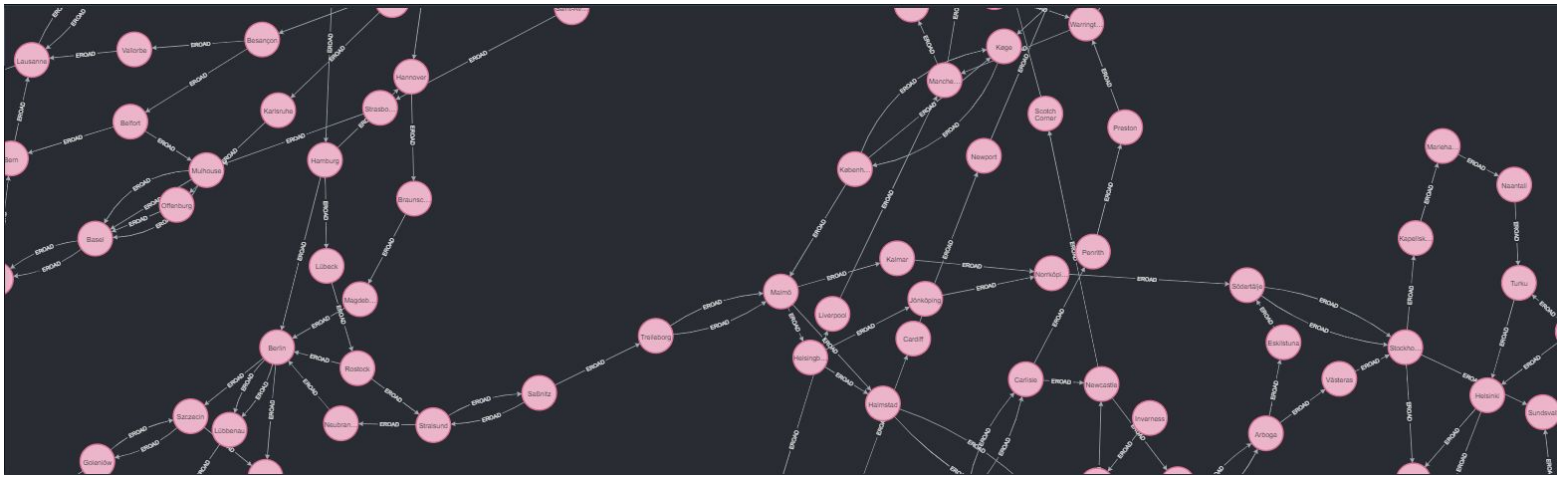
Filip Jachura
Klaudia Klepacka

Stages of work

1. Analysis of different types of graph embedding algorithms
2. The application for finding the most similar cities to the given ones based on graph embedding algorithms

Neo4j model

- 895 nodes (cities)
- 1250 egdes (roads)

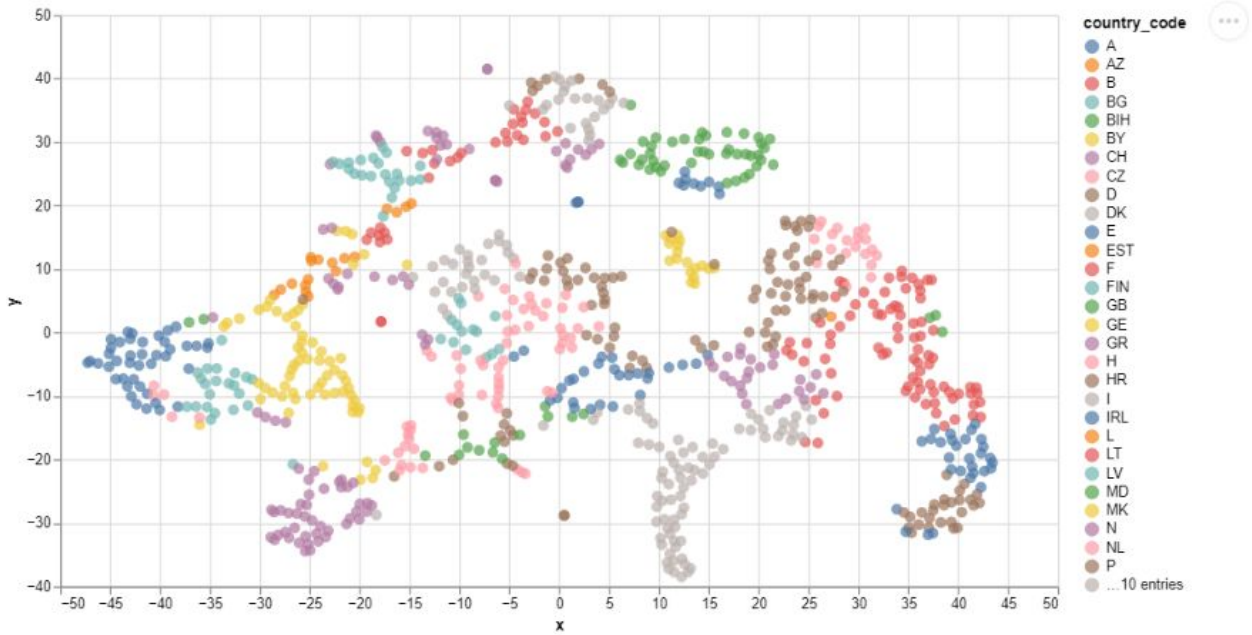


Embedding algorithms in Neo4j

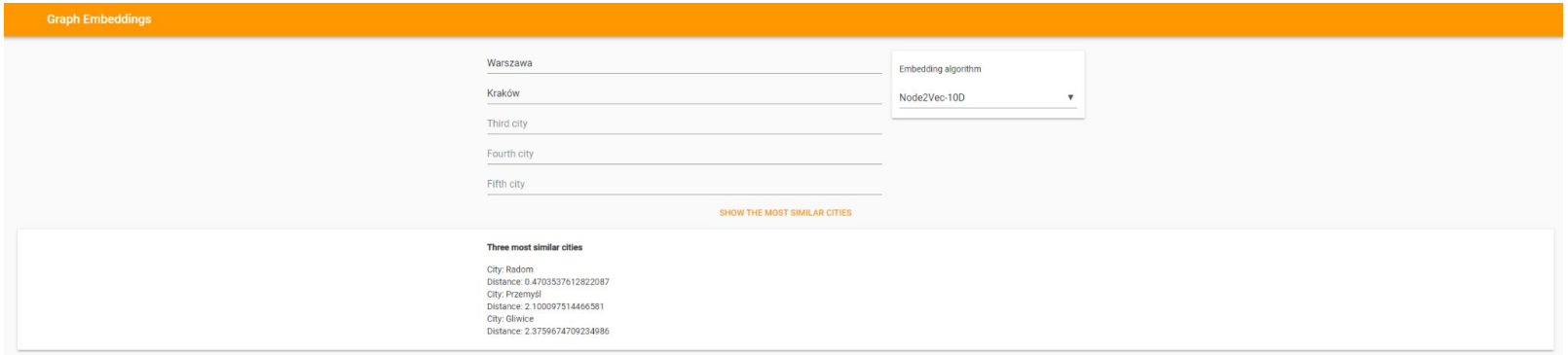
Graph Data Science Library

- **Node2Vec** - computes a vector representation of a node based on random walks in the graph
- **FastRP** - uses a linear projection chosen in a random way
- **GraphSage** - uses node feature information to generate node embeddings on unseen nodes or graphs. Instead of training individual embeddings for each node, the algorithm learns a function that generates embeddings by sampling and aggregating features from a node's local neighborhood

The best results – Node2Vec 10D



Application for finding the most similar cities



Problems

- The documentation for embedding algorithms applies to the old version of neo4j

Run FastRP in stream mode on a named graph. **Cypher**

```
CALL gds.fastRP.stream(
  graphName: String,
  configuration: Map
) YIELD
  nodeId: Integer,
  embedding: List of Float
```

- It’s not easy to

```
with driver.session(database="neo4j") as session:
    fastRP_2d = pd.DataFrame(session.run("""CALL gds.alpha.randomProjection.stream({
          nodeProjection: "ReferencePlace",
          relationshipProjection: {
            eroad: {
              type: "EROAD",
              orientation: "UNDIRECTED"
            }
          },
          embeddingSize: 2,
          maxIterations: 1
        })
        YIELD nodeId, embedding
        RETURN nodeId, gds.util.asNode(nodeId).name AS name, gds.util.asNode(nodeId).country_code as countryCode, embedding;"""))
    fastRP_2d = fastRP_2d.rename(columns={0: "nodeId", 1: "name", 2: "countryCode", 3: "embedding"})
```

algorithm

Thank you for your attention