COIMBATORE INSTITUTE OF TECHNOLOGY

M.SC DATA SCIENCE

21MDS42 - GRAPH THEORY

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ALUMNI NETWORK INFLUENCE

Problem Statement:

The project aims to incorporate the influence of alumni working in various companies into the placement process at CIT using a graph-based influence propagation model. This involves constructing a graph that represents alumni, current students, and companies, and developing algorithms to calculate and propagate alumni influence scores through the graph. The goal is to improve placement outcomes by leveraging alumni networks to prioritize companies for student placements.

Aim:

The aim of the project is to enhance the placement outcomes at CIT by integrating the influence of alumni working in various companies through a graph-based influence propagation model. This involves constructing a comprehensive graph that maps the relationships between alumni, current students, and companies, and developing sophisticated algorithms to calculate and propagate influence scores. By effectively leveraging the alumni network, the project seeks to strategically prioritize companies for student placements, thereby optimizing the placement process and maximizing opportunities for current students.

Solution:

1. **Graph Construction**: Create a graph with nodes representing alumni, current students, and companies. Add edges between alumni and companies based on alumni employment, and between students and alumni based on connections (e.g., mentorship).

2. **Influence Propagation Model**: Assign initial influence scores to alumni based on factors like seniority. Use a propagation algorithm (e.g., random walks) to update influence scores based on the strength of connections in the graph.

3. **Placement Process Integration**: Use the calculated influence scores to prioritize companies for student placements. Give higher priority to companies with alumni connections and higher influence scores during the matching process.

4**. Evaluation**: Validate the model's effectiveness by comparing placement outcomes with and without considering alumni influence. Use metrics such as job placement rates and student satisfaction to measure the impact of alumni influence.

Concepts used:

- Random Walk
- Page Rank
- Matching Algorithm
- Comparison and Network Analysis Metrics

Technology Stack:

Flask

Code:

1) App.py

```python
from flask import Flask, render_template, request, redirect, url_for


app = Flask(__name__)

# Sample data for alumni and companies
alumni_data = [
    {"name": "John Doe", "company": "Google", "role": "Software Engineer",
"info": "Lorem ipsum dolor sit amet.", "linkedin":
"https://www.linkedin.com/johndoe"},
    {"name": "Jane Smith", "company": "Facebook", "role": "Data Scientist",
"info": "Consectetur adipiscing elit.", "linkedin":
"https://www.linkedin.com/janesmith"}
]

# Sample data for alumni connections (graph edges)
alumni_connections = {
    "Google": ["Facebook"],
    "Facebook": ["Google", "Microsoft"],
    "Microsoft": ["Facebook", "Apple"],
    "Apple": ["Microsoft", "Amazon"],
    "Amazon": ["Apple"],
    "CIT": ["Google", "Facebook", "Microsoft", "Apple", "Amazon"]
}
```

```python
companies = set(alumni['company'] for alumni in alumni_data)

def is_placement_possible(student_company, alumni_data,
alumni_connections, visited=None):
    if visited is None:
        visited = set()
    visited.add(student_company)
    if student_company not in alumni_connections:
        return False
    for connected_company in alumni_connections[student_company]:
        if connected_company not in visited:
            if connected_company == "CIT":
                return True
            if is_placement_possible(connected_company, alumni_data,
alumni_connections, visited):
                return True
    return False

def get_influential_alumni(company, alumni_data, alumni_connections):
    influencers = {}
    for alumnus in alumni_data:
        if alumnus['company'] == company:
            influencers[alumnus['name']] =
len(alumni_connections.get(alumnus['company'], []))
    return influencers

@app.route('/')
def login():
    return render_template('login.html')

@app.route('/select', methods=['POST'])
def select():
    user_type = request.form['user_type']
    if user_type == 'alumni':
        return redirect(url_for('alumni'))
    elif user_type == 'student':
        return redirect(url_for('student_select'))
    return redirect(url_for('login'))
```

```python
@app.route('/student_select')
def student_select():
    return render_template('student_select.html', companies=companies)

@app.route('/alumni', methods=['GET', 'POST'])
def alumni():
    if request.method == 'POST':
        name = request.form['name']
        company = request.form['company']
        role = request.form['role']
        info = request.form['info']
        linkedin = request.form['linkedin']
        alumni_data.append({"name": name, "company": company, "role": role,
"info": info, "linkedin": linkedin})
        companies.add(company)
    return render_template('alumni.html', companies=companies)

@app.route('/student', methods=['POST'])
def student():
    selected_company = request.form['company']
    influential_alumni = get_influential_alumni(selected_company,
alumni_data, alumni_connections)
    alumni_at_company = [alumni for alumni in alumni_data if
alumni['company'] == selected_company]
    placement_possible = is_placement_possible(selected_company,
alumni_data, alumni_connections)
    return render_template('student.html', alumni=alumni_at_company,
placement_possible=placement_possible, influencers=influential_alumni)

@app.route('/gain_from_alumni', methods=['POST'])
def gain_from_alumni():
    alumni_name = request.form['alumni_name']
    alumni = next((alumnus for alumnus in alumni_data if alumnus['name'] ==
alumni_name), None)
    if alumni:
        return redirect(alumni['linkedin'])
    return "Alumni LinkedIn URL not found."

if __name__ == '__main__':
    app.run(debug=True)
```

2) Alumini.html

```
{% extends 'base.html' %}


{% block content %}
<style>
  body {
    background-color: #f8f9fa;
  }
  .container {
    background-color: #fff;
    padding: 20px;
    border-radius: 10px;
    margin-top: 50px;
    box-shadow: 0 4px 6px rgba(0, 0, 0, 0.1);
  }
  h2 {
    color: #343a40;
  }
  .form-control {
    margin-bottom: 10px;
  }
  .btn-primary {
    background-color: #007bff;
    border-color: #007bff;
  }
  .btn-primary:hover {
    background-color: #0056b3;
```

```css
        border-color: #0056b3;
    }
    .list-group {
        display: flex;
        flex-wrap: wrap;
        padding-left: 0;
        margin-bottom: 0;
    }
    .list-group-item {
        position: relative;
        display: block;
        padding: 0.75rem 1.25rem;
        margin-bottom: -1px;
        background-color: #f8d7da;
        border: 1px solid rgba(0, 0, 0, 0.125);
        border-radius: 0;
    }
    .list-group-item:hover {
        background-color: #f3c2c4;
        border-color: #f3c2c4;
    }
</style>
<div class="container">
    <div class="row">
        <div class="col-md-6">
            <h2>Add Alumni Details</h2>
            <form action="/alumni" method="post">
                <div class="form-group">
```

```html
        <label for="name">Name:</label>
        <input type="text" class="form-control" id="name" name="name">
      </div>
      <div class="form-group">
        <label for="company">Company:</label>
        <input type="text" class="form-control" id="company" name="company">
      </div>
      <div class="form-group">
        <label for="role">Role:</label>
        <input type="text" class="form-control" id="role" name="role">
      </div>
      <div class="form-group">
        <label for="info">About Company:</label>
        <textarea class="form-control" id="info" name="info"></textarea>
      </div>
      <div class="form-group">
        <label for="linkedin">LinkedIn:</label>
        <input type="text" class="form-control" id="linkedin" name="linkedin">
      </div>
      <button type="submit" class="btn btn-primary">Submit</button>
    </form>
  </div>
  <div class="col-md-6">
    <h2>Companies</h2>
    <div class="list-group">
      {% for company in companies %}
      <a href="#" class="list-group-item list-group-item-action">{{ company }}</a>
      {% endfor %}
```

```
        </div>

      </div>

    </div>

</div>

{% endblock %}
```

3) Base.html

```html
<!DOCTYPE html>

<html>

<head><center>

  <title>Graph Theory Project</title>

  <link rel="stylesheet" type="text/css" href="{{ url_for('static', filename='style.css')
}}">

</head>

<body>

  <div class="container">

    {% block content %}{% endblock %}

  </div></center>

</body>

</html>
```

4)Login.html

```html
{% extends 'base.html' %}


{% block content %}

<style>

  body {

    font-family: Arial, sans-serif;
```

```css
    background-color: #f8f9fa;
  }
  .container {
    max-width: 400px;
    margin: 50px auto;
    padding: 20px;
    background-color: #fff;
    border-radius: 5px;
    box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
  }
  h2 {
    text-align: center;
    margin-bottom: 20px;
  }
  form {
    text-align: center;
  }
  label {
    display: block;
    margin-bottom: 10px;
  }
  input[type="radio"] {
    margin-right: 5px;
  }
  input[type="submit"] {
    padding: 10px 20px;
    background-color: #007bff;
    color: #fff;
```

```
        border: none;

        border-radius: 5px;

        cursor: pointer;

    }

    input[type="submit"]:hover {

        background-color: #0056b3;

    }

</style>


<div class="container"><center>

    <h2>Login</h2>

    <form action="/select" method="post">

        <label><input type="radio" name="user_type" value="alumni"> Alumni</label>

        <label><input type="radio" name="user_type" value="student">
Student</label>

        <br>

        <input type="submit" value="Submit">

    </form></center>

</div>

{% endblock %}
```

5)Select.html

```
{% extends 'base.html' %}


{% block content %}
<div class="container">

    <div class="row">

        <div class="col-md-6 offset-md-3">
```

```html
        <h2 class="text-center">Select User Type</h2>
        <form action="/select" method="post" class="mt-4">
          <div class="form-group"><center>
            <label for="user_type">Select user type:</label>
            <select class="form-control" id="user_type" name="user_type">
              <option value="alumni">Alumni</option>
              <option value="student">Student</option>
            </select>
          </div>
          <div class="text-center">
            <button type="submit" class="btn btn-primary">Submit</button></center>
          </div>
        </form>
      </div>
    </div>
</div>
{% endblock %}
```

6)student_select.html

```html
{% extends 'base.html' %}

{% block content %}
<div class="container">
    <div class="row">
        <div class="col-md-6 offset-md-3">
            <h2>Select Company</h2>
            <form action="/student" method="post">
```

```
            <div class="form-group"><center>
                <label for="company">Select a company:</label>
                <select class="form-control" id="company" name="company">
                    {% for company in companies %}
                    <option value="{{ company }}">{{ company }}</option>
                    {% endfor %}
                </select>
            </div>
            <button type="submit" class="btn btn-primary">Go</button>
        </form></center>
    </div>
  </div>
</div>
{% endblock %}
```

7) Student.html

```
{% extends 'base.html' %}

{% block content %}
<div class="container">
  <div class="row">
    <div class="col-md-6">
      <h2>Alumni at {{ alumni[0]['company'] }}</h2>
      <ul class="list-group">
        {% for alumnus in alumni %}
        <li class="list-group-item">{{ alumnus['name'] }} - {{ alumnus['role'] }}</li>
        {% endfor %}
      </ul>
```

```html
        {% if placement_possible %}

        <p>Placement is possible based on our graph theory calculations.</p>

        {% else %}

        <p>Placement is not possible based on our graph theory calculations.</p>

        {% endif %}

    </div><center>

    <div class="col-md-6">

        <h2>Influential Alumni at {{ alumni[0]['company'] }}</h2>

        {% if influencers %}

        <ul class="list-group">

            {% for name, connections in influencers.items() %}

            <li class="list-group-item">{{ name }} - Connections: {{ connections }}</li>

            {% endfor %}

        </ul>

        <form action="/gain_from_alumni" method="post">

            <div class="form-group">

                <label for="alumni_name">Select an influential alumni to gain
from:</label>

                <select class="form-control" id="alumni_name" name="alumni_name">

                    {% for name, _ in influencers.items() %}

                    <option value="{{ name }}">{{ name }}</option>

                    {% endfor %}

                </select>

            </div>

            <div class="form-group">

                <label for="alumni_linkedin">Alumni LinkedIn:</label>
```

```html
            <input type="text" class="form-control" id="alumni_linkedin"
name="alumni_linkedin">
        </div>
        <button type="submit" class="btn btn-primary">Gain</button>
    </form>
    {% else %}
    <p>No influential alumni found for {{ alumni[0]['company'] }}</p>
    {% endif %}</center>
  </div>
 </div>
</div>
{% endblock %}
```

8) Style.css

```css
body {
    font-family: Arial, sans-serif;
    margin: 0;
    padding: 0;
    background-color: #f4f4f4;
}

.container {
    width: 80%;
    margin: auto;
    overflow: hidden;
}
```

```css
form {
    margin-bottom: 20px;
}

label {
    display: block;
    margin-bottom: 5px;
}

input[type="text"],
textarea {
    width: 100%;
    padding: 5px;
    margin-bottom: 10px;
    border: 1px solid #ccc;
    border-radius: 3px;
}

input[type="radio"] {
    margin-right: 5px;
}

input[type="submit"] {
    padding: 5px 10px;
    background-color: #007bff;
    color: white;
    border: none;
    border-radius: 3px;
```
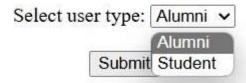
```css
    cursor: pointer;

}


ul {

    list-style-type: none;

    padding: 0;

}


li {

    margin-bottom: 5px;

}


h2 {

    margin-top: 20px;

    margin-bottom: 10px;

}
```

OUTPUT:

Select User Type

Select user type: Alumni ▾

| Alumni |
| Submit | Student |

Add Alumni Details

Name: Prithika J

Company: Zoho

Role: DataAnalyst

Enter information
about the company

About Company:
LinkedIn: https://www.linkedin.com/in/

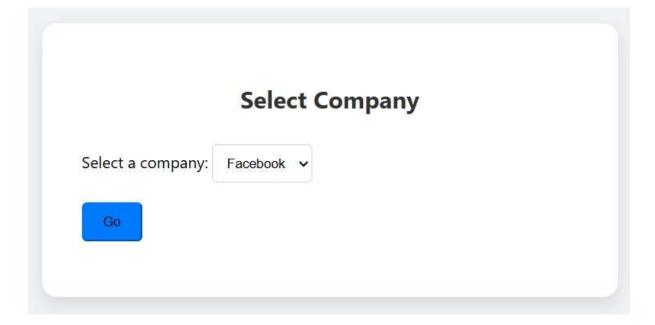Submit

Companies

Facebook

Google

Companies

Facebook

Zoho

Google

Select User Type

Select user type: Student ⌄

Submit

Select Company

Select a company: Facebook ⌄

Go

Alumni at Zoho

- Prithika J - DataAnalyst

Placement is not possible based on our graph theory calculations.

Influential Alumni at Zoho

- Prithika J - Connections: 0

Select an influential alumni to gain from: Prithika J ▾

Alumni LinkedIn: [   ]

[Gain]