Single-Page Module-Recommender Web-Application

Graz University of Technology
Technische Universität München
Overview

- Introduction / Motivation
- Infrastructure
- Recommender Application
  - Module Ranking / Attendance Information
  - Collaborative Filtering for Students
  - Lecturer’s Recommendation
- Conclusion
Introduction

- Lucas Reeh
  - Graz University of Technology
  - CAMPUSonline

- Bachelor Thesis / Erasmus Project
  - Technische Universität München (Munich)
Introduction / Motivation

- Module
  - Collection of Lectures and Exams

- Elective Subjects
  - Assist Students in Selection

- Improve University Curriculum-Offer
Infrastructure (1)

- Campus-Management-System
  - CAMPUSonline
  - All-In-One Database
Infrastructure (2)

- Curriculum Data
  - Modules (Nodes)
  - Electives
  - Grades / Progress
## Infrastructure (3)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[20071]</td>
<td>Bachelor Studies in Mathematics</td>
<td>180</td>
<td>6</td>
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<td>[20071]</td>
<td>Bachelor's Thesis</td>
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<td>A 1.3 Courses Abstract Mathematics</td>
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<td>[VK]</td>
<td>[MA2003] Measure and Integration</td>
<td>5</td>
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<td>[VK]</td>
<td>[MA2004] Vector Analysis</td>
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<td>[VK]</td>
<td>[MA2005] Ordinary Differential Equations</td>
<td>5</td>
<td>1</td>
</tr>
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<td>[VK]</td>
<td>[MA2006] Complex Analysis</td>
<td>5</td>
<td>1</td>
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<td>[VK]</td>
<td>[MA2101] Algebra</td>
<td>9</td>
<td>1</td>
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<td>[VK]</td>
<td>[MA2203] Algebraic Structures in Geometry</td>
<td>5</td>
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<tr>
<td>[VK]</td>
<td>[MA2204] Elementary Differential Geometry</td>
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<tr>
<td></td>
<td>A 1.4 Courses Applied Mathematics</td>
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</tbody>
</table>

Total Credits: 180 ECTS: 6
Infrastructure (4)

- Web-Application
  - Single-Page
  - Google Web-Toolkit
  - Technical Details (End of Presentation)
Navigation
## Search

A search bar is highlighted with the text "Analysis" entered. Below the search bar, a list of courses is displayed:

### A 1.1 Basics
- MA1001: Analysis 1
- MA1002: Analysis 2

### A 1.3 Courses Abstract Mathematics
- MA2004: Vector Analysis

### A 1.5 Advanced Courses Mathematics
- MA3504: Convex Analysis
- MA3001: Functional Analysis

A red arrow points from the search bar to the "Analysis" course under A 1.1 Basics.
## Module Ranking / Attendance Information

<table>
<thead>
<tr>
<th>ID</th>
<th>Course</th>
<th>Rec. Sem.</th>
<th>Semester</th>
<th>Attendance % (act.)</th>
<th>Attendance % (ex.)</th>
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<tr>
<td>MA2004</td>
<td>Vector Analysis</td>
<td>3</td>
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<td>90</td>
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<td>MA2003</td>
<td>Measure and Integration</td>
<td>3</td>
<td>3</td>
<td>39</td>
<td>94</td>
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<tr>
<td>MA2005</td>
<td>Ordinary Differential Equations</td>
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<td>4</td>
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<tr>
<td>MA2203</td>
<td>Algebraic Structures in Geometry</td>
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<td>Complex Analysis</td>
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<td>4</td>
<td>7</td>
<td>57</td>
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Collaborative Filtering (1)

- Like Amazon
- Only elective modules
Collaborative Filtering (2)
Collaborative Filtering (3)
Collaborative Filtering (4)
Collaborative Filtering (5)

<table>
<thead>
<tr>
<th>ID</th>
<th>Code</th>
<th>Course Title</th>
<th>Rec. Sem.</th>
<th>Attendance % (act.)</th>
<th>Attendance % (ex.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MA2003</td>
<td>Measure and Integration</td>
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<td>39</td>
<td>94</td>
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<td></td>
<td>MA2006</td>
<td>Complex Analysis</td>
<td></td>
<td>7</td>
<td>57</td>
</tr>
</tbody>
</table>

|      | MA2501 | Algorithmic Discrete Mathematics   |           | 30                  | 85                 |
|      | MA2402 | Basic Statistics                    |           | 29                  | 84                 |
|      | MA2503 | Introduction to Nonlinear Optim...  |           | 24                  | 80                 |
|      | MA2302 | Numerical Analysis                  |           | 18                  | 75                 |
|      | MA2902 | Mathematical Modeling: Case St...   |           | 5                   | 44                 |
Lecturer’s Recommendation (1)

- Defines Requirements for Modules
Lecturer’s Recommendation (2)

- Student passed all required Modules
Lecturer’s Recommendation (3)

- Module will be recommended
Lecturer’s Recommendation (4)

MA2402 “Markov Chains”

- MA1001 “Analysis 1”
- MA1002 “Analysis 2”
- MA2004 “Vector Analysis”

### Requirements: MA2404

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
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<tbody>
<tr>
<td>MA1001</td>
<td>Analysis 1</td>
</tr>
<tr>
<td>MA1002</td>
<td>Analysis 2</td>
</tr>
<tr>
<td>MA2004</td>
<td>Vector Analysis</td>
</tr>
</tbody>
</table>

Number of active Students matching: 261
Lecturer’s Recommendation (5)

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Attendance % (act.)</th>
<th>Attendance % (ex.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA2004</td>
<td>Vector Analysis</td>
<td>40</td>
<td>90</td>
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</tbody>
</table>
Statistics Feature

### Statistics

#### Current and Former Students

<table>
<thead>
<tr>
<th>Study Status</th>
<th>Number of Students</th>
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</thead>
<tbody>
<tr>
<td>Current Students</td>
<td>460</td>
</tr>
<tr>
<td>- First Semester</td>
<td>0</td>
</tr>
<tr>
<td>- Suspended</td>
<td>6</td>
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<tr>
<td>Former Students</td>
<td>478</td>
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</table>

#### Module Attendance by Subject Type

<table>
<thead>
<tr>
<th>Subject Type</th>
<th>Number of Modules</th>
<th>MIN Attendance</th>
<th>AVG Attendance</th>
<th>MAX Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
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<tr>
<td>Compulsory subjects</td>
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<td>Elective subjects</td>
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<td>121</td>
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</table>

#### Module Attendance Percentage

<table>
<thead>
<tr>
<th>Attendance Percentage</th>
<th>Number of Modules</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>2149</td>
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<tr>
<td>0% - 25%</td>
<td>275</td>
</tr>
<tr>
<td>25% - 50%</td>
<td>91</td>
</tr>
<tr>
<td>50% - 75%</td>
<td>59</td>
</tr>
<tr>
<td>75% - 100%</td>
<td>52</td>
</tr>
</tbody>
</table>

### Module Attendance Percentage

#### Attendance Percentage

<table>
<thead>
<tr>
<th>Attendance Percentage</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% - 25%</td>
<td>36</td>
</tr>
<tr>
<td>25% - 50%</td>
<td>60</td>
</tr>
<tr>
<td>50% - 75%</td>
<td>90</td>
</tr>
<tr>
<td>75% - 100%</td>
<td>30</td>
</tr>
</tbody>
</table>
Conclusion

- Commercial use of lecturer’s recommendation feature
- Collaborative filtering needs pre-existing data
- Agile development
- Real world evaluation missing
Future

- Production Environment
- Master Projects
  - based on this project started
  - complex recommendation algorithms
- Evaluation
Technical Details (1)

- **CAMPUSonline DB (Oracle 11g)**
  - Materialized Views
  - Java-Persistence-API (JPA)

- **GWT 2.4**
  - Declarative UI in XML (Ui-Binder)
  - Dependency Injection (Gin, Guice)
  - Internationalization I18N (Server, Client)
  - Resource Bundles, Messages
  - Services (Request Factory)
Technical Details (2)

- GWTP 0.7 (GWT Platform)
  - Actions, Presenter
  - MVC-Pattern
- GXT 3.0
  - UI-Component-Library (UiBinder)
  - Grid, Tree, Buttons etc
- Maven
- Source Github
  - [https://github.com/lr86/ModuleRecommender](https://github.com/lr86/ModuleRecommender)