Understanding and supporting students’ learning experience and academic performance using statistical and machine learning.

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Introduction

- Basic information of project
  - Learning behavior under online environment
  - Using of statistical analysis and machine learning
  - Website design
- Framework of the project
Part 1 - Data Analysis & Visualization

• Integrated & Sorted Data

21_22 Original dataset
✓ CWK.xlsx
✓ Distribution of exam scores.xlsx
✓ Grades.xlsx
✓ Results.csv

Integrated dataset
➤ Personal Information
  • BUPT Student ID & ID number
➤ Academic Performance
  • Grades of each assignments
  • Class Test
  • Exam & Each question
  • Overall QMUL & BUPT Result
➤ Information related to watching videos
  • Engagement
  • Attendance
  • Video views
Data Analysis & Visualization

• Positive Correlation between Exam and Class Test
Data Analysis & Visualization

• Attendance & video views
Data Analysis & Visualization

• Preliminary conclusions

For 21_22 Students

• Shows little correlation with the scores level
  • Total engagement
  • Attendance
  • The number of video views - low in general
  • Weighted engagement (discrete distribution)
  • Video view% (discrete distribution)

• Some correlation between class tests and scores levels of students
• Some correlation with the coursework and exam grades
• Positive correlation between exam and class test scores
• The attendance and video views decreased over time
Part 2 - Affinity Analysis

• Use Apriori algorithm to find the specific video's relationship

First step
✓ Find frequent itemsets in the data using the Apriori algorithm

Second step
➢ Create association rules from those itemsets
Affinity Analysis

There are the rules between the videos of the training set

Rule #1
Rule: If a student watches frozenset({'20210917 - IoT_G1_G2 Recorded - JMS - Part B'}) they will also watch 20210917 - IoT_G1_G2 Recorded - JMS - Part A
- Confidence: 1.000

Rule #2
Rule: If a student watches frozenset({'2021014 - IoT_G1_G2 Recorded - FurtherProgramming_Spring_Framework - Part A', '20210917 - IoT_G1_G2 Recorded - JMS - Part B'}) they will also watch 20210917 - IoT_G1_G2 Recorded - JMS - Part A
- Confidence: 1.000

Rule #3
Rule: If a student watches frozenset({'20210930 - IoT_G1_G2 Recorded - Spring Framework - Part B', '2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part A'}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part B
- Confidence: 1.000

Rule #4
Rule: If a student watches frozenset({'20210930 - IoT_G1_G2 Recorded - Spring Framework - Part B', '2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part B'}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part A
- Confidence: 1.000

Rule #5
Rule: If a student watches frozenset({'2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part B', '20210920 - IoT_G1_G2 Recorded - JSP - Part B'}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_andConcurrency - Part A
- Confidence: 1.000
Affinity Analysis

There are the rules between the videos of the **testing set**

**Rule #1**
Rule: If a student watches frozenset({"20210917 - IoT_G1_G2 Recorded - JMS - Part B"}) they will also watch 20210917 - IoT_G1_G2 Recorded - JMS - Part A
- Train Confidence: 1.000
- Test Confidence: 0.964

**Rule #2**
Rule: If a student watches frozenset({"20210914 - IoT_G1_G2 Recorded - FurtherProgramming_Spring_Framework - Part A", "20210917 - IoT_G1_G2 Recorded - JMS - Part B"}) they will also watch 20210917 - IoT_G1_G2 Recorded - JMS - Part A
- Train Confidence: 1.000
- Test Confidence: 0.947

**Rule #3**
Rule: If a student watches frozenset({"20210930 - IoT_G1_G2 Recorded - Spring Framework - Part B", "2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part A"}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part B
- Train Confidence: 1.000
- Test Confidence: 0.909

**Rule #4**
Rule: If a student watches frozenset({"20210930 - IoT_G1_G2 Recorded - Spring Framework - Part B", "2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part B"}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part A
- Train Confidence: 1.000
- Test Confidence: 1.000

**Rule #5**
Rule: If a student watches frozenset({"2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part B", "20210920 - IoT_G1_G2 Recorded - JSP - Part B"}) they will also watch 2021018 - IoT_G1_G2 Recorded - Threads_and_Concurrency - Part A
- Train Confidence: 1.000
- Test Confidence: 1.000
Part 3 - Website UI Design

- HTML Page
- Functions:
  - Add
  - Delete
  - Write
  - Drag
Part 3 - Bayesian Network

- **DAG**
- Node: random variables
- Edge: relationships between nodes
- Conditional Probability

$$p(x) = \prod_{i \in I} p(x_i \mid x_{pa(i)})$$
Problem Encountered

• Continuous -> Discrete
• Complexity of Network
Immediate and future work

• Construct multi-dimensional networks for relationship description and prediction
  • interaction network
  • Bayesian network
• Utilize multi-modality information to understand student behaviors
  • evaluation metrics like video view, exam result etc
  • statistical characteristics
• Develop strategies for learning quality enhancement in new-normal environment
  • personal estimation / group orientation
  • user-friendly interface
Thank you for watching