Ongoing Works
Agenda

Overview & Timeline

Toward Machine Intelligence in Education

Analysis Tools & Visualization

Data Gathering

Activity Types

Growth

Learner's Performance Prediction

Academic Patterns

Real Curriculum Coverage

Preliminary Machine Intelligence Exploits

Recommendation System

Student Traits

Real Curriculum Coverage

Preliminary Machine Intelligence Exploits

Tracking Tools & Correlation Analysis

Real Curriculum Coverage

Preliminary Machine Intelligence Exploits

My Courseville

Activity Types

Growth

Data Gathering

Overview & Timeline

Toward Machine Intelligence in Education

Analysis Tools & Visualization
An informal experiment in using Facebook in class management

Realistic LMS options at Chulalongkorn University

Key tools in delivering innovative teaching scheme

Education Intelligence Platform

Timeline

2011-2013
Best practices

2013-2014
Campus-wide roadshows & workshops
Customer supports
Manuals
Support Channels
Project Management

2014-2015
Synchronization w/ implementation of teaching/learning paradigm

2016 and beyond
Application of Big Data & Machine Intelligence
Skills / E-Portfolio
Learning Analytics
Curriculum research
Recommenders

Verbal introduction
Adoption within a group of colleague

July 2016
myCourseVille
Learning Content Aggregator

Teachers

Learners

July 26, 2016
Facebook logins for life-long engagement

Communicate effectively via Facebook groups

In-class “Active Learning” tools

Integration with Echo 360 Lecture Capturing

Built-in sharing with Course Dropbox

Real-time Polling and Survey results

Engage students with Attractive Icon-based UI

Course archiving and Material Reuse

Flexible options for learning Assessments

Emphasis placed on Working in Groups

Give students Feedbacks Symbolically or in details

Built-in content authoring tool with Multimedia support

Increase productivity of course admin task with Teacher’s Friendly Functionalities

Instructor-controlled Access permission

Participate in Team Teaching

Integration with Chula Curriculum QA Info System

Support instructor-assigned Teaching Assistants

Analyze with Learning Analytics

July 2016
Analysis Tools & Visualization

Features with Machine Intelligence

AI & Data Analytics Research

Data Gathering
Growth of Activity Logs

Data Omitted

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Analysis Tools & Visualization

[Diagram of user participation and analytics]

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Analysis Tools & Visualization
Lecture Re-runs

83 minutes 0 seconds

Watched
41 times

Seen by
27 users

Ending reached
7
Analysis Tools & Visualization

YouTube Playlist
Analysis Tools & Visualization

Correlation Analysis

**Correlation Analysis (BETA)**

- *r* = 0.94
  - Highly Correlated

Data Series:
- series-1
  - Final Exam
- series-2
  - Current Course Total Points

Fetch & Plot

Student List:
- Name 1
- Name 2
- Name 3
- Name 4

**Example Points**
- Final Exam = 24
  - Current Course Total Points = 62.5567
- Final Exam = 19.6667
  - Current Course Total Points = 44.9267
- Final Exam = 17
  - Current Course Total Points = 30.4467
Analysis Tools & Visualization

Student Traits

<table>
<thead>
<tr>
<th>Abbr</th>
<th>Attribute</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Academic Performance</td>
<td>64%</td>
</tr>
<tr>
<td>DP</td>
<td>Discipline</td>
<td>86%</td>
</tr>
<tr>
<td>EG</td>
<td>Course Engagement</td>
<td>85%</td>
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<tr>
<td>LMS</td>
<td>LMS Usage</td>
<td>67%</td>
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</table>

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<td>Academic Performance</td>
<td>64%</td>
</tr>
<tr>
<td>DP</td>
<td>Discipline</td>
<td>90%</td>
</tr>
<tr>
<td>EG</td>
<td>Course Engagement</td>
<td>24%</td>
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<tr>
<td>LMS</td>
<td>LMS Usage</td>
<td>61%</td>
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July 26, 2016
Toward Machine Intelligence in Education

Published and Ongoing Research Works with myCourseVille

- **Learner’s Performance**
  - Learner’s Performance vs. Activities in LMS

- **Academic Patterns**
  - Course Periodic Behavior Modelling

- **Real Curriculum Coverage**
  - Inferring Coverage of Knowledge Units from LMS Course Materials

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Learner’s Performance vs. Activities in LMS

Students that “will” end up with “better” Performance

Students that “will” end up with “worse” Performance

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Learner’s Performance vs. Activities in LMS

Half-Term LMS Activities

Continuous Attention to Course Movement

Enthusiasm in reacting to Course Movement

Responsibility to assigned work

predicts

End-of-term Performance

or

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Learner’s Performance vs. Activities in LMS

False Alarm

Missed Detection

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Learner’s Performance vs. Activities in LMS

Unpublished Results Omitted

July 26, 2016
Course Periodic Behavior Modelling

**Assumptions:**

- Each LMS’s course demonstrate a weekly activity pattern
- Weekly courses’ behavior will altogether reflect the periodic behavior of the overall system
- Amount of activities tends to increase throughout the semester

**Thus, we can:**

- Model each course’s weekly behavior for the entire semester
- Predict the semester activity pattern (+amount of activities) for LMS

Course Periodic Behavior Modelling

Observation (Training Set)

Course Periodic Behavior Modelling

Test Data (2015/1)

Pattern Normalization

Course Clustering

Activity Prediction / Aggregation

Prediction Result

A posteriori observation period of 3 weeks yields the best accuracy of 84.35%
Inferring Coverage of Knowledge Units from Course Materials

**Assumptions:**
- Actual knowledge topics covered in the course are reflected in the course materials uploaded to LMS.

**Thus, we can:**
- Infer knowledge topics actually covered in the course (for the semester instance) better than from the (static) course description defined in the curriculum documents.
Knowledge Topics presented to actual teaching / learning in the course.

Standard Curriculum

Knowledge Unit 1
Knowledge Unit 2
Knowledge Unit 3
Knowledge Unit N

Web Mining

Keywords

Web Documents

Course Materials
Inferring Coverage of Knowledge Units from Course Materials

Sample Results

Course materials collected from 5 institutes:
- Chulalongkorn University
- University of Cambridge
- MIT
- Carnegie-Mellon University
- Stanford University

Selected equivalent courses in Computer Networks and Operating Systems

Knowledge Units defined by the Association for Computing Machinery (ACM)
Knowledge Units defined by the Association for Computing Machinery (ACM)

### Computer Networks

<table>
<thead>
<tr>
<th>Knowledge Units</th>
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</thead>
<tbody>
<tr>
<td>Authentication</td>
</tr>
<tr>
<td>Computer Networks</td>
</tr>
<tr>
<td>Data communications</td>
</tr>
<tr>
<td>Local and wide area networks</td>
</tr>
<tr>
<td>Network and web security</td>
</tr>
<tr>
<td>Network applications</td>
</tr>
<tr>
<td>Network architecture</td>
</tr>
<tr>
<td>Network management</td>
</tr>
<tr>
<td>Network protocols</td>
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<tr>
<td>Performance evaluation</td>
</tr>
<tr>
<td>Wireless and mobile networks</td>
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</table>

### Operating System

<table>
<thead>
<tr>
<th>Knowledge Units</th>
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</thead>
<tbody>
<tr>
<td>Additional emerging technologies</td>
</tr>
<tr>
<td>Applied emerging technologies</td>
</tr>
<tr>
<td>Conceptual emerging technologies</td>
</tr>
<tr>
<td>Managing system resources</td>
</tr>
<tr>
<td>Operating systems for mobile devices</td>
</tr>
<tr>
<td>Real-time operating system design</td>
</tr>
<tr>
<td>Scheduling algorithms</td>
</tr>
<tr>
<td>Support for concurrent processing</td>
</tr>
<tr>
<td>Support for virtualization</td>
</tr>
<tr>
<td>System performance evaluation</td>
</tr>
<tr>
<td>System Resource Management</td>
</tr>
</tbody>
</table>
Inferring Coverage of Knowledge Units from Course Materials

Sample Results

Unpublished Results Omitted

Computer Networks

Operating Systems

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Preliminary
Machine Intelligence-Enabled Features

Auto YouTube Video Recommendation for Additional Self-Learning

On-screen Presentation
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Learning Analytics