Machine Learning for Online Learning

Dit-Yan Yeung
Professor and Head
Department of Computer Science and Engineering
Online Learning

A substitute schoolteacher has found herself busier than ever helping support teachers design e-learning activities. Photo: AFP

For 12-year-old Kaitlyn Yu Ching, staying home for online learning over the past month did not make much difference from face-to-face lessons, as live-streamed classes were conducted following a strict timetable every week, even for physical education and music.
Massive Open Online Course (MOOC) Platforms

HKUSTx
Free online courses from The Hong Kong University of Science and Technology
HKUST Online Learning Platforms for the Community
# HKUST-MIT Research Alliance Consortium

<table>
<thead>
<tr>
<th>LEAD UNIVERSITIES</th>
<th>FOUR CLUSTERS</th>
<th>HKUST-MIT RESEARCH ALLIANCE CONSORTIUM</th>
<th>CONTACT US</th>
</tr>
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<tbody>
<tr>
<td>HKUST</td>
<td>Internet-of-Things (IoT) for Intelligent Buildings &amp; Transportation</td>
<td><strong>Aims:</strong> To build the network and mechanism required for R&amp;D collaboration between world class universities and technology companies to bolster the global innovation with emphasis on Intelligent Living technology.</td>
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<tr>
<td>MIT</td>
<td>Data Science &amp; E-Learning Research</td>
<td><strong>Mission:</strong> To conduct a pre-competitive research which can lead to new capabilities and business opportunities.</td>
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<td>Advanced Manufacturing</td>
<td><strong>Vision:</strong> To advance and cultivate Hong Kong Research and Development capability using a mission-oriented approach to solve critical and relevant problems globally.</td>
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<tr>
<td></td>
<td>Biomedical Systems</td>
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</tbody>
</table>

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Email to consortium@ust.hk  
Tel.: (852) 2358 6167  
Fax.: (852) 2358 1541
Data Science and e-Learning Research Cluster

5 ITF projects funded by Innovation and Technology Commission (ITC) so far

2 are led by me to develop personalized e-learning platforms for both formal education (primary, secondary, and tertiary education sectors) and professional training
Learnlex Platform (hosted by Trumptech)
Sample Question

Math topics (137)

Math topic-groups (6)
137 Topics from 6 Groups

Algebraic
- Equations (linear equations in two unknowns)
- Formulas
- Identities
- Laws of Integral Indices
- Simple Polynomials (factorisation)
  - ... 12 topics

Data handling
- Frequency polygons and curves
- Histograms
- Pie charts
- Measures of Central Tendency (averages)
  - ... 20 topics

Geometric
- Coordinate systems
- Deductive geometry (geometric construction)
- Graphs of functions
- Pythagoras’ Theorem
- Trigonometry
  - ... 9 topics

Measures
- Angles (degree)
- Area (squares, rectangles)
- Perimeter (circumference)
- Speed
- Time (the 24-hour time)
  - ... 24 topics

Numeric
- 5-digit numbers
- Decimals (division)
- Fractions (mixed operation)
- Squares and square roots
- Multiples and factors
  - ... 46 topics

Spatial
- 3-D shapes (vertices, edges, faces, directions)
- Circles
- Direction (compass bearings)
- Recognising 2-D shapes
- Symmetry (Rotational)
  - ... 26 topics
## Attempt History of a Student

<table>
<thead>
<tr>
<th>order</th>
<th>Question Id</th>
<th>Math topic-group</th>
<th>Math topic</th>
<th>Correct or Not</th>
<th>Time-stamp</th>
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### Knowledge Tracing

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Recurrent Neural Network for Knowledge Tracing

Probability of scoring 100 or 0 in the next question

Neural network model

Attempt history

[Inspired by Deep Knowledge Tracing, C. Piech et al, NIPS 2015]
Question Recommendation based on Student Performance
Professional Training Courses on Open edX (collaboration with Cyberwisdom)
Please Join Pilot Launch