Using the MOOClet Framework as a Problem Formulation to apply Machine Learning to automatically improve modular online educational resources through Experimentation and Personalization

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Data-Driven Education

How do we improve courses and learners' interactions with them using data, and algorithms?

Given a course, improvements can be made by creating alternative versions, and then testing which versions maximize learning.

On the other hand, this one-size-fits-all assumption neglects the option of testing ***which*** versions are best for **which** students.

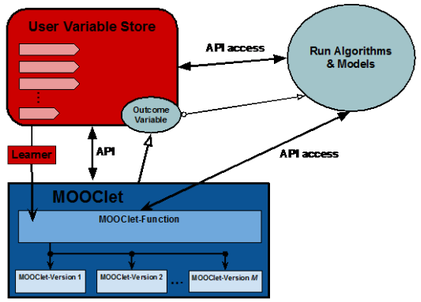
How might we formalize the optimization problem of maximizing learning and engagement in online courses?
How to do this by CHANGING which versions of a resource are presented?

One Problem Formulation

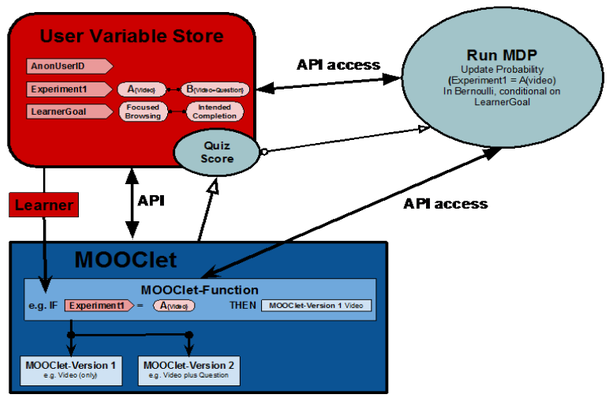
With respect to **Software Implementation** a **MOOClet** is defined as any modular component of an online course for which:

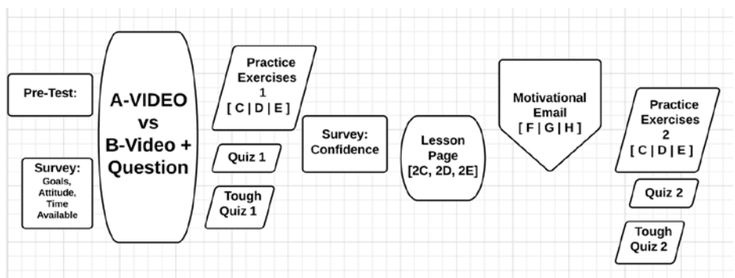
- Multiple **MOOClet-Versions** can be authored
- Which of these MOOClet-Versions is presented can be determined by a function (called the **MOOClet-Function**) applied to variables associated with each student in a **User Variable Store**.
- The User Variable Store allows dynamic updating and addition of variables, from any MOOClet and/or an external API.

Design Pattern for Software Architecture



Example of Implementation in EdX





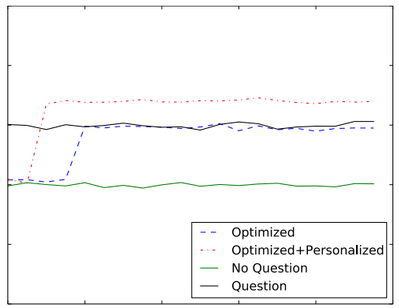
Optimized with Multi-armed Bandit

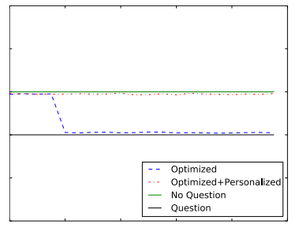
Arms: {A-Video, B-Video + Question}
Reward: Quiz Score

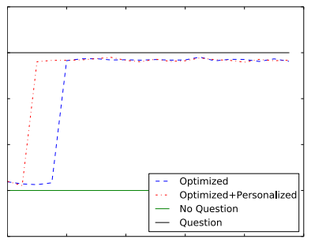
Optimized: Eventually gives B-Video + Question to everyone.

Markov Decision Process

States: {LearnerGoal = FocusedBrowser, IntendedCompleter}
Actions: {A, B}
Policy: MOOClet Function, IF statement
Reward: Quiz Score







Personalized:
A-Video to FocusedBrowser
B-Video to IntendedCompleter

Also can use User Variable Store and MOOClet-Functions to represent **User Models** and **Intelligent Tutoring Systems.**

For details see [tiny.cc/moocletframework] Williams et al (2014). Improving Online Education through Experimentation and Personalization of Modules.