Analytics: climbing up the ladder of behavior control

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Abstract

Learning Analytics can be conceptualized as an action control process. Information is collected at the behavioral level and then re-mapped to serve diagnosis at higher levels of control. We describe the rationale for moving up the ladder of behavior control with examples from eye-tracking and clickstream analysis.

1 Overview

Sensors used in analytics collect data at low temporal resolutions. Eye-tracking systems for example record gaze at a very high rate (250 Hz) without semantic information. Similarly, clickstream data collected online represent atomic actions that do not reflect the orientation of the learner's behavior. On the opposite, the expected output of an analytics system should inform decision-making at a much higher level, for example, is a learner going to drop out of a course at the end of a week, or do partners understand each other. The gap between sensor data and indicators useful for decision requires the re-mapping of behavioral streams into cognitively meaningful indicators. The computation of indicators should ideally be content independent and calibration free.

We will describe the development of gaze indicators that reflect the breadth of the focus of attention and the coupling between a listener and a speaker. In dyadic interaction, these indicators are related to the level of abstraction of dialogue and the quality of interaction. We extended the rationale of these indicators to the case of one user listening to a video lecture with the notion of *with-me-ness*: similar to teachers wondering whether their students are "with them". Students who attend more closely to the references made by the teacher indeed achieve better learning.

An obvious limitation of gaze-based analytics is that eye-trackers are not (yet) widespread. We are investigating whether video-watching behavior captured by clickstream logs can serve as a proxy for attention. First results are encouraging and show that it is possible to define an information-processing index that reflects the engagement of learners with the video. This indicator is sensitive to both in video drop-out and course drop-out and reflects whether students process video superficially (speeding up, scrolling forward) or more intensively (checking back for reference, rewatching). Similar to the approach we followed for gaze re-mapping, we aggregate the atomic actions (Play, Pause, Seek back) into more meaningful actions that are psychologically more meaningful to assess learning strategies.

Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP), page 38,
October 25-29, 2014, Doha, Qatar.