Affective Learning Analytics: Description and Prediction Based on Student Emotion in MOOC

We know that emotions can promote or hinder learning. So how do we, as researchers and instruction designers, build a MOOC environment which takes account and responds to student emotions? Our research goal is to model and predict student emotion in a MOOC setting. The potential applied design payoffs are affect learning analytics and dashboards designed for future MOOCs. This is a challenging problem: We are attempting to predict more emotions with greater precision and with less intrusion than previous studies.[1]

We first begin by describing the particular value of our data set, which is based on the introductory University of Notre Dame Statistics course, “I Heart Stats.” Using two different self-reporting methods, the Self-Assessment Manikin (Figure 1) and an Emotion List (Pick Two) (Figure 2), we collected self-reported student affect from 10-15% of the students at 10 points throughout the course.

We then discuss the major MOOC emotions based on our data. Notice, for example, in Figure 3 that Hope, Enjoyment, Contentment, and Pride, are major MOOC emotions, and note how this compares with and differs from traditional learning contexts. Also notice how these emotions change as the course unfolds: Hope and Anxiety decrease while Pride and Contentment increase. Furthermore, since we have collected two emotions from each student, we also discuss the
importance of observing co-occurring emotions in the MOOC learning space. Hope, for instance, often co-occurs with both Anxiety and Enjoyment, thus indicating two quite different emotional states.[2]

Using state transition graphs, we then describe the emotional trajectories of students as they work their way through the course. What are the emotions of students just before they drop out? What are the emotional trajectories of top performing students? What are the key emotional transitions that are indicative of learning?

We then discuss a second research question: Can we correlate student log data with emotional states to predict how students are feeling based solely on log data? In other words, can we implement sensor-free emotion detection in the wild? We focus specifically on predicting student emotions in response to MOOC Video Events and Homework Problem Sets. We describe our models built on both new MOOC-specific features as well as features that have proven successful in past studies.[3] Using Regression methods that have previously been deployed [4] as well as Bayesian Belief Networks,[5] we discuss models that correlate student-emotion in relation to log data. We evaluate these models using student-level cross-validation, and we will be working on measuring the generalizability of the models with a second set of data currently being gathered from another MOOC, “Math in Sports.” Preliminary results suggest that even simple features, such as the number of video plays and pauses, indicate that there are correlations between certain video features and student emotions.

We conclude this session by opening things up and describing the design implications based on our research. In short—What is the “design for learning” payoff? How can smart affect sensors improve the quality of learning at scale? If we know that a student is confused or bored, can we automatically intervene and adjust content and delivery to improve learning and lower MOOC dropout rates? How do we create models based on machine learning that can constellate historical and real-time data to produce a new type of attentive and ultimately more human online learning experience?
Key References

[1] [Yang, D. et al.] Exploring the Effect of Confusion in Discussion Forums of Massive Open Online Courses [2015]
[3] [Kim, J. et al.] Understanding in-video dropouts and interaction peaks in online lecture videos [2014]
[5] [Arroyo, I. et al.] Bayesian Networks and Linear Regression Models of Students’ Goals, Moods and Emotions [2010]