

Multimodal Learning Analytics Data Challenges

Xavier Ochoa
Escuela Superior Politécnica
del Litoral
Vía Perimetral Km. 30.5
Guayaquil, Ecuador
xavier@cti.espol.edu.ec

Nadir Weibel
University of California, San
Diego
La Jolla, CA, USA
weibel@ucsd.edu

Marcelo Worsley
University of Southern
California
3470 Trousdale Parkway,
WPH-601A
Los Angeles, CA, USA
worsley@usc.edu

Sharon Oviatt
Incaa Designs
11140 Wing Point Drive, N.E.
Bainbridge Island, WA, USA
sharon.oviatt@incaadesigns.org

ABSTRACT

This is a proposal for organizing a Multimodal Learning Analytics (MLA) data challenge as part of the workshop offering of the Learning Analytics and Knowledge (LAK) conference. It explains the motivation of the event, its objectives, target groups, expected format, organization, dissemination strategy and schedule.

CCS Concepts

•Applied computing → Education;

Keywords

Multimodal, Data Challenge, Multimodal datasets

1. MOTIVATION

Learning is an innately multimodal activity. Students collaborate through face-to-face conversations, while using digital and non-digital representations to support their ideas. Teachers use digital multimedia to explain a topic, while the students take notes on a multitude of digital and non-digital platforms. Students work together to build physical projects, while annotating drawings and taking digital photographs of their developments. Learning Analytics research, however, has concentrated mainly on computer-based learning contexts, where tools tend to automatically capture, in a fine-grained level of detail, the interactions with their users. The relative abundance of readily available data and the low technical barriers to process it, make computer-based learning systems the ideal place to conduct Learning Analytics research. On the contrary, in learning contexts where computers are not used, the actions of the actors of

the learning process are not automatically captured. Without traces to be analyzed, computational models and tools used traditionally in Learning Analytics are not applicable. While this bias towards computer-based learning context has helped the initial stages of Learning Analytics, computer-based learning still represents a small subset of the learning contexts. Multimodal Learning Analytics[2] (MLA) seeks to expand the current scope of Learning Analytics, focusing on the analysis of learning processes that happen on the physical or physical/virtual world and require the capture, processing and analysis of more natural signals such as speech, writing, sketching, facial expressions, hand gestures, object manipulation, tool use, artifact building, etc. This workshop is an opportunity to introduce members of the Learning Analytic community to methodologies, techniques and tools to capture, process and analyze multimodal learning traces.

2. OBJECTIVES

Facilitate access to multimodal datasets: One of the main barriers to start research in MLA is access to high-quality, annotated multimodal recordings. By offering these datasets to any interested researcher, the MLA community seeks to expand the available human talent capable of conducting learning analytics studies with multimodal signals.

Sharing advanced approaches and techniques: The ability to contrast and compare approaches and techniques to analyze diverse multimodal signals is a result of working on common datasets and questions. Research teams are able to directly learn from the developments of other teams and the current state-of-the-art is easily determined.

Disseminate the state of MLA research: A goal for the workshop this year is to disseminate the current capabilities of MLA to analyze non-computer-based learning contexts among the wide Learning Analytics community.

Identify new datasets: Including ones involving additional modalities, languages, and learning activities.

3. DATASETS

This year, two multimodal datasets will be shared. Each dataset will have challenges at two levels. To facilitate the participation of researchers already used to work with log data, the first level will provide features already extracted

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

LAK '16 April 25-29, 2016, Edinburgh, United Kingdom

© 2016 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-4190-5/16/04...\$15.00

DOI: <http://dx.doi.org/10.1145/2883851.2883913>

from the different modalities. The research question at this level will be to combine those features into a model that can infer a specific aspect of the learning process. The second level is oriented to signal processing researchers and consists of extracting relevant learning traces from raw recordings of different media (audio, video, digital pen, etc.). For both levels, the datasets will also provide ground truth against which the models and techniques can be evaluated. The datasets to be provided will be:

The Math Data Corpus[1]: This dataset involves 12 sessions, with small groups of three English-speaking students collaborating while solving mathematics problems. Data were collected on their natural multimodal communication and activity patterns during these problem-solving and peer tutoring sessions, including students' speech, digital pen input, facial expressions, and physical movements. This dataset has been expanded with full manual and automatic transcripts of the students speech. It also contains more than 10.000 annotations of the students diagrams during problem solving. The main research questions behind this dataset will be automatic estimation of solution correctness, individual expertise, group performance, group collaboration level and evidence of learning.

Oral Presentation Quality Corpus: This challenge includes a data corpus that involves 40 oral presentations of Spanish-speaking students in groups of 4 to 5 members presenting projects. The following data is available: speech, facial expressions and physical movements in video, skeletal data gathered from Kinect for each individual, and slide presentation files. In addition grading for individuals when doing their presentations is included as well as a group-grade related to the quality of the slides used when doing each presentation. This challenge seeks determine how multimodal techniques can help in evaluating presentation skills.

4. TARGET GROUPS

Existing MLA researchers: This event is the annual meeting venue for the existing MLA community. The datasets that will be part of this challenge are among the most researched topics in MLA.

New MLA researchers: It is one of the objectives of this workshop to attract new researchers from the Learning Analytics community to MLA. The low-barriers to participate in the challenge will enable researchers that are used to alphanumeric-only data to test their approaches and techniques on data generated from multimodal signals.

LA researchers and practitioners: This workshop is also directed to the general Learning Analytics community. Researchers could attend the workshop to discover how to incorporate new modes (such as speech, writing, gestures, etc.) to their current monomodal analysis. Practitioners could attend the workshop to establish how MLA could help them to measure and feedback learning on real-world, non-computer-based contexts.

5. DISSEMINATION STRATEGY

Apart from the dissemination of the call through traditional channels (mailing lists, web-site and relevant discussion fora), the organizers will identify and personally contact researchers both from the MLA and general Learning Analytics communities to invite to apply their approaches to one or more of the challenges.

6. PROGRAM COMMITTEE

The program committee is formed with members of the MLA community, researchers of Multimodal Interaction and Learning Analytics. These members are: Michael Johnston (Interactions), Alejandro Andrade (Indiana University), Kate Thompson (University of Sydney), Engin Bumbacher (Stanford University), Mirko Raça (École polytechnique fédérale de Lausanne), Richard Davis (Stanford University), Bertrand Schneider (Stanford University), Shuchi Grover (SRI International), Saad Khan (Educational Testing Service), Lei Chen (Educational Testing Service), Katherine Chiluita (Escuela Superior Politécnica del Litoral)

7. FORMAT

Following the successful experience of the previous MLA challenges, this event will be organized around the analysis of two different datasets. The results of all the participant teams will be collected, compared and contrasted. The participating teams and the audience are invited to discuss about the level of success of the presented approaches to solve the challenge and possible collaborations to improve the results.

8. SCHEDULE

This will be a full-day workshop (6 hours). The schedule will be: Introduction (15 minutes). Presentation of the datasets and challenges (30 minutes). Each team Work on the challenges (2 hours). Lunch break. Oral Presentation Corpus at Level 1 and 2 (30 minutes). Critique of the approaches for Oral Presentation Corpus Level 1 (30 minutes). Critique of the approaches for Math Data Corpus Level 2 (30 minutes). General discussion about the results for the Math Data Corpus (30 minutes). Coffee break. Discussion about future collaboration and the MLA community (1 hour). Final remarks, future steps and conclusions (30 minutes).

9. REFERENCES

- [1] S. Oviatt, A. Cohen, and N. Weibel. Multimodal learning analytics: description of math data corpus for icmi grand challenge workshop. In *Proceedings of the 15th ACM on International conference on multimodal interaction*, pages 583–590. ACM, 2013.
- [2] M. Worsley. Multimodal learning analytics: enabling the future of learning through multimodal data analysis and interfaces. In *Proceedings of the 14th ACM international conference on Multimodal interaction*, pages 353–356. ACM, 2012.