

Crowd, the *Teaching Assistant*: Educational Assessment Crowdsourcing

Pallavi Manohar and Shourya Roy

Xerox Research Centre India
Etamin Block, Prestige Technology Park-II
Outer Ring Road, Bangalore- 560103
Email: pallavi.manohar, shourya.roy@xerox.com

Abstract

We propose a novel educational assessment method to enhance teachers' productivity using crowdsourcing and clustering technique.

Background and Motivation

Assessment of students' work is an integral part of school teachers' job responsibility. Various forms of assessments are done by teachers to form valid and reliable judgments of pupils' progress for the development of the curriculum. Data from assessment has also become an integral feature of how schools and the education system as a whole are held to account for their performance. However, doing assessment constitutes a significant part of teachers workload given that assignments and examinations are routine activities in today's education system. Assessment is a tedious job as well given that responses to the same questions need to be evaluated leading to a monotonous and repetitive work of assessment. Teachers need aid in such assessment to be able to utilize their time in creative jobs, personalized attention to students, thereby enhancing their productivity.

Technology enabled solutions in the education industry have become more and more common with advancements of computer technologies and penetration of Internet. However, assessment in the teacher-student ecosystem has received little attention compared to other aspects, like making educational content available globally, creating electronic content for dissemination, developing analytic and collaboration tools. The most relevant example in assessment is *Xerox IgniteTM* which is an educational assessment management system¹. *IgniteTM* is a web-based software tool for printing, scanning, and scoring hand-marked assessments that also manages the data and produces personalized reports. However, presently *IgniteTM* can perform automatic assessments of assignments of limited types, e.g., alphanumeric characters to lines connecting objects to other free-form marks (e.g., a circle, X, check, slash, full or partial fill-in). While it is a great leap from existing fill-in the bubble responses,

types of assignments covered by *IgniteTM* are restricted because of wide variety in types of assignments and limitations of current automatic document recognition technology.

In this paper, we propose to crowdsource the educational assessment which is a novel and cost-effective mechanism that overcomes deficiencies of automatic grading, in particular lack of accuracy of hand-writing and drawing recognition. Crowdsourced education has recently been an area of interest in human computation research. (Monika 2012) presents an exploratory study on how educational organizations can leverage crowdsourcing for different educational activities. Crowdsourced methods for personalized online education, content creation, its improvement and curation, and for peer assessment are discussed in (Weld et al. 2012). The assessment mechanism is about feedback to students by their peers as part of their grading and the limitations involved therein are discussed. (Heimerl et al. 2012) presents educational assessment using *Community Sourcing* where they propose engaging local crowd to perform expert work (grading of non-autogradable exams) via physical kiosks. They show that community sourcing works for better accuracy at the lower cost if expert skills are available with the community, rewards are relevant to the community, and crowdsourcing kiosk is placed within the expert community.

We present crowdsourced educational assessment by (i) transforming monotonous but non-autogradable assignments into micro-tasks which can be crowdsourced on popular platforms like Amazon Mechanical Turk² (ii) designing of the tasks intelligently using clustering technique for secure distribution, and significant efficiency with respect to time and cost for crowdsourcing. Further, we propose to modify the tasks creatively to *Community Source* the assessment to teachers in rural and semi-urban regions for their development. Here, our aim is to promote education for a specific community and not necessarily to utilize the expertise as in (Heimerl et al. 2012).

Crowdsourcing as a Solution

Fig. 1(a) shows the system proposed for educational assessment using crowdsourcing. Digitization, i.e., scanning of the paper based assignments (completed by students) is the first step. We design micro-tasks in a creative way leveraging

Copyright © 2013, Association for the Advancement of Artificial Intelligence (www.aaai.org). All rights reserved.

¹<http://www.acs-inc.com/health-and-human-services/education-services/ignite-teacher-tool.aspx>

²<http://www.mturk.com>

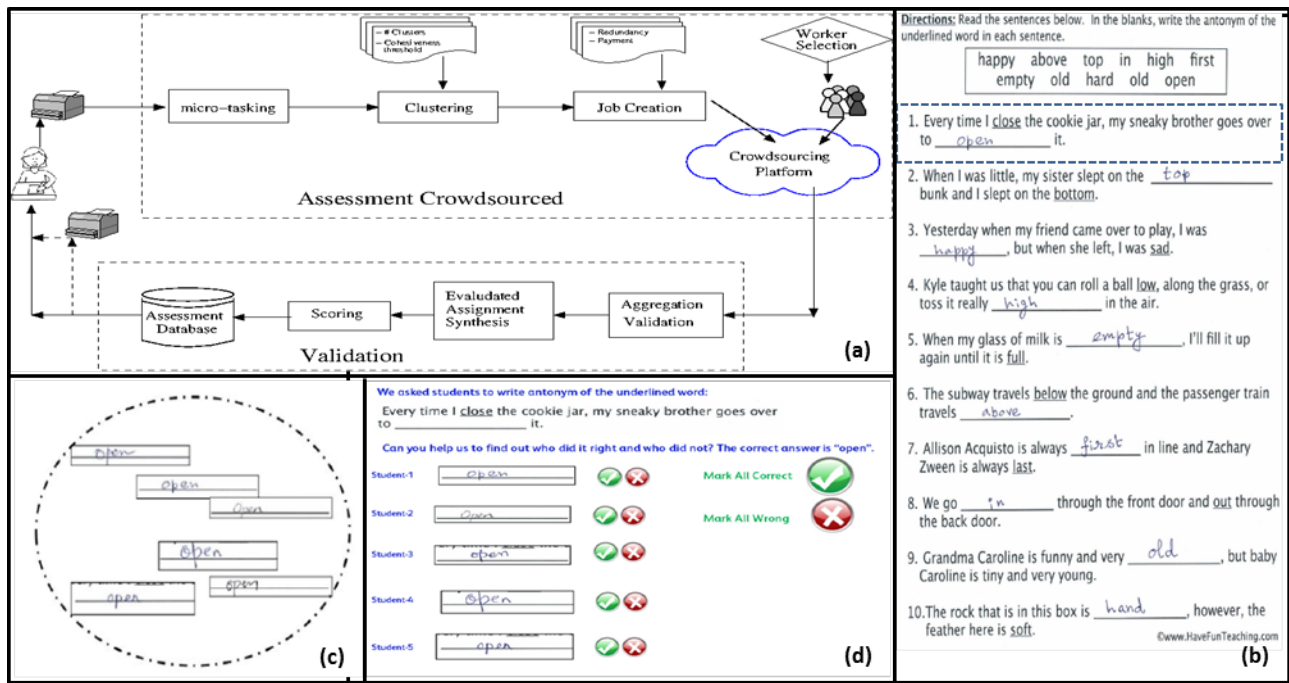


Figure 1: Crowdsourced educational assessment. (a) An end-to-end system (b) A sample assignment sheet to learn antonyms (c) A cluster of responses for question 1 from the antonym assignment (d) HIT for question 1.

repetitive patterns of worksheets to create easy to understand and execute by workers who may not have all skills required for such assessments. We process the scanned images to extract the questions and answers, cluster similar answers (as images), and present each question and clustered responses as a Human Intelligent Task (HIT), see Fig. 1 (b), (c), and (d), respectively. Clustering groups same responses, e.g., correct antonym *open* for Question-1, together thereby making it possible to see same responses and grade them in one shot. Most importantly, we thereby reduce processing time for reading and interpreting sentences (or context, in general) to minimal. Further, we provide correct answer along with the question as a part of HIT (See Fig. 1(d)) so that crowd can execute the HITs even if they don't know the correct answer to the question. Whereas in the case of *Community Sourcing*, we do not provide the correct answer in HITs designed for the community (rural teachers) and ask them to submit their answer as a part of the task. After completion of the task, a message can be displayed by the platform showing the correct answer. This design of the task gives a chance of self-assessment to the community workers and also helps learning while earning. We can use capability of the platform to recognize possible erroneous assessment in such a design and provide notifications to the requester (teachers).

Responses by the crowd on completed HITs from an assignment are aggregated, validated, and stored as a complete assignment by the requester, i.e., urban teacher (See Fig. 1(a)). Scoring module scores the assignment and writes it on the top of the assignment as in case of the assess-

ment corrected by hand. We propose to leverage existing handwriting synthesis capabilities to make corrected assignments appear as evaluated by hand. Assessment database stores data for all the students which can be used to generate reports and hence provide actionable views of the data so that teachers can differentiate instructions. Students can be shown corrected copies in a printed form which could be an optional step.

In this paper, we have introduced an interesting crowdsourcing task which assists school teachers while promoting crowd education. Study on feasibility of the proposed assessment system and further analysis is in progress. We believe that this technique can be applied to a broad range of non-autogradable educational assessment tasks.

References

Heimerl, K.; Gawalt, B.; Chen, K.; Parikh, T.; and Hartmann, B. 2012. Communitysourcing: Engaging local crowds to perform expert works via physical kiosks. In *Proceedings of CHI-ACM SIGCHI Conference on Human Factors in Computing Systems*.

Monika, S. 2012. The application of crowd sourcing in educational activities. *Social Technologies* 2(1):67–76.

Weld, D.; Adar, E.; Chilton, L.; Hoffmann, R.; Horvitz, E.; Koch, M.; Landay, J.; Lin, C.; and Mausam. 2012. Personalized online educational crowdsourcing challenge. In *Proceedings of AAAI-HCOMP, the fourth Human Computation Workshop*.