

Estimating Learner's Confidence Level for Multiple choice Questions Using the Penalized Regression Method

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E-learning has been adopted by several companies for qualification acquisition. In e-learning, multiple choice questions are often used, and learners are required to choose answers that seem correct to them. Reviews are indispensable to address inconsistencies and shortcomings in knowledge; therefore, questions that are incorrectly answered are mainly extracted for review. However, among correctly answered questions, there may be some that the learner chose without confidence; these questions should also be extracted for review. In this study, we propose a method that can estimate the confidence level when a learner chooses answers for multiple choice questions by applying penalized regression to the learner's biosignals.

In the proposed method, the following biosignals are measured from the learner for each problem: thinking time, operation time, transition distance of the gaze, maximum inclination angle and movement distance of the head, appearance rate of four brain waves, standard deviation of the RR interval, and root mean square of the difference between adjacent RR intervals. Feature values are calculated by the biosignals, and the confidence level is estimated by applying the feature values to the penalized regression.

We conducted an experiment with six subjects to evaluate the method. They answered 29 multiple choice questions and a questionnaire about the confidence level for each answer. In the experiment, we compared the correct rate for estimation among ridge regression, lasso regression, and elastic net. Results show that the values of the average of correct rates are 56.90%, 67.24%, and 64.95% for ridge, lasso, and elastic net, respectively.

Keywords: e-learning, multi-choice problem, confidence level, bio-signal, penalized regression