World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:15, No:03, 2021

Applied Complement of Probability and Information Entropy for Prediction in Student Learning

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Abstract : The probability computation of events is in the interval of [0, 1], which are values that are determined by the number of outcomes of events in a sample space S. The probability Pr(A) that an event A will never occur is 0. The probability Pr(B) that event B will certainly occur is 1. This makes both events A and B a certainty. Furthermore, the sum of probabilities $Pr(E_1) + Pr(E_2) + \ldots + Pr(E_n)$ of a finite set of events in a given sample space S equals 1. Conversely, the difference of the sum of two probabilities that will certainly occur is 0. This paper first discusses Bayes, the complement of probability, and the difference of probability for occurrences of learning-events before applying them in the prediction of learning objects in student learning. Given the sum of 1; to make a recommendation for student learning, this paper proposes that the difference of argMaxPr(S) and the probability of student-performance quantifies the weight of learning objects for students. Using a dataset of skill-set, the computational procedure demonstrates i) the probability of skill-set events that have occurred that would lead to higher-level learning; ii) the probability of the events that have not occurred that requires subject-matter relearning; iii) accuracy of the decision tree in the prediction of student performance into class labels and iv) information entropy about skill-set data and its implication on student cognitive performance and recommendation of learning.

Keywords : complement of probability, Bayes' rule, prediction, pre-assessments, computational education, information theory
Conference Title : ICCSAE 2021 : International Conference on Computer Science and Automation Engineering
Conference Location : Dubai, United Arab Emirates
Conference Dates : March 22-23, 2021