Review of: "Academic Performance Prediction Based on Convolutional Neural Networks and IRT Parameters as RGB Images"

Teerapong Panboonyuen[1]

1 Chulalongkorn University, Thailand

Potential competing interests: No potential competing interests to declare.

This paper presents a novel approach to predicting academic performance by transforming Item Response Theory (IRT) parameters into RGB images for training a convolutional neural network (CNN). The authors argue that current methods in the literature have inadequately explored the intersection of computer vision and educational assessment. By analyzing historical performance data from over 4 million students in Brazil, the study demonstrates that images corresponding to higher scores exhibit lighter tones, indicating stronger performance. The CNN achieved a Spearman Correlation of 0.86 across 20,000 images, suggesting robust generalization capabilities.

Strengths:

- The manuscript is well-organized, with a clear structure that facilitates comprehension.
- The overall presentation is coherent, allowing readers to easily follow the logical progression of ideas.

Weaknesses:

While the work has a promising foundation, there are some evident shortcomings:

- The manuscript would benefit from additional experimental conditions to verify the robustness of the proposed solution.
- It is unclear how certain hyperparameters were chosen, as the paper lacks a systematic exploration of these decisions.
- This paper introduces a method that involves transforming IRT parameters into RGB matrices, but it does not sufficiently explain the mathematical reasoning behind this transformation. The lack of detailed mathematical derivation or justification may make it difficult for readers to understand the rationale and significance of the chosen approach.
- This paper introduces the idea of transforming IRT parameters into RGB images but does not provide a clear mathematical explanation of how these transformations capture key statistical properties of the data. A more thorough treatment of the mathematical relationship between the parameters and the RGB format is necessary.
- While CNNs are powerful in image classification, the paper does not offer a detailed theoretical rationale for why CNNs, in particular, are suited for this task compared to other machine learning models that may handle non-image data more efficiently.
- The use of Spearman correlation is briefly mentioned as a performance metric, but there is no detailed discussion or mathematical validation of why this metric was chosen over others. Including a comparison of correlation metrics would strengthen the paper's claims.

- This paper does not provide a rigorous mathematical error analysis, such as an assessment of overfitting, underfitting, or model variance. A deeper look into the model's performance across different data subsets with relevant statistical measures would improve the robustness of the conclusions.

I believe the critical changes will mainly depend on how the authors tackle the concerns raised above. Generally, I will expect:

- more discussion/comparison with related works;
- deeper analyses of the proposed method (might with additional experiments);
to support the claims made in this work.