Review of: "Deep Learning Modeling for Prediction of Cognitive Task Related Features from Resting-state fMRI Data"

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Potential competing interests: No potential competing interests to declare.

Summary:

The authors adapted the connectivity-based graph convolutional network, originally designed for Autism classification, to perform regression based prediction of cognitive scores. This modification involved incorporating an LSTM layer as the final component, enabling the prediction of Kohs block-design test scores on healthy adults. The authors employed a leave-two-out occlusion technique to pinpoint essential regions of interest (ROIs) and interregional relations between brain networks.

The main findings are as follows:

1. The cGCN-LSTM model outperforms the baseline model Lasso Regression in both scenarios: 1. Using rs-fMRI and age data 2. Using rs-fMRI data only.
2. Age exhibits a non-significant negative correlation with Kohs block-design test scores.

The authors conclude that:

The authors conclude that the cGCN-LSTM model effectively predicts Kohs block-design test scores using rs-fMRI data. They also highlight the utility of the leave-two-out occlusion method in identifying task-related brain regions and networks. Consequently, this approach holds promise for enhancing the design of future task-based fMRI scans.

General impressions:

The study unveils an innovative adaptation of the existing cGCN framework for a distinct application and a diverse outcome variable.

Major concern:

The IQ score discussed in section 2.3 includes both mental age and calendar age. Yet, on the left side of Figure 2, the graph shows predictions for the Kohs score using both age and fMRI data. This scenario raises concerns of potential data leakage, as the inclusion of calendar age in the Kohs score could impact the predictive outcome. Should these concerns prove valid, it would be advisable to consider adjusting Figure 2 and the ROI rankings in Table 1.

Clarification requested:

1. Materials and Methods section:
    a. Please explain the Apathy score and provide the citation for it.
    b. Please specify if alternative numbers of neighbors were tested in KNN and, if applicable, include prediction discrepancies in the supplementary materials
2. Results section:
    a. Please clarify when using the word accuracy, is it always referring to Pearson's product-moment correlation coefficient?
    b. Please confirm the presence of an ROI rankings table for leave-two-out occlusion and include it if available.
    c. Please enlarge Figure 2 for improved readability.