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A LightGBM Analysis of Emotional Well-Being in Children with Autism Spectrum Disorder: Predictive Contributions of Sensory Sensitivity, Parent–Child Attachment, and Social Competence

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1. Round 1

1.1. Reviewer 1

Reviewer:

In the paragraph stating “Among the factors that have attracted substantial attention, sensory sensitivity has emerged as one of the most distinctive and clinically relevant characteristics of ASD,” the rationale for focusing specifically on sensory sensitivity rather than broader sensory processing dimensions remains underdeveloped. The authors should justify why sensory sensitivity was isolated as the primary sensory predictor and discuss whether sensory seeking, sensory avoidance, or sensory registration patterns were considered.

The paragraph beginning “Another factor that may play a fundamental role in emotional well-being among children with ASD is parent–child attachment” would be strengthened by a discussion of developmental stage effects. Attachment processes may differ considerably between younger children and preadolescents; therefore, the authors should explain whether age-related moderation effects were considered and whether attachment functions similarly across the entire 7–12-year age range.

In the paragraph introducing social competence, specifically the sentence "Social competence refers to the capacity to engage effectively in social interactions, understand social cues, establish relationships, communicate appropriately, and adapt behavior to varying interpersonal contexts," the authors should more explicitly differentiate social competence from the diagnostic social communication deficits that define ASD. Without this distinction, there is a risk of conceptual overlap between predictor and outcome mechanisms.

In Table 1, the correlation between social competence and emotional well-being is reported as $r = 0.74$. This relatively strong association raises concerns regarding conceptual overlap between the constructs. The authors should discuss discriminant validity and provide evidence that emotional well-being and social competence represent distinct constructs rather than overlapping dimensions of adaptive functioning.

Regarding Table 2, the manuscript states "Comparison of training and testing metrics revealed only a modest reduction in predictive accuracy, indicating minimal overfitting." While the decrease from $R^2 = 0.893$ to $R^2 = 0.821$ appears acceptable, the authors should provide additional validation evidence such as repeated cross-validation, bootstrapping, or external validation to support the claim of model stability.

Authors revised the manuscript and uploaded the document.

1.2. Reviewer 2

Reviewer:

The final paragraph of the Introduction states "Machine learning algorithms can process high-dimensional data, detect nonlinear relationships, identify complex interactions, and generate highly accurate predictive models." However, only three predictor variables were included in the model. The authors should justify the necessity of using a machine learning approach for such a low-dimensional dataset and compare its advantages against multiple regression or structural equation modeling.

In the Study Design and Participants section, the sentence "Participants were recruited through collaboration with educational psychologists, pediatric developmental specialists, and autism support organizations" requires greater detail. Please describe the recruitment procedure, response rate, number of eligible participants approached, and proportion of families who declined participation to allow readers to evaluate potential selection bias.

The participant description reports "A total of 428 children met the inclusion criteria and participated in the research." No a priori sample size justification or power analysis is provided. Even though machine learning approaches often prioritize predictive performance, the authors should explain how the adequacy of the sample size was determined and whether the sample-to-feature ratio met accepted methodological standards.

In the Measures section, the sentence "Emotional well-being was assessed using the Emotional Well-Being Scale for Children developed by Stirling (2015)" requires additional psychometric information specific to the present sample. Please report Cronbach's alpha, McDonald's omega, or other reliability coefficients obtained from the current dataset rather than relying exclusively on previous validation studies.

The paragraph describing the Short Sensory Profile-2 states that "Higher scores reflect greater sensory sensitivity and atypical sensory processing experiences." The authors should clarify whether total scores or specific sensory domains were entered into the LightGBM model. Given the multidimensional nature of sensory processing, collapsing all domains into a single score may obscure clinically meaningful patterns.

In the paragraph describing data collection, the statement "limited missing values were addressed using appropriate imputation procedures" is insufficiently detailed. The manuscript should explicitly specify the percentage of missing data, the imputation method employed (e.g., mean substitution, multiple imputation, KNN imputation), and the rationale for selecting that procedure.

In the Data Analysis section, the sentence "Hyperparameter optimization was performed through grid search procedures combined with five-fold cross-validation" requires expansion. The authors should provide the search space, optimization criteria, selected hyperparameters, and computational procedures to ensure reproducibility and methodological rigor.

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The demographic description reports that “38.8% were classified as Level 1, 44.6% as Level 2, and 16.6% as Level 3 according to DSM-5 diagnostic criteria.” ASD severity level may substantially influence emotional well-being and social competence. The authors should examine whether severity level moderated the predictive relationships or contributed independently to the model.

Authors revised the manuscript and uploaded the document.

2. Revised

Editor’s decision: Accepted.
Editor in Chief’s decision: Accepted.

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