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Optimizing Oil Palm Genomic Predictions with Artificial Neural Networks

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Abstract Text:
Genomic selection (GS) has revolutionized animal and crop breeding by enabling the prediction ofgenetic values for individuals without phenotypic data. Artificial neural networks (ANNs) havedemonstrated significant promise in GS applications, though their optimal implementation remainsa challenge. This study examines key factors influencing ANN performance in genomic prediction,utilizing an oil palm dataset from two sites. Site 1 was used for training and validation, while Site 2served as a test set to assess performance on different genetic crosses.Our findings emphasize the critical importance of model optimization. Bayesian optimizationproved highly effective in this regard. Optimized multilayer perceptron (MLP) models achievednotable improvements in test set prediction accuracy (*r*), with increases of up to 32.8% for totalbunch production and 5.1% for bunch number compared to the best conventional methods.Comparable *r* values were observed for height increment. ANNs showed satisfactoryrepeatability, comparable to Bayesian GS methods, further supporting their reliability for genomicprediction. Nonetheless, replicates remain essential for accurately evaluating ANN performance.This study confirms the significant potential of ANNs in genomic prediction and underscores theneed for meticulous optimization to enhance their effectiveness.

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