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Interpreting the role of nuchal fold for fetal growth restriction prediction using machine learning

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SCIENTIFIC REPORTS

Volume: 12 Issue: 1

Article Number: 3907

DOI: 10.1038/s41598-022-07883-0

Published: MAR 10 2022

Indexed: 2022-06-29

Document Type: Article

Abstract

The objective of the study is to investigate the effect of Nuchal Fold (NF) in predicting Fetal Growth Restriction (FGR) using machine learning (ML), to explain the model's results using model-agnostic interpretable techniques, and to compare the results with clinical guidelines. This study used second-trimester ultrasound biometry and Doppler velocimetry were used to construct six FGR (birthweight < 3rd centile) ML models. Interpretability analysis was conducted using Accumulated Local Effects (ALE) and Shapley Additive Explanations (SHAP). The results were compared with clinical guidelines based on the most optimal model. Support Vector Machine (SVM) exhibited the most consistent performance in FGR prediction. SHAP showed that the top contributors to identify FGR were Abdominal Circumference (AC), NF, Uterine RI (Ut RI), and Uterine PI (Ut PI). ALE showed that the cutoff values of Ut RI, Ut PI, and AC in differentiating FGR from normal were comparable with clinical guidelines (Errors between model and clinical; Ut RI: 15%, Ut PI: 8%, and AC: 11%). The cutoff value for NF to differentiate between healthy and FGR is 5.4 mm, where low NF may indicate FGR. The SVM model is the most stable in FGR prediction. ALE can be a potential tool to identify a cutoff value for novel parameters to differentiate between healthy and FGR.

Keywords

Keywords Plus: [UTERINE ARTERY DOPPLER](#); [THICKNESS](#); [PREGNANCY](#); [STANDARDS](#); [INDEXES](#)

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Categories/Classification

Research Areas: Science & Technology - Other Topics

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Journal information

[SCIENTIFIC REPORTS](#)

ISSN: 2045-2322

Current Publisher: NATURE PORTFOLIO, HEIDELBERGER PLATZ 3, BERLIN 14197, GERMANY

Journal Impact Factor: [Journal Citation Reports™](#)

Research Areas: Science & Technology - Other Topics

Web of Science Categories: Multidisciplinary Sciences

4.996

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