OPEN DATA, EXPLAINABLE AI, DATA SCIENCE AND CONVENTIONAL NITS: THE RECIPE FOR NEW MACHINE LEARNING DIAGNOSTIC TESTS ON MASLD

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INTRODUCTION
Metabolic dysfunction-associated steatotic liver disease (MASLD) has a prevalence exceeding 25% in the general population. Non-invasive tests, namely the FIB-4 index, NFS, APRI, and AST/ALT, play a crucial role in differentiating advanced fibrosis stages (F012 vs. F34 in metavir score).

AIM
Developing and optimizing an interpretable machine learning model that employs the aforementioned non-invasive test parameters as features, surpassing their individual performances in diagnosing advanced fibrosis in MASLD patients.

METHOD
- Open data from two cohorts, China (train) and Malaysia (test), are used, with 540 participants (early/advanced fibrosis: 391/149) and 147 participants (116/31) having liver biopsy-confirmed hepatic fibrosis.
- Features: age, sex, BMI, ALB, PLT, AST, ALT, ALTI/AST, AST/PLT, presence of diabetes/impaired fasting glycemia, (DM.IFG), FIB-4 score, NFS score, APRI score
- The machine learning model is trained, tuned, and validated using the train dataset, followed by testing on the test dataset.
- 10-fold cross-validation (10CV) enhances the robustness of the model.
- Feature engineering expands feature space by considering power and product combinations of initial features.
- Shapley values from explainable artificial intelligence are utilized to understand feature importance in catboost predictions.

RESULTS
We conducted a comparative analysis between the catboost model (ML) and the four non-invasive tests (NITs) FIB-4, NFS, APRI, and AST/ALT using specific threshold values for advanced fibrosis, namely 1.30, -1.455, 0.64, and 0.87, respectively. The comparison was performed on identical folds within the 10-fold cross-validation (10CV) framework, with consistent random seed selection.

CONCLUSIONS
- By utilizing data science with catboost, feature engineering, and the parameters/scores from four NITs, we achieve superior performance and robustness compared to those NITs testing on the train dataset.
- 10-fold cross-validation (10CV) enhances model robustness.
- Explainable artificial intelligence identifies the importance of FIB-4, NFS, and PLT*8, potentially leading to a novel non-invasive test.
- We propose a paradigm shift for classifying MASLD patients into early and advanced fibrosis stages.
- Linear cut-off values alone are inadequate, necessitating data science and explainable artificial intelligence to provide insights.
- Combining parameters from all four NITs in an interpretable machine learning framework improves outcomes.

REFERENCES

ACKNOWLEDGEMENTS

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