

The Selection of Indicators from Initial Blood Routine Test Results to Improve the Accuracy of Early Prediction of COVID-19 Severity

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Abstract

Early prediction of disease severity is important for effective treatment of COVID-19. We determined that age is a key indicator for severity predicting of COVID-19, with an accuracy of 0.77 and an AUC of 0.92. In order to improve the accuracy of prediction, we proposed a Multi Criteria Decision Making (MCDM) algorithm, which combines the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Naïve Bayes (NB) classifier, to further select effective indicators from patients' initial blood test results. The MCDM algorithm selected 3 dominant feature subsets {Age, WBC, LYMC, NEUT}, {Age, WBC, LMYC} and {Age, NEUT, LYMC}. Using these feature subsets, the optimized prediction model could achieve an accuracy of 0.82 and an AUC of 0.93. This result indicated that using age and the indicators selected by the MCDM algorithm from blood routine test results can effectively predict the severity of COVID-19 at an early stage.

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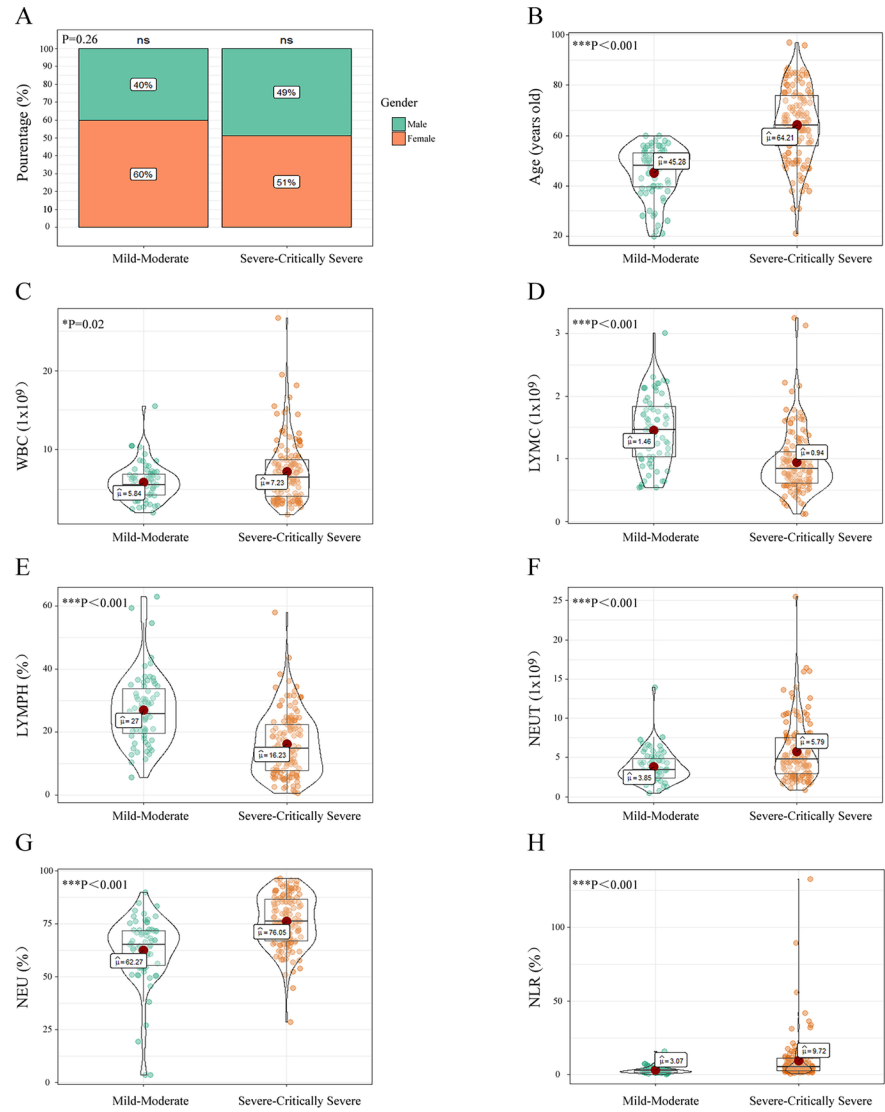
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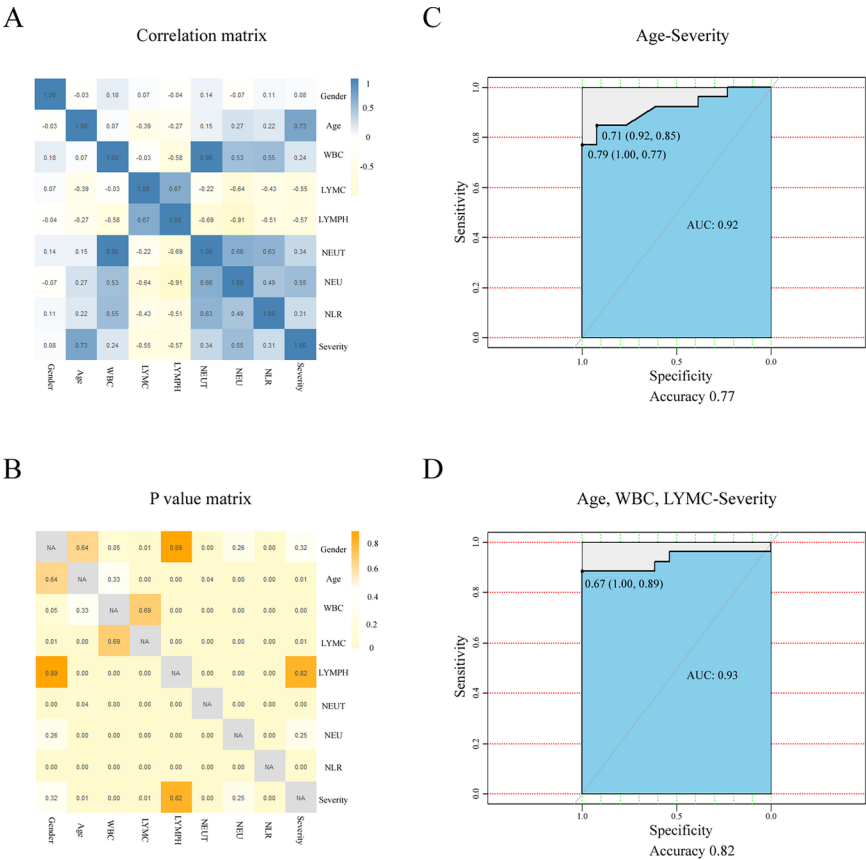
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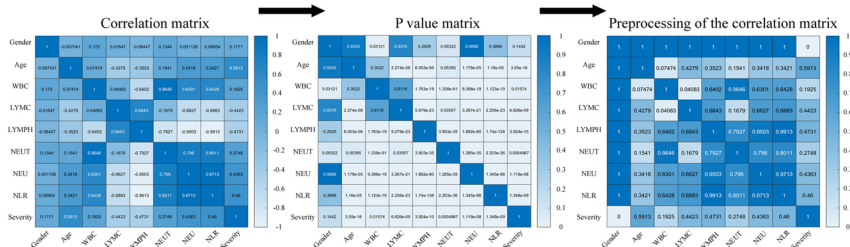
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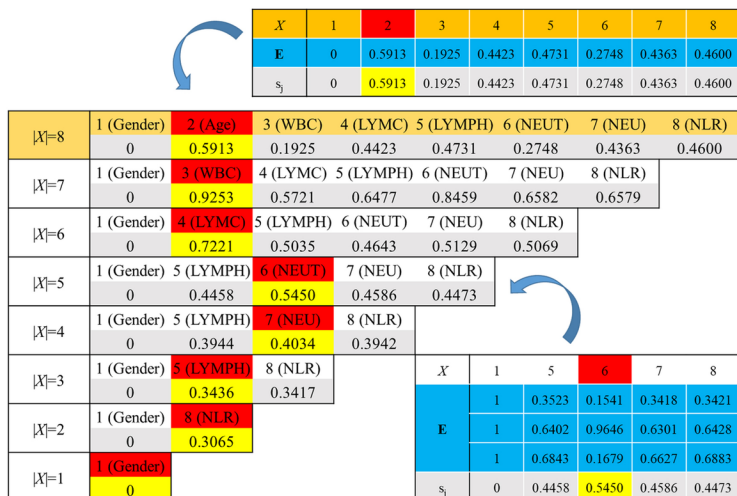
A

MCDM algorithm-Stage 1. Preprocessing



B

MCDM algorithm-Stage 2. Feature Ranking



C

MCDM algorithm-Stage 3. Feature Selection

EVAL1	2 (Age)	5 (LYMPH)	8 (NLR)	4 (LYMC)	7 (NEU)	6 (NEUT)	3 (WBC)	1 (Gender)
EVAL1 (subset)	2 (Age)	5 (LYMPH)	8 (NLR)	4 (LYMC)	7 (NEU)	6 (NEUT)	3 (WBC)	1 (Gender)
	0.745223	0.770701	0.796178	0.802548	0.789809	0.777707	0.726115	0.719745
EVAL1+EVAL2	2 (Age)	3 (WBC)	4 (LYMC)	6 (NEUT)	7 (NEU)	5 (LYMPH)	8 (NLR)	1 (Gender)
(subset)	0.745223	0.789809	0.815287	0.815287	0.796178	0.777707	0.726115	0.719745

D

MCDM algorithm-Stage 4. Performance Evaluation

