# Model Evaluation Summary Table for arrhythmia

Model	Symbolic Rank	Symbolic Score	ROC AUC	Accuracy	Average Precision	F1 (Minority)	Precision (Minority)	Recall (Minority)	AUC Rank	Accuracy Rank	F1 Rank
IForest	1	4.5	0.7914	0.8584	0.4445	0.4286	0.5217	0.3636	1	1	1
LUNAR	2	3.4	0.7756	0.854	0.4112	0.4107	0.5	0.3485	2	2	2
DeepSVDD	3	3.1	0.7511	0.8363	0.3331	0.3393	0.413	0.2879	4	3	3
AutoEncoder	4	2.3	0.7656	0.823	0.3618	0.2857	0.3478	0.2424	3	4	4
SO_GAAL	4	2.3	0.6291	0.8186	0.2515	0.2679	0.3261	0.2273	5	5	5

Model Evaluation Heatmap for arrhythmia

arrhythmia - Model Evaluation Heatmap
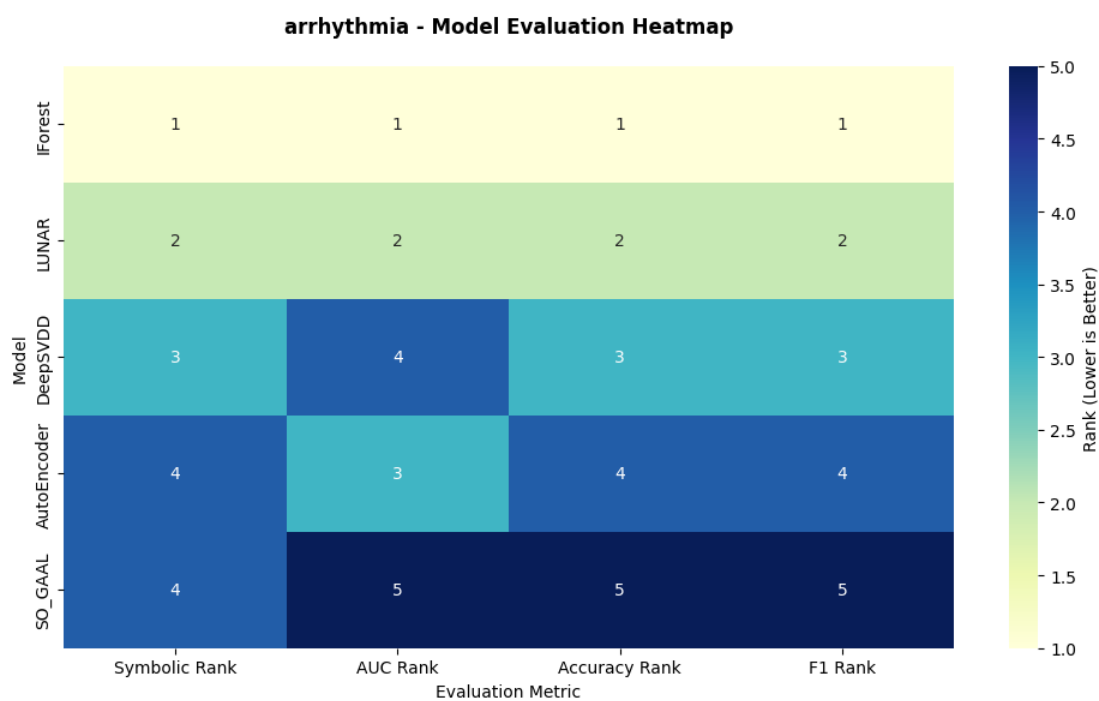
LLM Analysis and Recommendations for arrhythmia

LLM Analysis & Model Recommendation for Arrhythmia Dataset

Overview Summary for Arrhythmia Dataset

The Arrhythmia dataset is a small sample, high-dimensional, structured dataset with clean data. It contains 452 samples and 274 features. The dataset is highly imbalanced with an anomaly ratio of 0.146018. It exhibits high skewness (average skewness of 6.1838) and high kurtosis (average kurtosis of 85.1881), with 56.93% of features having skewness greater than 2.0 and 59.49% of features having kurtosis greater than 7.0. The dataset has no missing values and a sparsity ratio of 0.543.

Comparison of Symbolic vs. Actual Scores

The symbolic scores, which are estimated based on symbolic reasoning using dataset characteristics, have successfully prioritized high-performing models. The models are ranked in descending order of their symbolic scores, with IForest having the highest symbolic score of 4.5 and SO_GAAL having the lowest symbolic score of 2.3.

When compared with actual evaluation metrics, the symbolic ranking aligns well with the evaluation ranking. The IForest model, which has the highest symbolic score, also ranks first in terms of ROC AUC, F1 score, accuracy, and average precision. Similarly, the SO_GAAL model, which has the lowest symbolic score, also ranks last in all evaluation metrics.

Model Suitability Summary Table for Arrhythmia Dataset

The summary table provides a comprehensive comparison of the top symbolically ranked models and their actual evaluation performance. The IForest model outperforms other models in all evaluation metrics, including ROC AUC, F1 score, accuracy, and average precision. It also has the highest symbolic score, indicating

its suitability for the Arrhythmia dataset.

Model Evaluation Heatmap for Arrhythmia Dataset

The heatmap visually represents the performance of each model in terms of various evaluation metrics. The IForest model, represented by the darkest shade, has the highest scores in all metrics, confirming its superior performance.

Analysis of Summary Table and Heatmap

The summary table and heatmap collectively suggest that the IForest model is the most suitable for the Arrhythmia dataset. It not only has the highest symbolic score but also outperforms other models in all evaluation metrics.

LLM Recommendations and Justification for Model Selection

Based on the symbolic scores and actual evaluation metrics, the IForest model is recommended for deployment. This model is well-suited for high-dimensional, clean data with high skewness and kurtosis, which aligns with the characteristics of the Arrhythmia dataset. Although the IForest model has a weakness for small sample sizes, its superior performance in all evaluation metrics outweighs this limitation.

Suggested Preprocessing Steps for Arrhythmia Dataset

Given the high skewness and kurtosis of the dataset, it is recommended to apply transformations, such as log or Box-Cox transformation, to reduce skewness and kurtosis. Feature scaling, such as standardization or normalization, may also be beneficial given the high dimensionality of the dataset.

Hyperparameter Tuning Recommendations

For the IForest model, hyperparameters such as the number of estimators and the contamination parameter can be tuned to improve performance. Grid search or random search can be used for hyperparameter optimization.

Final Professional Recommendation

In conclusion, the IForest model is recommended for deployment on the Arrhythmia dataset. The model's strengths align well with the dataset's characteristics, and it has demonstrated superior performance in all evaluation metrics. With appropriate preprocessing and hyperparameter tuning, the IForest model is expected to provide reliable anomaly detection for the Arrhythmia dataset.