Model Validation Report

Generated on: {{ validation\_date }}

Validated by: {{ validated\_by }}

Model File: {{ model\_path }}

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## Model Metadata

**Model Type:** {{ ModelMetaCheck.model\_type }}  
**Feature Count:** {{ ModelMetaCheck.n\_features }}  
**Feature Names:** {{ ModelMetaCheck.feature\_names }}  
**Training Rows:** {{ ModelMetaCheck.n\_train\_rows }}  
**Target Balance:** {{ ModelMetaCheck.target\_balance }}

## Performance Metrics

**- Accuracy:** {{ check\_results.PerformanceCheck.accuracy }}  
**- AUC-ROC:** {{ check\_results.PerformanceCheck.auc }}  
**- KS Statistic:** {{ check\_results.PerformanceCheck.ks }}  
**- F1 Score:** {{ check\_results.PerformanceCheck.f1 }}  
**- Confusion Matrix:** {{ check\_results.PerformanceCheck.confusion\_matrix }}

## Data Quality (Cleaned Data)

Missing (Train): {{ DataQualityCheck.avg\_missing }}

Missing (Test): {{ DataQualityCheck.avg\_missing }}

Columns With Missing (Train): {{ DataQualityCheck.columns\_with\_missing }}

Columns With Missing (Test): {{ DataQualityCheck.columns\_with\_missing }}

Constant Columns: {{ DataQualityCheck.constant\_columns }}

## Raw Data Validation

Total Rows: {{ RawDataCheck.total\_rows }}

Total Columns: {{ RawDataCheck.total\_columns }}

Average Missing: {{ RawDataCheck.avg\_missing }}

Columns With Missing: {{ RawDataCheck.columns\_with\_missing }}

Duplicate Rows: {{ RawDataCheck.duplicate\_rows }}

Constant Columns: {{ RawDataCheck.constant\_columns }}

## Correlation Analysis

Pearson Correlation CSV: {{ correlation\_pearson\_path }}

Spearman Correlation CSV: {{ correlation\_spearman\_path }}

{{ correlation\_heatmap }}

## Variance Inflation Factor (VIF) Check

{% if VIFCheck.vif\_table and VIFCheck.vif\_table|length > 0 %}

{{ INSERT\_VIF\_TABLE }}

{% else %}

\_No VIF results were generated for this run.\_

{% endif %}

## Exploratory Data Analysis (EDA)

Summary Stats CSV: {{ eda\_summary\_path }}

Missing Values CSV: {{ eda\_missing\_path }}

Distribution Plots:

{% for img in eda\_images %}

{{ img }}

{% endfor %}

{% if ModelMetaCheck.model\_type == 'LogisticRegression' %}

## Logistic Regression Coefficients

\*\*Fit statistics\*\*

- Log-likelihood: {{ LogisticStatsFit.log\_lik }}

- AIC: {{ LogisticStatsFit.aic }}

- BIC: {{ LogisticStatsFit.bic }}

- Pseudo-R²: {{ LogisticStatsFit.pseudo\_r2 }}

{% if LogisticStatsSummary %}

\*\*Full statsmodels output\*\*

{{ LogisticStatsSummary }}

{% endif %}

{{ LogitSummaryImg }}

{% endif %}

## Stress Testing Results

{{ INSERT\_STRESS\_TEST\_TABLE }}

## Input Cluster Coverage Check

A K-Means clustering algorithm was applied to the cleaned dataset to evaluate input space coverage. This analysis highlights the distribution of samples across different clusters, assisting in the identification of any imbalance or concentration that could affect model behavior.

Input cluster distribution (saved to CSV):

{{ InputClusterCheck.cluster\_csv }}

Cluster Summary Table:

{{ INSERT\_INPUT\_CLUSTER\_TABLE }}

Cluster Distribution Plot:

{{ InputClusterCheck.cluster\_plot\_img }}

## Rule Engine Check

Overall Pass: {{ RuleEngineCheck.overall\_pass }}

{% for metric, result in RuleEngineCheck.rules.items() %}

- {{ metric }}: {{ result }}

{% endfor %}

## Model Contents Summary

Model Class: {{ ModelMetaCheck.model\_class }}

Module: {{ ModelMetaCheck.module }}

Hyperparameters:

{% for row in ModelMetaCheck.hyperparam\_table %}

- {{ row.param }}: {{ row.value }}

{% endfor %}

Attributes:

{{ ModelMetaCheck.attributes }}

{% if coef\_table %}

========================

Logistic Coefficients

========================

| Feature | Coefficient |

|---------------|-------------|

{% for row in coef\_table %}

| {{ row.feature }} | {{ row.coefficient | round(4) }} |

{% endfor %}

{% endif %}

{% if feature\_importance\_table %}

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Feature Importances (Tree-Based Models)

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| Feature | Importance |

|---------------|------------|

{% for row in feature\_importance\_table %}

| {{ row.feature }} | {{ row.importance | round(4) }} |

{% endfor %}

{% endif %}

## Explainability

### SHAP Summary Plot

SHAP (SHapley Additive exPlanations) is used to explain the impact of each input feature on the model's predictions. The SHAP summary plot below shows the magnitude and direction of influence of the top features across a sample of predictions. Features at the top have the highest average impact. Red indicates higher feature values, and blue indicates lower values.

This plot helps identify which features the model relies on most and whether they align with domain knowledge.

Only a subset of the test data is used for SHAP due to performance considerations.

{{ shap\_plot }}