

# Model Performance Summary – AI-Based Health Management System

## 1. XGBoost

### *Performance Metrics:*

Metric	Value
Accuracy	0.9306
AUC	0.9813
F1	0.9291
Precision	0.9506
Recall	0.9085

### *Best Parameters:*

Parameter	Value
Learning Rate	0.008
Max Depth	15
n_estimators	800
Subsample	0.75
Colsample_bytree	0.75

## 2. CatBoost

### *Performance Metrics:*

Metric	Value
Accuracy	0.9326
AUC	0.9816
F1	0.9314
Precision	0.9490
Recall	0.9143

### *Best Parameters:*

Parameter	Value
Depth	10
Iterations	2000

L2 Leaf Reg	5
Learning Rate	0.03
Random Seed	42

#### ***Top Features:***

Rank	Feature	Importance
1	Hemoglobin	19.21
2	Troponin_t	10.25
3	Admission_type	5.71

### **3. LightGBM (Standard)**

#### ***Performance Metrics:***

Metric	Value
Accuracy	0.9341
AUC	0.9812
F1	0.9268
Precision	0.9512
Recall	0.9037

#### ***Best Parameters:***

Parameter	Value
Learning Rate	0.01
Max Depth	20
Num Leaves	256
n_estimators	1500
Subsample	0.6

#### ***Top Features:***

Rank	Feature	Importance
1	hadm_id	40871
2	hemoglobin	20767
3	spo2	19700

### **4. LightGBM (No Removal - Balanced)**

**Performance Metrics:**

Metric	Value
Accuracy	0.9353
AUC	0.9825
F1	0.9342
Precision	0.9516
Recall	0.9173

**Best Parameters:**

Parameter	Value
Learning Rate	0.02
Max Depth	12
Num Leaves	96
n_estimators	1500
Subsample	0.85

**Top Features:**

Rank	Feature	Importance
1	hadm_id	17492
2	troponin_t	6643
3	temperature	6374

**5. Ensemble LightGBM (Advanced)**

**Performance Metrics:**

Metric	Value
Accuracy	0.9409
AUC	0.9826
F1	0.9398
Precision	0.9587
Recall	0.9216

**Best Parameters:**

Parameter	Value
Feature Eng.	advanced_medical

Feature Selection	ensemble
Model Type	LightGBM
Features Used	30
Total Patients	33018

***Top Features:***

Rank	Feature	Importance
1	creatinine	16507
2	glucose	16503
3	oxygen_content	16399
4	temperature	16067
5	rate_pressure_product	15826