

XGBoost Classification Report:				
	precision	recall	f1-score	support
Benign	0.96	1.00	0.98	40032
Brute Force -Web	1.00	0.98	0.99	57
Brute Force -XSS	1.00	0.82	0.90	17
DDOS attack-HOIC	1.00	1.00	1.00	1986
DDOS attack-LOIC-UDP	1.00	1.00	1.00	325
DoS attacks-GoldenEye	1.00	1.00	1.00	2060
DoS attacks-Slowloris	1.00	1.00	1.00	956
Infiltration	0.69	0.15	0.25	1981
SQL Injection	0.83	1.00	0.91	5
accuracy			0.96	47419

Figure 4.1: XGBoost Classification Report (Before SMOTE)

LightGBM Classification Report:				
	precision	recall	f1-score	support
Benign	0.96	0.95	0.95	40032
Brute Force -Web	0.24	0.30	0.27	57
Brute Force -XSS	0.00	0.00	0.00	17
DDOS attack-HOIC	0.90	0.89	0.90	1986
DDOS attack-LOIC-UDP	0.76	0.91	0.83	325
DoS attacks-GoldenEye	0.64	0.99	0.78	2060
DoS attacks-Slowloris	0.94	0.70	0.80	956
Infiltration	0.29	0.20	0.24	1981
SQL Injection	0.00	0.00	0.00	5
accuracy			0.91	47419

Figure 4.2: LightGBM Classification Report (Before SMOTE)

CatBoost Classification Report:				
	precision	recall	f1-score	support
Benign	0.96	1.00	0.98	40032
Brute Force -Web	0.93	0.98	0.96	57
Brute Force -XSS	1.00	0.82	0.90	17
DDOS attack-HOIC	1.00	1.00	1.00	1986
DDOS attack-LOIC-UDP	1.00	1.00	1.00	325
DoS attacks-GoldenEye	1.00	1.00	1.00	2060
DoS attacks-Slowloris	1.00	1.00	1.00	956
Infiltration	0.71	0.11	0.19	1981
SQL Injection	0.67	0.40	0.50	5
accuracy			0.96	47419

Figure 4.3: CatBoost Classification Report (Before SMOTE)

XGBoost Classification Report:				
	precision	recall	f1-score	support
Benign	0.99	0.91	0.95	40032
Brute Force -Web	0.93	0.98	0.96	57
Brute Force -XSS	1.00	1.00	1.00	17
DDOS attack-HOIC	1.00	1.00	1.00	1986
DDOS attack-LOIC-UDP	1.00	1.00	1.00	325
DoS attacks-GoldenEye	1.00	1.00	1.00	2060
DoS attacks-Slowloris	1.00	1.00	1.00	956
Infiltration	0.33	0.91	0.48	1981
SQL Injection	1.00	0.80	0.89	5
accuracy			0.92	47419

Figure 4.4: XGBoost Classification Report (After SMOTE)

LightGBM Classification Report:				
	precision	recall	f1-score	support
Benign	1.00	0.89	0.94	40032
Brute Force -Web	0.93	1.00	0.97	57
Brute Force -XSS	1.00	0.82	0.90	17
DDOS attack-HOIC	1.00	1.00	1.00	1986
DDOS attack-LOIC-UDP	1.00	1.00	1.00	325
DoS attacks-GoldenEye	1.00	1.00	1.00	2060
DoS attacks-Slowloris	1.00	1.00	1.00	956
Infiltration	0.29	0.92	0.44	1981
SQL Injection	1.00	0.80	0.89	5
accuracy			0.90	47419

Figure 4.5: LightGBM Classification Report (After SMOTE)

CatBoost Classification Report:				
	precision	recall	f1-score	support
Benign	0.99	0.90	0.94	40032
Brute Force -Web	0.88	1.00	0.93	57
Brute Force -XSS	1.00	0.88	0.94	17
DDOS attack-HOIC	1.00	1.00	1.00	1986
DDOS attack-LOIC-UDP	1.00	1.00	1.00	325
DoS attacks-GoldenEye	1.00	1.00	1.00	2060
DoS attacks-Slowloris	1.00	1.00	1.00	956
Infiltration	0.30	0.89	0.45	1981
SQL Injection	0.50	0.80	0.62	5
accuracy			0.91	47419

Figure 4.6: CatBoost Classification Report (After SMOTE)

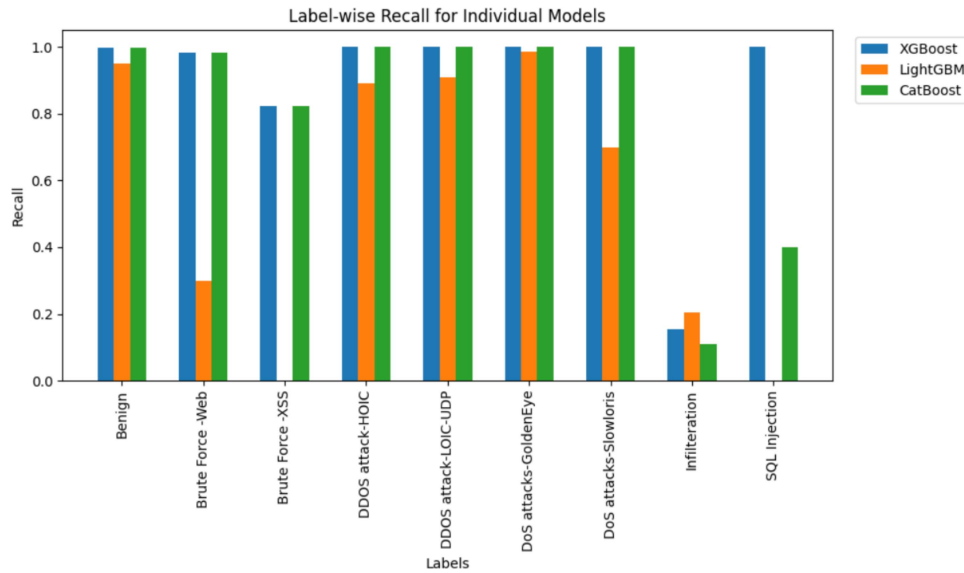


Figure 4.7: Recall Comparison for 3 Models (Before SMOTE)

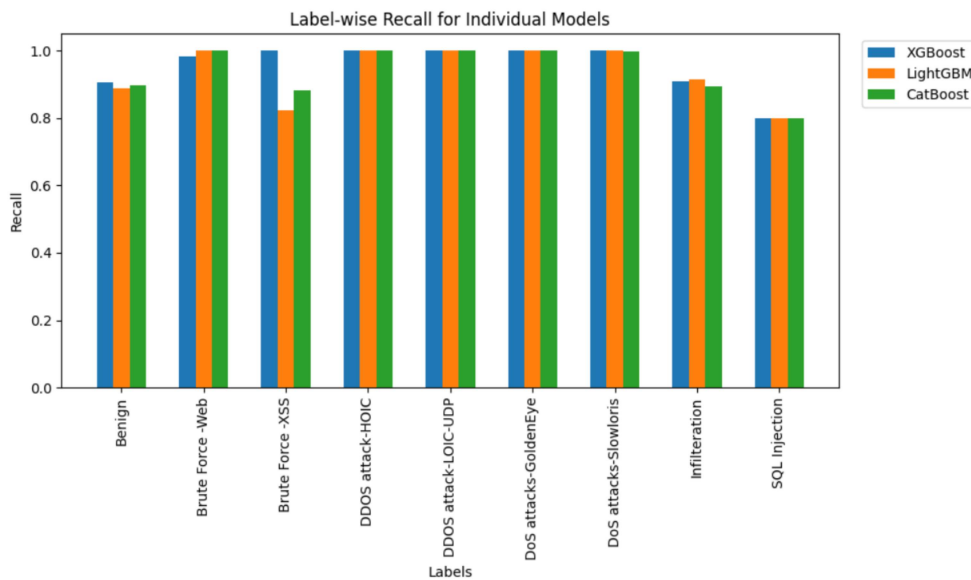


Figure 4.8: Recall Comparison for 3 Models (After SMOTE)

#### 4.2.2 Unified Defense: Ensemble of XGBoost, LightGBM, CatBoost

Our journey through experimentation and analysis has unveiled a captivating revelation - the fusion of XGBoost, LightGBM, and CatBoost models. This strategic confluence represents the pinnacle of our quest, a harmonious ensemble that transcends the individual capabilities of each model. While these models have demonstrated remarkable