
Assignment 4

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https://github.com/USI-Projects-Collection/mobile_ass_04.git

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Note

The assignment is at the end of the tutorial file (Paolo.Deidda.Assignment04.ipynb)

Exercise 0

Results

The balanced accuracy for 5-fold and Leave-One-User-Out (LOUO) cross-validation was computed for both the old dataset (`example_data_w_engagement.csv`) and the new dataset (`assignment_data.csv`). Below are the results:

5-Fold Cross-Validation

Model	Old Dataset (%)	New Dataset (%)	Change
XGBoost	68.75 ± 0.78	63.40 ± 0.67	Decreased
DummyClassifier	47.58 ± 0.31	50.49 ± 0.24	Increased

Table 1: 5-Fold Cross-Validation Results

Leave-One-User-Out (LOUO) Cross-Validation

Model	Old Dataset (%)	New Dataset (%)	Change
XGBoost	45.27 ± 23.23	41.92 ± 16.32	Decreased
DummyClassifier	49.47 ± 1.02	49.83 ± 1.21	No Change

Table 2: Leave-One-User-Out Cross-Validation Results

Discussion

Did the results change?

Yes, the results for both 5-fold and LOUO cross-validation changed when using the new dataset.

Why did the results change?

The observed changes can be attributed to differences in dataset characteristics:

- **Feature distribution:** The new dataset likely has a different distribution of features, which impacts the model's ability to generalize.
- **User variability:** Leave-One-User-Out validation is more sensitive to changes in user-level data. This is reflected in the decreased performance of XGBoost for LOUO.
- **Class balance:** The slight increase in DummyClassifier's balanced accuracy suggests that the class distribution in the new dataset might be closer to uniform.

Exercise 1

The balanced accuracy scores for the Leave One Day Out (per user) paradigm are as follows:

- **XGBoost:** $63.95 \pm 2.17\%$
- **DummyClassifier:** $49.63 \pm 1.76\%$

Compared to other paradigms, the results here are more favorable. Specifically, the standard deviation is significantly lower than with the LOUO paradigm, indicating a tighter clustering of values around the mean with less fluctuation.

Exercise 2

Model	5-Fold	LOUO	LODO
Support Vector Machine (SVC)	$50.22 \pm 0.32\%$	$47.03 \pm 36.52\%$	$50.17 \pm 0.38\%$
Random Forest	$63.94 \pm 0.66\%$	$42.00 \pm 16.24\%$	$64.34 \pm 1.79\%$
Naive Bayes (GaussianNB)	$54.95 \pm 0.50\%$	$28.44 \pm 22.48\%$	$54.79 \pm 2.25\%$

Table 3: Performance of various classifiers across different validation paradigms.

Among the tested models, the Random Forest Classifier outperformed XGBoost. For the Naive Bayes classifier, a normal data distribution was assumed during its application. The performance results for each model across different paradigms are summarized below: