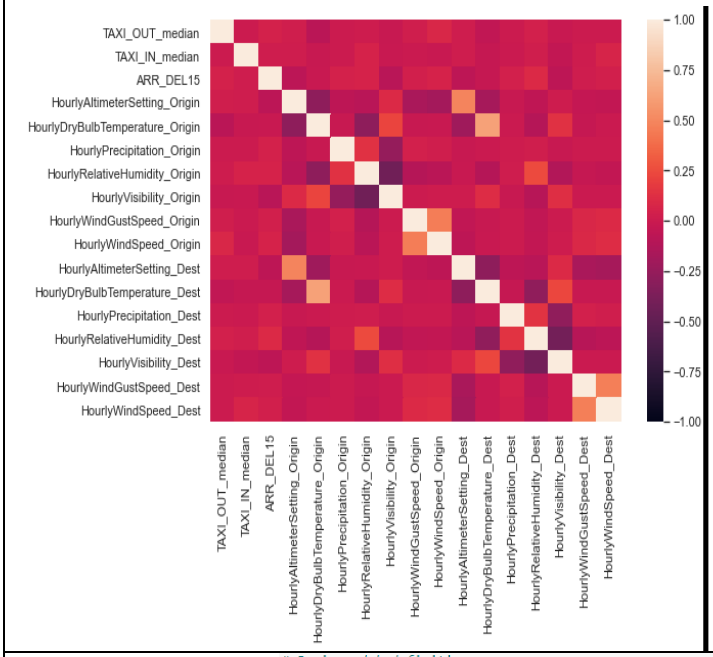
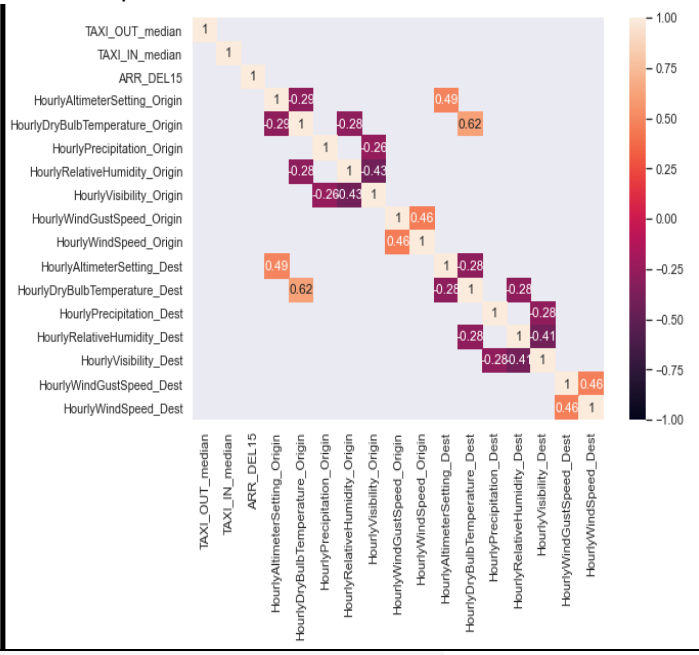
Model dataset size: 1e5 / Original: 7e6

Imbalanced dataset (“as is”)

Correlation Heatmap





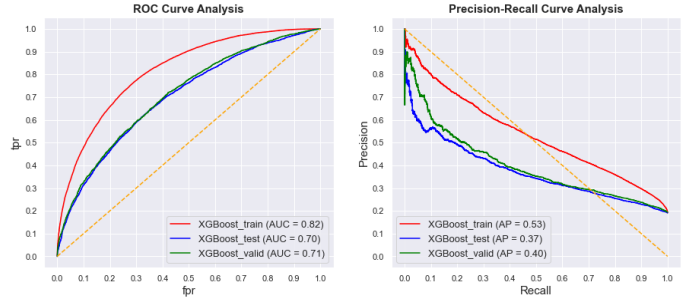

```
# Basic model definition:
xgb_model = XGBClassifier(use_label_encoder=False, verbosity=1, random_state=0, objective= 'binary:logistic',
                          booster='gbtree', tree_method='auto', num_boost_round = 999, early_stopping_round=10,
                          scale_pos_weight=scale_pos_weight)

params = {
            'min_child_weight': [0.1, 1, 5, 10, 50],
            'gamma': [0.5, 1, 1.5, 2, 5],
            'subsample': [0.6, 0.8, 1.0],
            'colsample_bytree': [0.6, 0.8, 1.0],
            'max_depth': [5, 10, 25, 50],
            'learning_rate': [0.0001, 0.001, 0.1, 1],
            'n_estimators': [50, 100, 250, 500],
            'reg_alpha': [0.0001, 0.001, 0.1, 1],
            'reg_lambda': [0.0001, 0.001, 0.1, 1]
        }
dask_rscv = RandomizedSearchCV(xgb_model,
                               cv=5,
                               param_distributions=params,
                               n_iter=50, # Number of parameter settings that are sampled → trades off runtime vs quality
                               scoring='average_precision', # AP summarizes a precision-recall curve
                               n_jobs=-2, # all CPUs but one are used
                               random_state=0)
```

One Hot Encoding (220 columnas)	[Additive-Smoothing Target Encoding] (27 columnas) [probar K-Fold Target Encoding?]
Model fitting time: 7h 50m 28s	Model fitting time: 1h 53m 17s
Best scorer:	Best scorer:

```
XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
              colsample_bynode=1, colsample_bytree=0.8, early_stopping_round=10,
              gamma=0.5, gpu_id=-1, importance_type='gain',
              interaction_constraints='', learning_rate=0.1, max_delta_step=0,
              max_depth=10, min_child_weight=50, missing=nan,
              monotone_constraints='()', n_estimators=100, n_jobs=4,
              num_boost_round=999, num_parallel_tree=1, random_state=0,
              reg_alpha=1, reg_lambda=0.0001,
              scale_pos_weight=4.327245053272451, subsample=0.8,
              tree_method='auto', use_label_encoder=False,
              validate_parameters=1, verbosity=1)
```

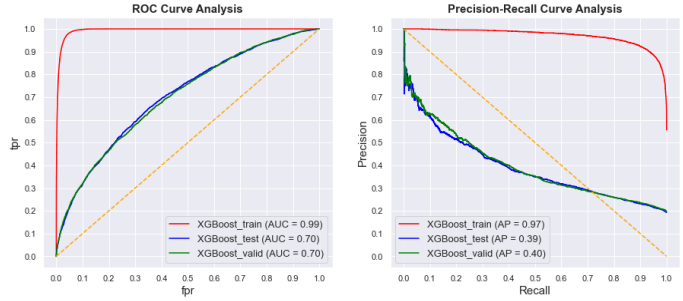
```
XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
              colsample_bynode=1, colsample_bytree=0.6, early_stopping_round=10,
              gamma=5, gpu_id=-1, importance_type='gain',
              interaction_constraints='', learning_rate=0.001, max_delta_step=0,
              max_depth=25, min_child_weight=5, missing=nan,
              monotone_constraints='()', n_estimators=250, n_jobs=4,
              num_boost_round=999, num_parallel_tree=1, random_state=0,
              reg_alpha=0.001, reg_lambda=0.1,
              scale_pos_weight=4.251706804711532, subsample=0.8,
              tree_method='auto', use_label_encoder=False,
              validate_parameters=1, verbosity=1)
```

```
-+-+-+ TRAINING dataset +-+-+-

Confusion matrix:
 [[41567 15293]
 [ 3400  9740]]
Normalized confusion matrix:
 [[0.73104115 0.26895885]
 [0.2587519  0.7412481 ]]

              precision    recall  f1-score   support

     on-time       0.92      0.73      0.82     56860
     delayed       0.39      0.74      0.51     13140

    accuracy                           0.73     70000
   macro avg       0.66      0.74      0.66     70000
weighted avg       0.82      0.73      0.76     70000

F-beta (ß=2) =  0.628
F1 =            0.510
Recall =        0.741
Precision =     0.389
Accuracy =      0.733
----------------------------------------------------

-+-+-+ TEST dataset: +-+-+-

Confusion matrix:
 [[8403 3735]
 [1158 1704]]
Normalized confusion matrix:
 [[0.69228868 0.30771132]
 [0.40461216 0.59538784]]

              precision    recall  f1-score   support

     on-time       0.88      0.69      0.77     12138
     delayed       0.31      0.60      0.41      2862

    accuracy                           0.67     15000
   macro avg       0.60      0.64      0.59     15000
weighted avg       0.77      0.67      0.71     15000

F-beta (ß=2) =  0.505
F1 =            0.411
Recall =        0.595
Precision =     0.313
Accuracy =      0.674
----------------------------------------------------

-+-+-+ VALIDATION dataset: +-+-+-

Confusion matrix:
 [[8358 3734]
 [1163 1745]]
Normalized confusion matrix:
 [[0.69120079 0.30879921]
 [0.39993122 0.60006878]]

              precision    recall  f1-score   support

     on-time       0.88      0.69      0.77     12092
     delayed       0.32      0.60      0.42      2908

    accuracy                           0.67     15000
   macro avg       0.60      0.65      0.59     15000
weighted avg       0.77      0.67      0.70     15000

F-beta (ß=2) =  0.510
F1 =            0.416
Recall =        0.600
Precision =     0.318
Accuracy =      0.674
```

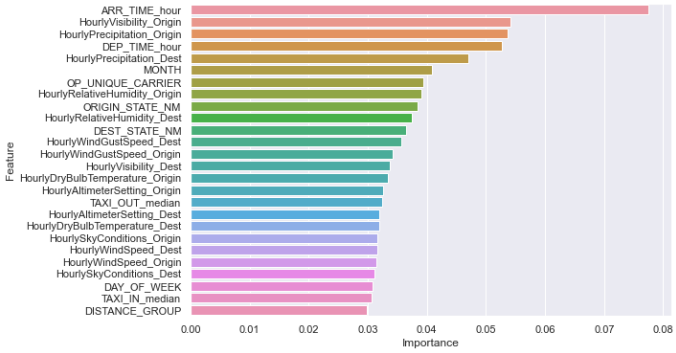


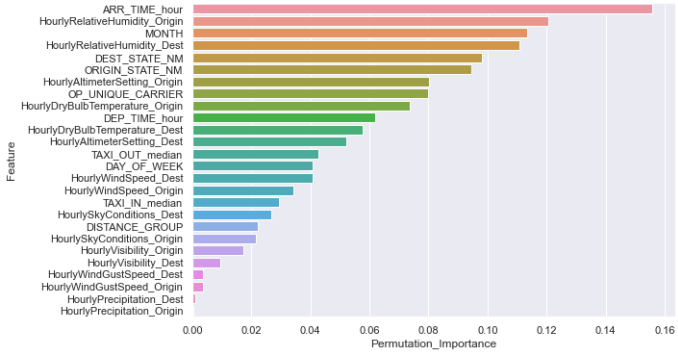
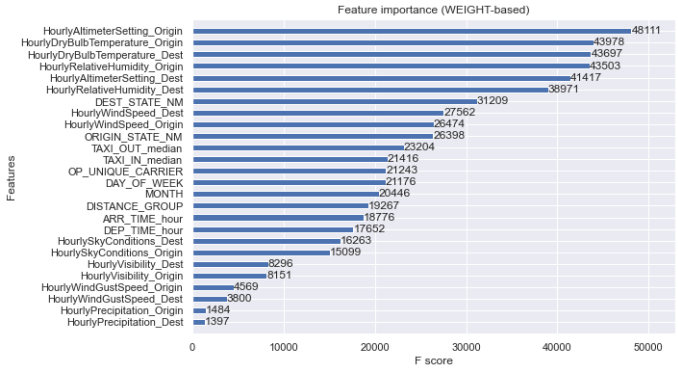
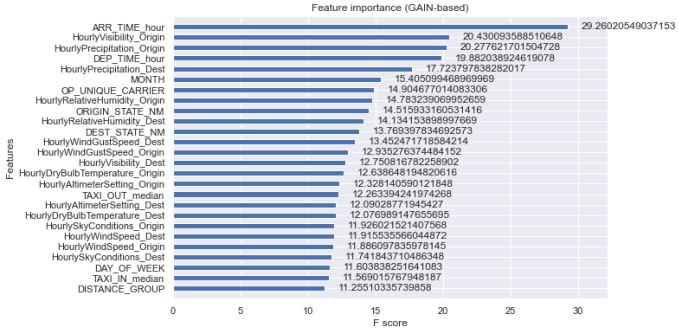
Demasiadas filas… (220 features)

```
-+-+-+ TRAINING dataset +-+-+-

Confusion matrix:
 [[54229  2442]
 [  318 13011]]
Normalized confusion matrix:
 [[0.95690918 0.04309082]
 [0.02385775 0.97614225]]

              precision    recall  f1-score   support

     on-time       0.99      0.96      0.98     56671
     delayed       0.84      0.98      0.90     13329

    accuracy                           0.96     70000
   macro avg       0.92      0.97      0.94     70000
weighted avg       0.97      0.96      0.96     70000

F-beta (ß=2) =  0.946
F1 =            0.904
Recall =        0.976
Precision =     0.842
Accuracy =      0.961
----------------------------------------------------

-+-+-+ TEST dataset: +-+-+-

Confusion matrix:
 [[10721  1378]
 [ 1899  1002]]
Normalized confusion matrix:
 [[0.88610629 0.11389371]
 [0.65460186 0.34539814]]

              precision    recall  f1-score   support

     on-time       0.85      0.89      0.87     12099
     delayed       0.42      0.35      0.38      2901

    accuracy                           0.78     15000
   macro avg       0.64      0.62      0.62     15000
weighted avg       0.77      0.78      0.77     15000

F-beta (ß=2) =  0.358
F1 =            0.379
Recall =        0.345
Precision =     0.421
Accuracy =      0.782
----------------------------------------------------

-+-+-+ VALIDATION dataset: +-+-+-

Confusion matrix:
 [[10612  1442]
 [ 1892  1054]]
Normalized confusion matrix:
 [[0.88037166 0.11962834]
 [0.64222675 0.35777325]]

              precision    recall  f1-score   support

     on-time       0.85      0.88      0.86     12054
     delayed       0.42      0.36      0.39      2946

    accuracy                           0.78     15000
   macro avg       0.64      0.62      0.63     15000
weighted avg       0.76      0.78      0.77     15000

F-beta (ß=2) =  0.369
F1 =            0.387
Recall =        0.358
Precision =     0.422
Accuracy =      0.778
```



Model's built-in Feature Importance



Demasiadas filas… (220 features)	sklearn.inspection / permutation_importance 
Demasiadas filas… (220 features)	xgboost / plot_importance / importance_type='weight' 
Demasiadas filas… (220 features)	xgboost / plot_importance / importance_type=’gain’  *(Parece ser el mismo que el primero: sklearn.inspection / permutation_importance)*