



# SIDEBANDS MODELS 2



# What did we do?

- We created a model for each set of data
- We worked with the proportions 2 to 1, 5 to 1 and 10 to 1, for the right and left sidebands.

	S	B	S+B	B/S
2	8334	16666	25000	1.9997600191984641
5	4167	20833	25000	4.999520038396928
10	2273	22727	25000	9.998680158380994

# Right sideband\_2\_2

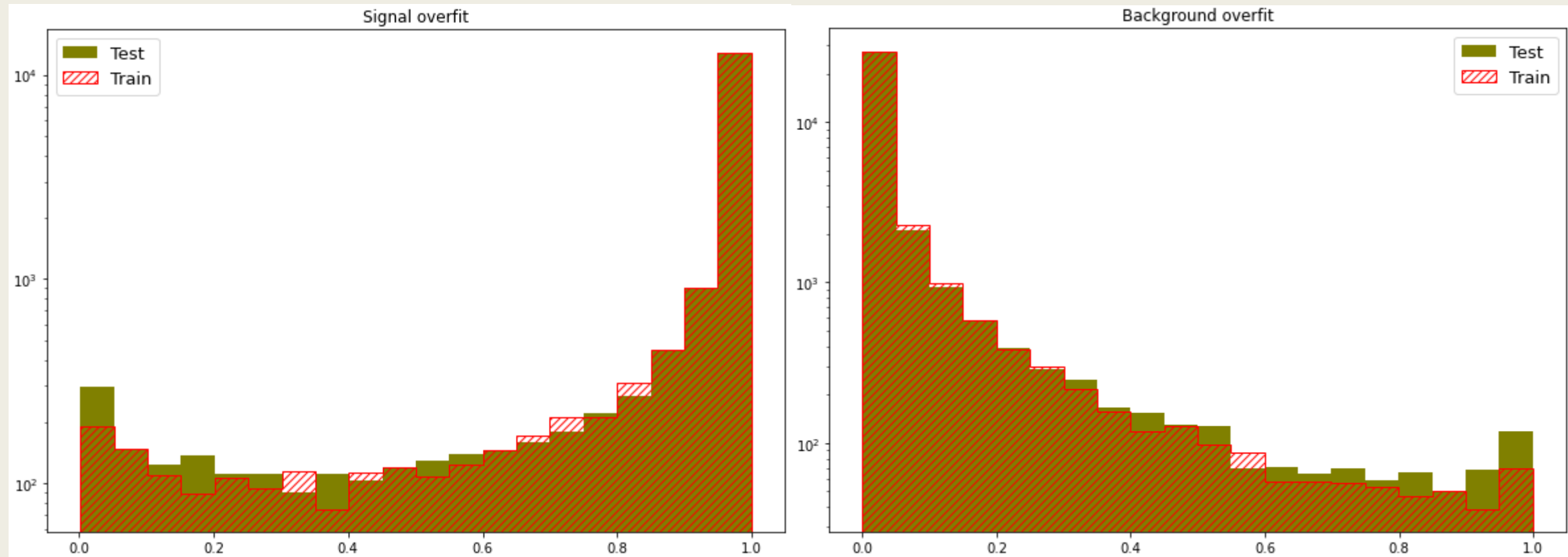
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 5, 'gamma': 0.15, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 0.01, 'reg_lambda': 400}
```

```
Out[20]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                        colsample_bynode=1, colsample_bytree=1, gamma=0.15, gpu_id=-1,
                        importance_type='gain', interaction_constraints='',
                        learning_rate=0.2, max_delta_step=0, max_depth=7,
                        min_child_weight=5, missing=nan, monotone_constraints='()',
                        n_estimators=200, n_jobs=0, num_parallel_tree=1, random_state=0,
                        reg_alpha=0.01, reg_lambda=400, scale_pos_weight=1, subsample=1,
                        tree_method='exact', validate_parameters=1, verbosity=None)
```

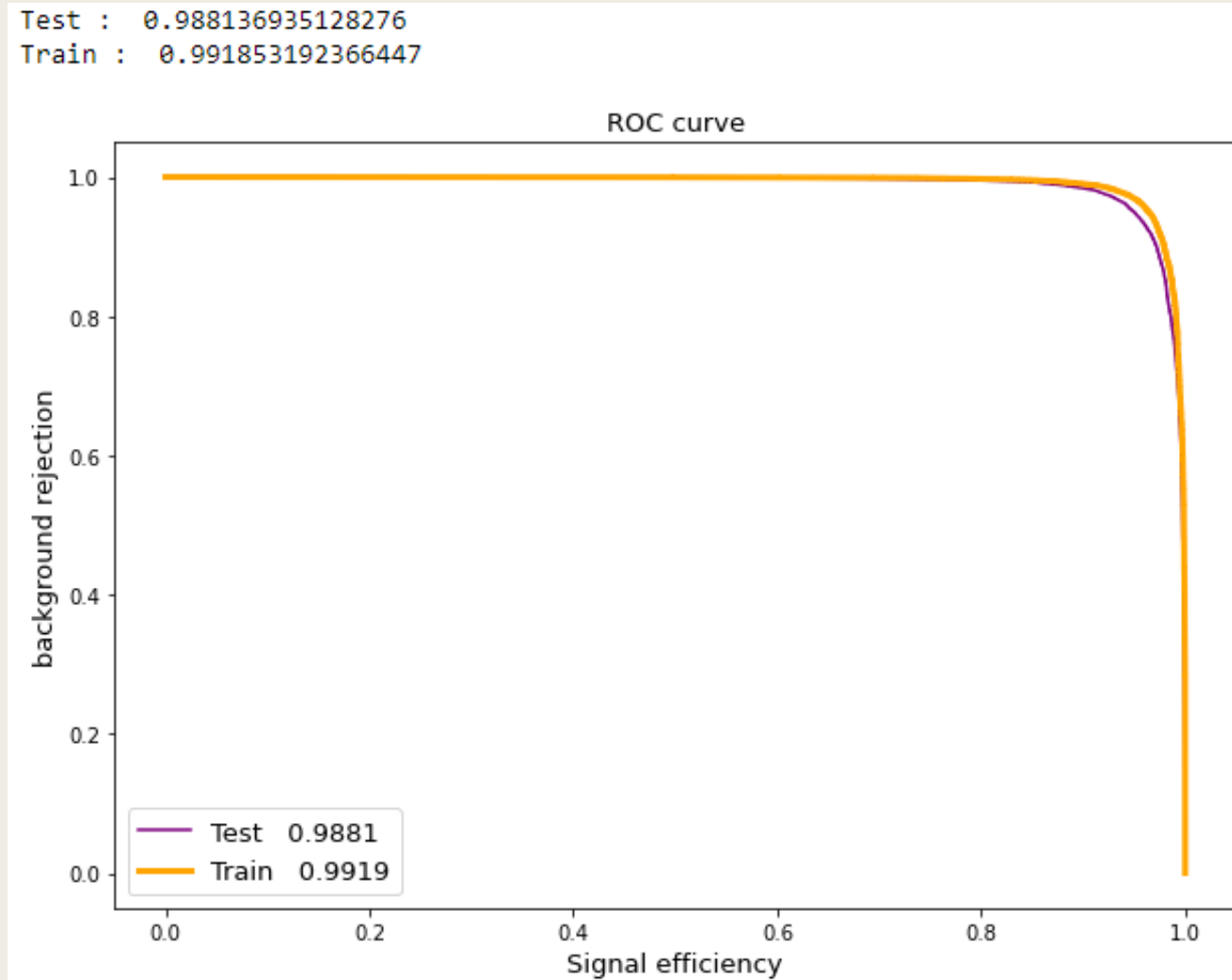
# R Sideband\_2\_2

- Overfitting



# R Sideband\_2\_2

## ■ ROC Curve



# Right Sideband\_5\_2

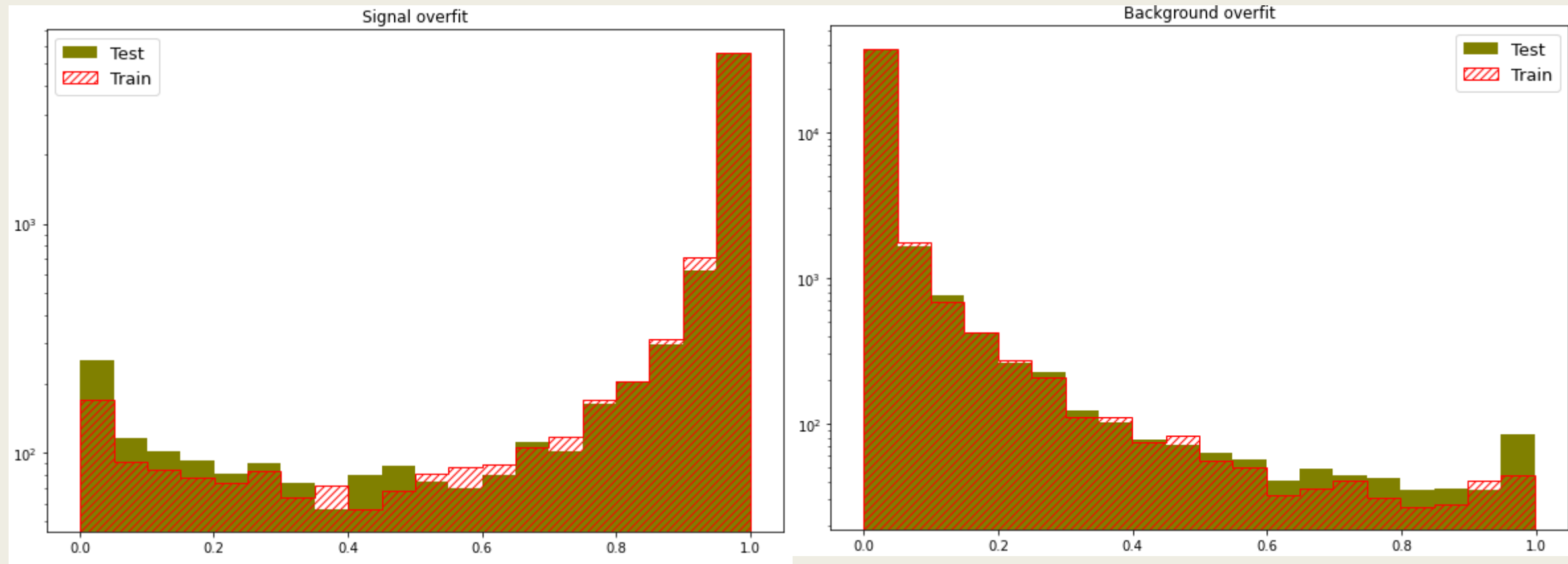
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 5, 'gamma': 0.05, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 0.01, 'reg_lambda': 400}
```

```
Out[20]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                        colsample_bynode=1, colsample_bytree=1, gamma=0.05, gpu_id=-1,
                        importance_type='gain', interaction_constraints='',
                        learning_rate=0.2, max_delta_step=0, max_depth=7,
                        min_child_weight=5, missing=nan, monotone_constraints='()',
                        n_estimators=200, n_jobs=0, num_parallel_tree=1, random_state=0,
                        reg_alpha=0.01, reg_lambda=400, scale_pos_weight=1, subsample=1,
                        tree_method='exact', validate_parameters=1, verbosity=None)
```

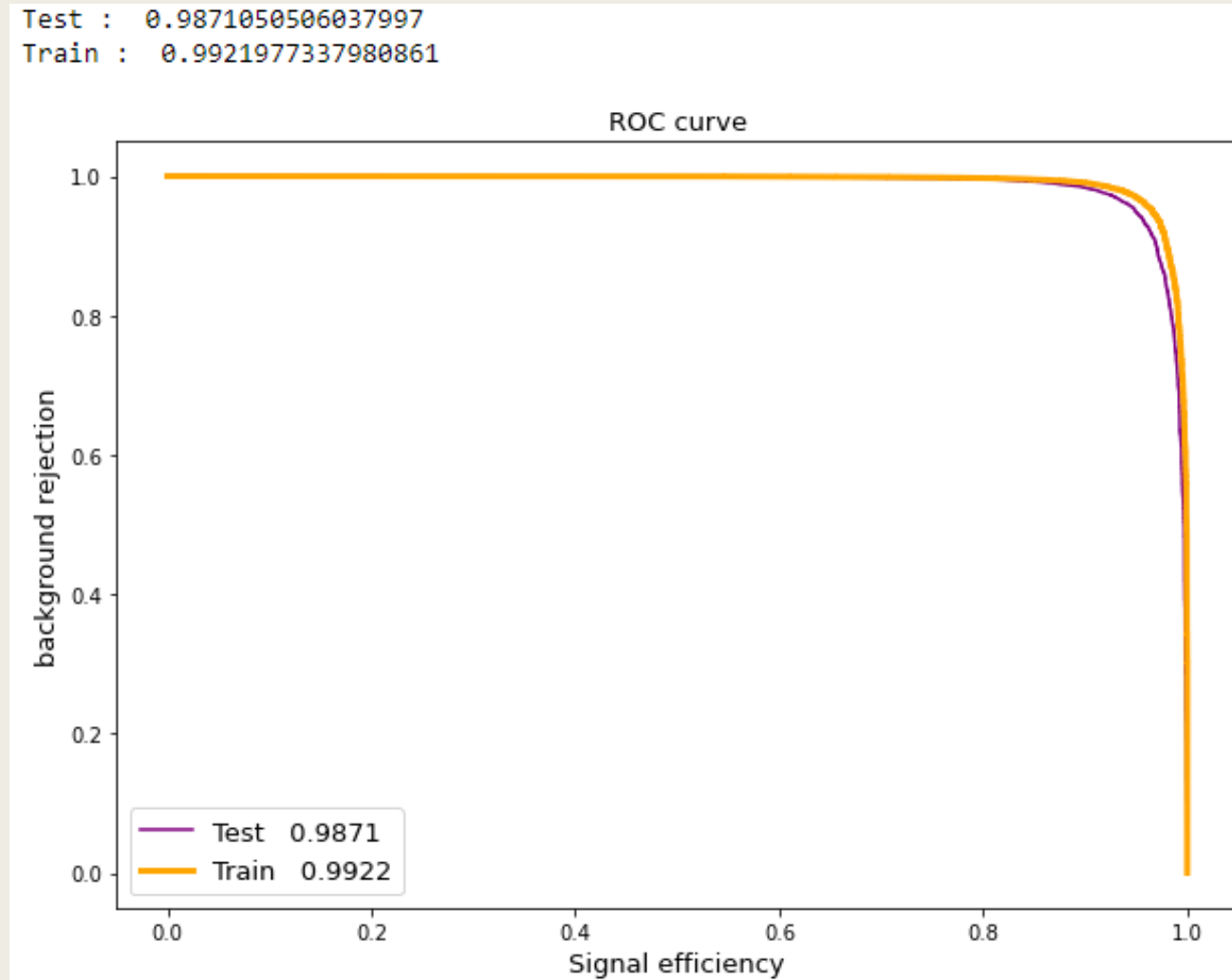
# R Sideband\_5\_2

- Overfitting



# R Sideband\_5\_2

## ■ ROC Curve





# Right Sideband\_10\_2

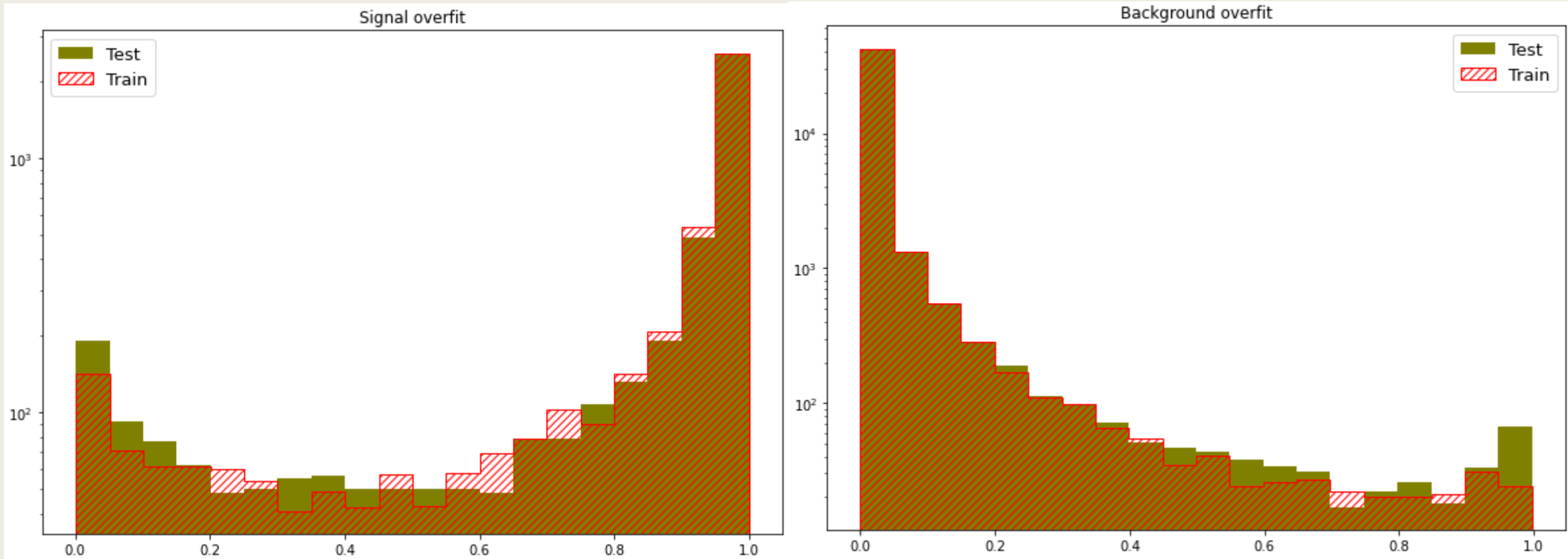
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 4, 'gamma': 0, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 1e-05, 'reg_lambda': 400}
```

```
Out[21]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                        colsample_bynode=1, colsample_bytree=1, gamma=0, gpu_id=-1,
                        importance_type='gain', interaction_constraints='',
                        learning_rate=0.2, max_delta_step=0, max_depth=7,
                        min_child_weight=4, missing=nan, monotone_constraints='()',
                        n_estimators=200, n_jobs=0, num_parallel_tree=1, random_state=0,
                        reg_alpha=1e-05, reg_lambda=400, scale_pos_weight=1, subsample=1,
                        tree_method='exact', validate_parameters=1, verbosity=None)
```

# R Sideband\_10\_2

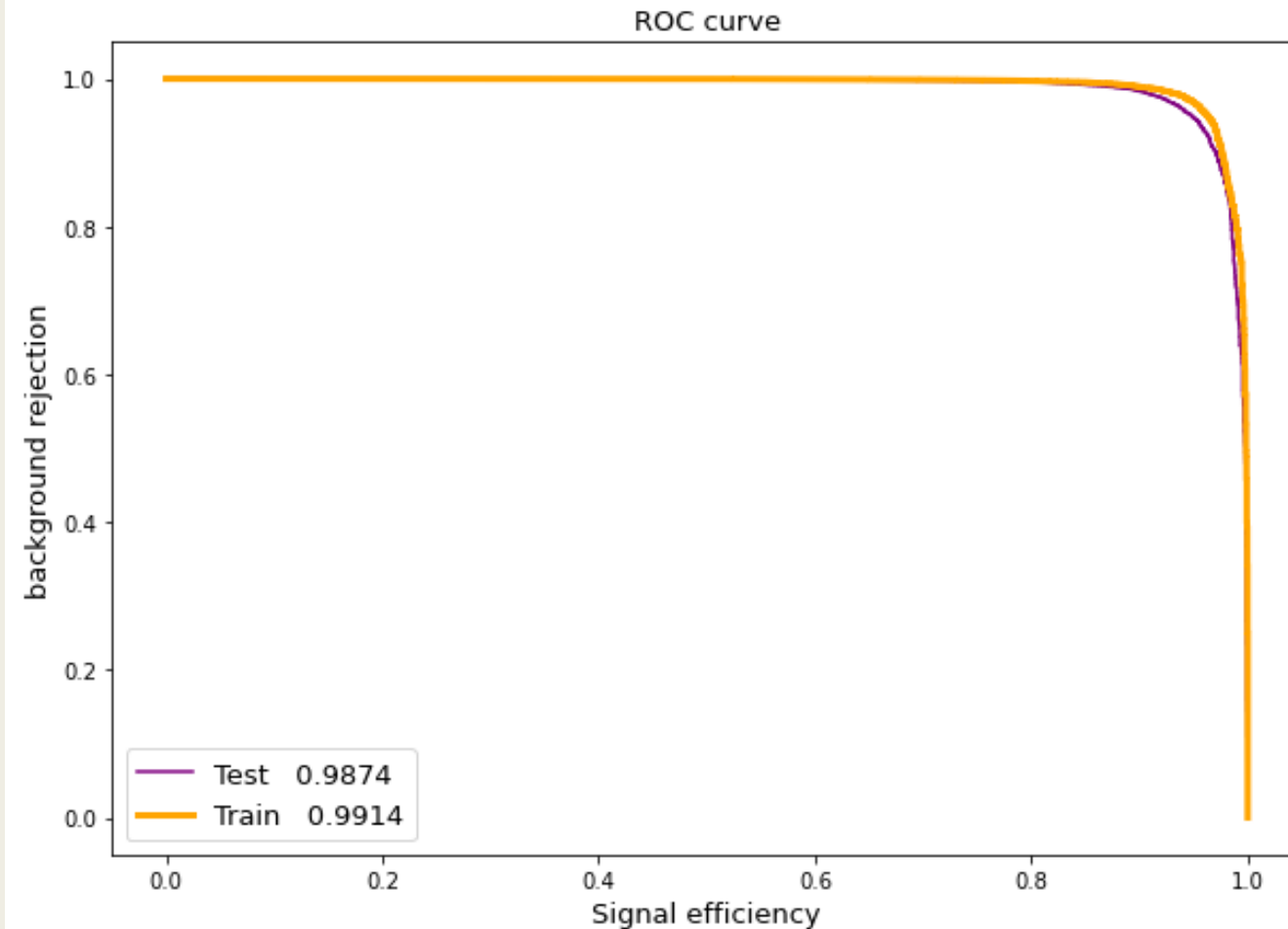
- Overfitting



# R Sideband\_10\_2

## ■ ROC Curve

Test : 0.98744440228277  
Train : 0.9913675828796414



# Left Sideband\_2\_2

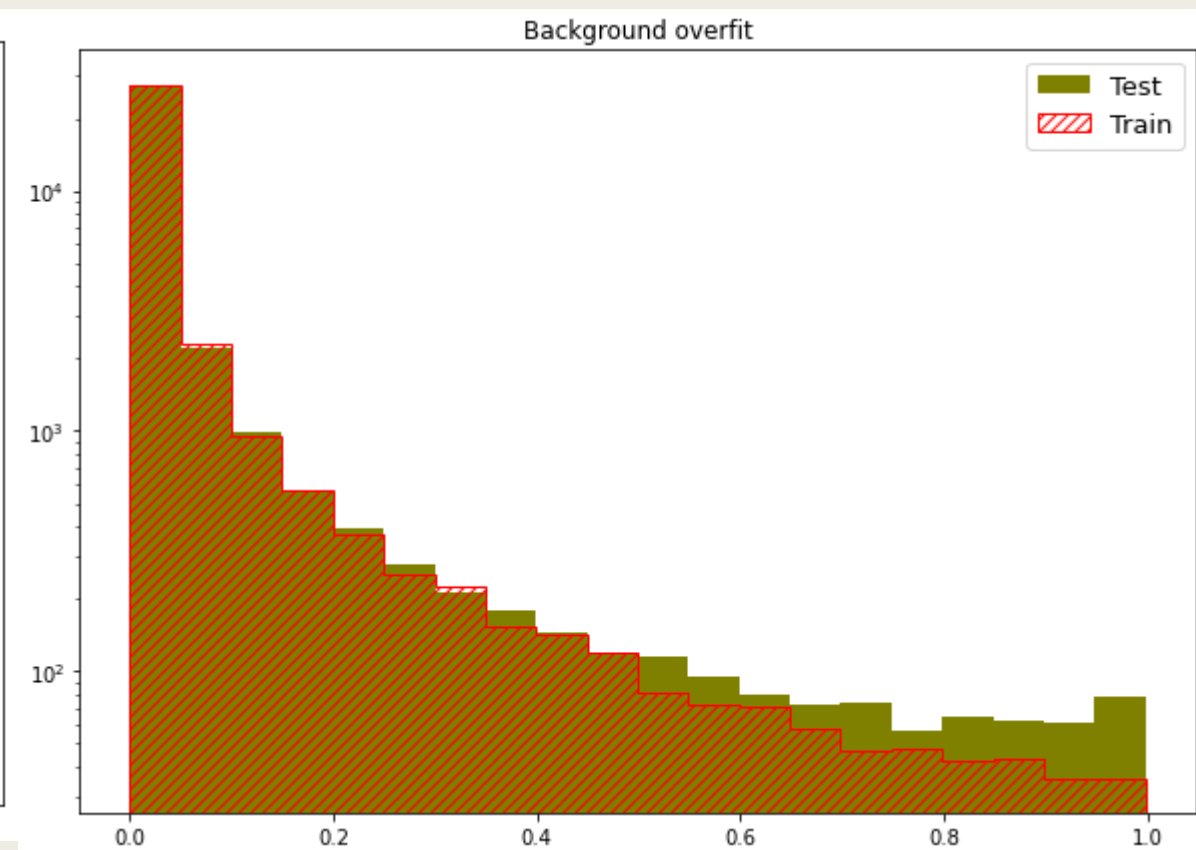
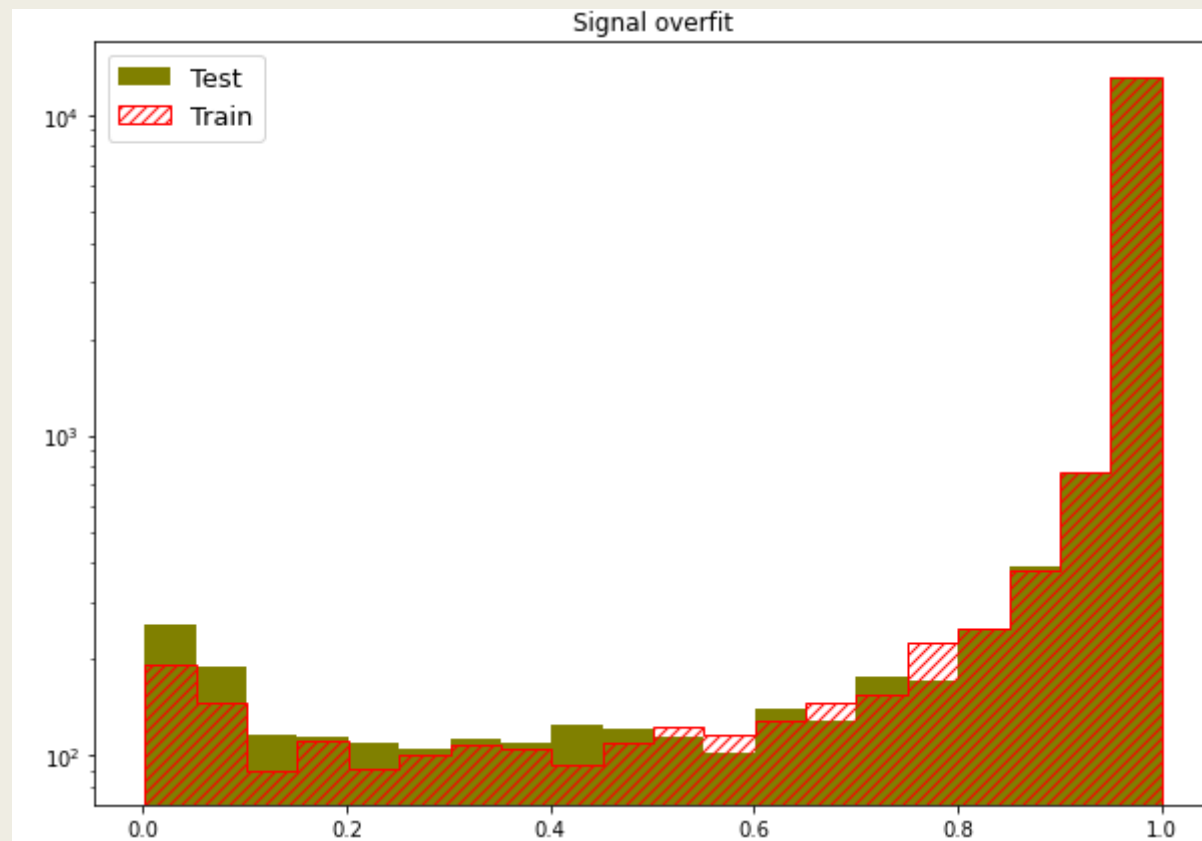
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 4, 'gamma': 0, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 0.01, 'reg_lambda': 400}
```

```
Out[8]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                      colsample_bynode=1, colsample_bytree=1, gamma=0, gpu_id=-1,
                      importance_type='gain', interaction_constraints='',
                      learning_rate=0.2, max_delta_step=0, max_depth=7,
                      min_child_weight=4, missing=nan, monotone_constraints='()',
                      n_estimators=200, n_jobs=0, num_parallel_tree=1, random_state=0,
                      reg_alpha=0.01, reg_lambda=400, scale_pos_weight=1, subsample=1,
                      tree_method='exact', validate_parameters=1, verbosity=None)
```

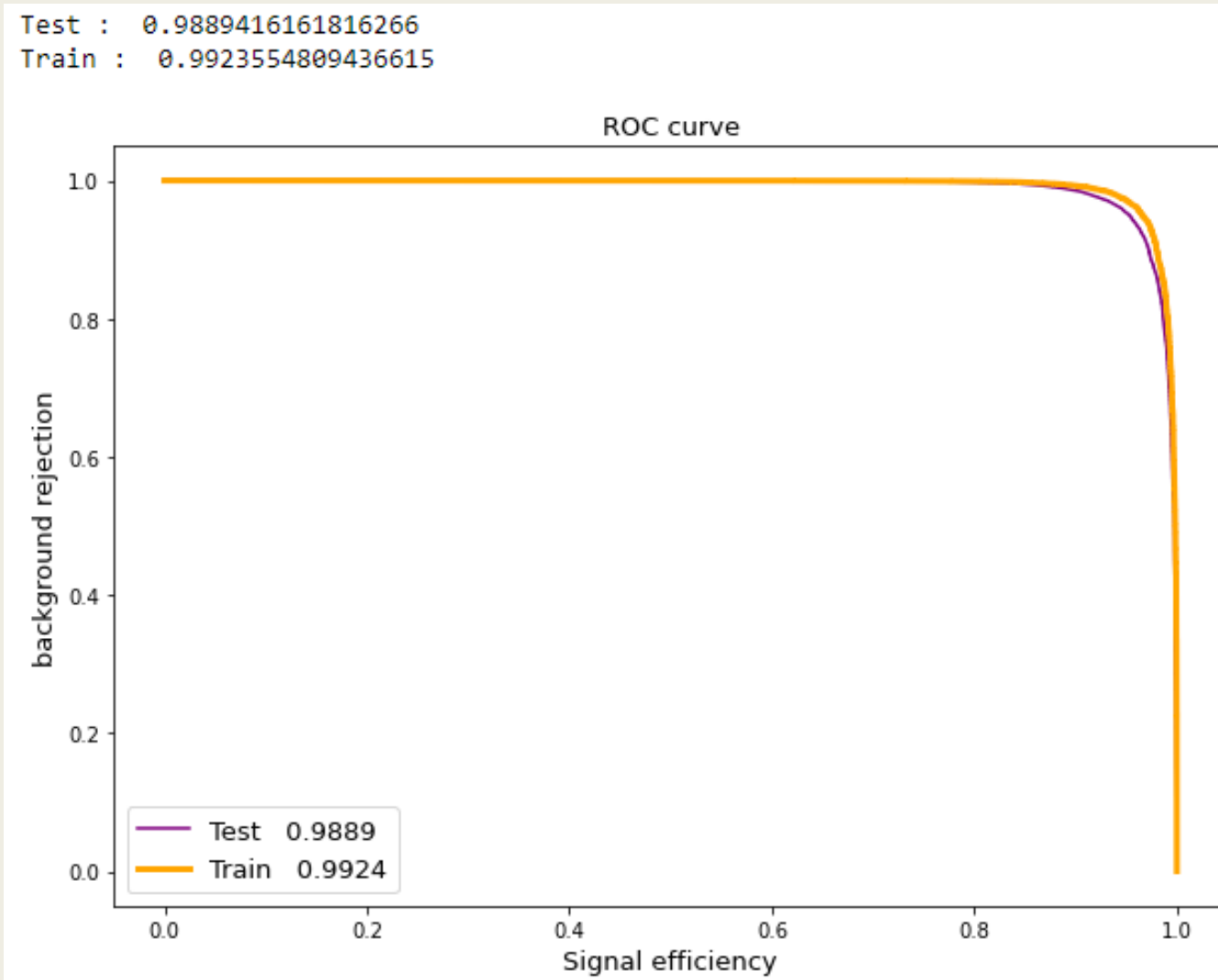
# LS 2\_2

- Signal and background overfitting



# L2\_2

## ■ ROC Curve



# Left Sideband\_5\_2

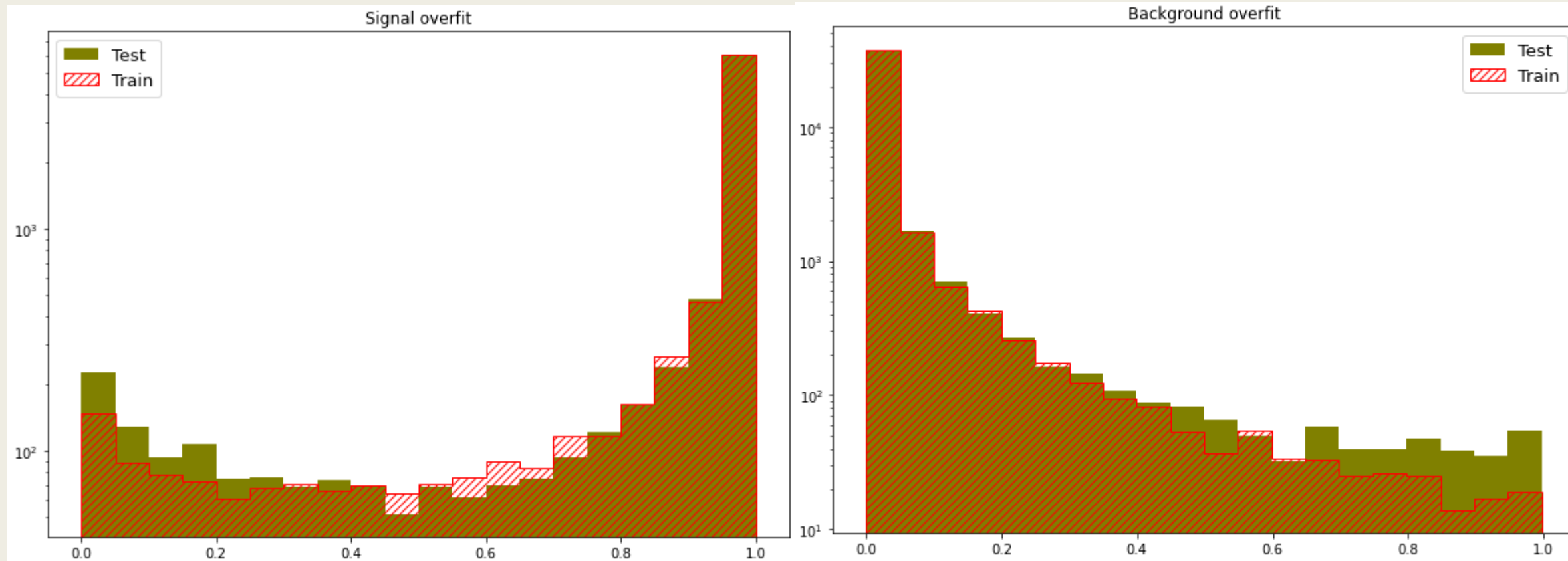
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 5, 'gamma': 0.1, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 0.1, 'reg_lambda': 400}
```

```
Out[6]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                      colsample_bynode=1, colsample_bytree=1, gamma=0.1, gpu_id=-1,
                      importance_type='gain', interaction_constraints='',
                      learning_rate=0.2, max_delta_step=0, max_depth=7,
                      min_child_weight=5, missing=nan, monotone_constraints='()',
                      n_estimators=400, n_jobs=0, num_parallel_tree=1, random_state=0,
                      reg_alpha=0.1, reg_lambda=400, scale_pos_weight=1, subsample=1,
                      tree_method='exact', validate_parameters=1, verbosity=None)
```

# LS\_5\_2

- Signal and background overfitting

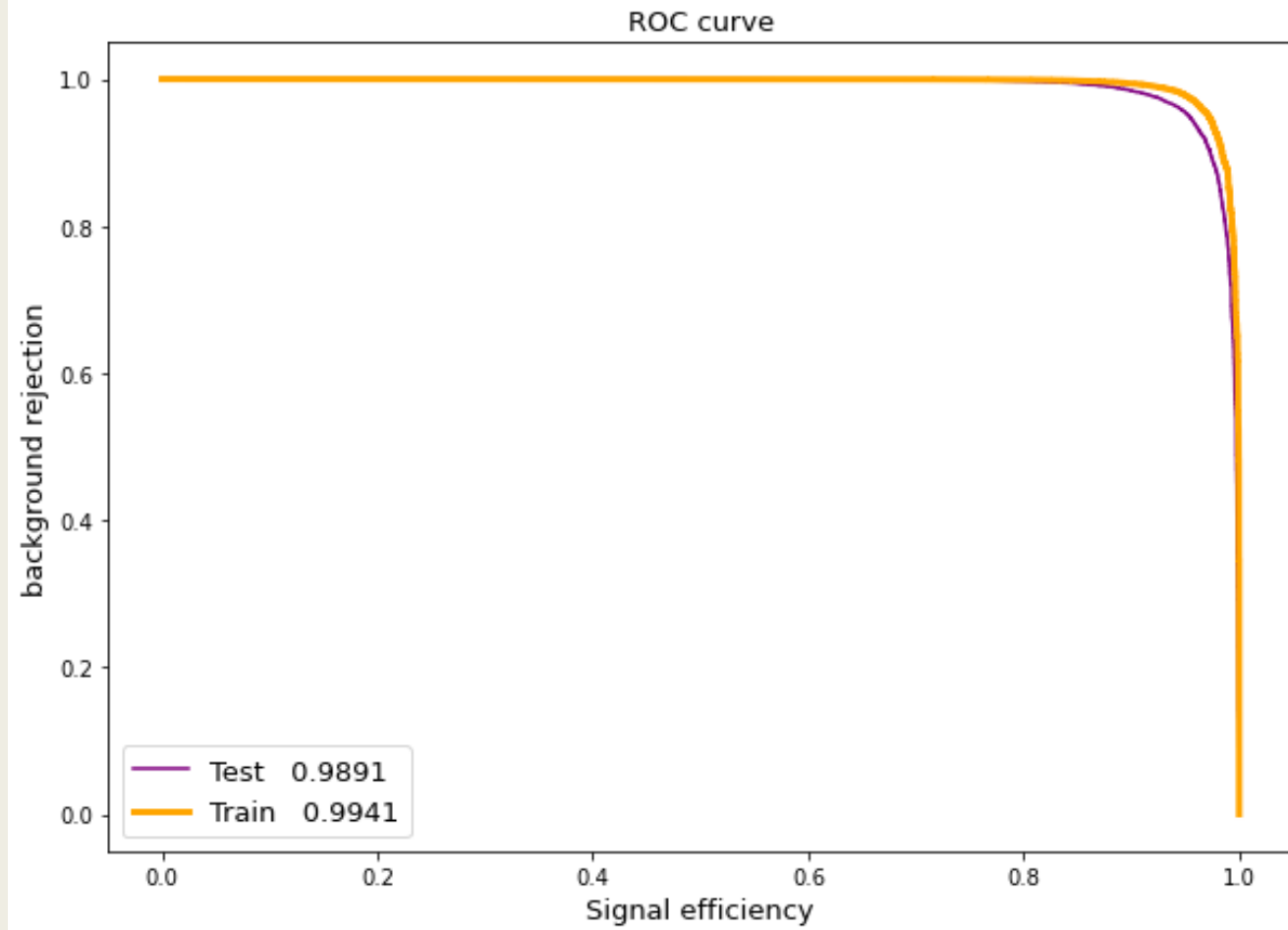




# LS\_5\_2

## ■ ROC Curve

Test : 0.9890577160479909  
Train : 0.9940741603167703



# Left Sideband\_10\_2

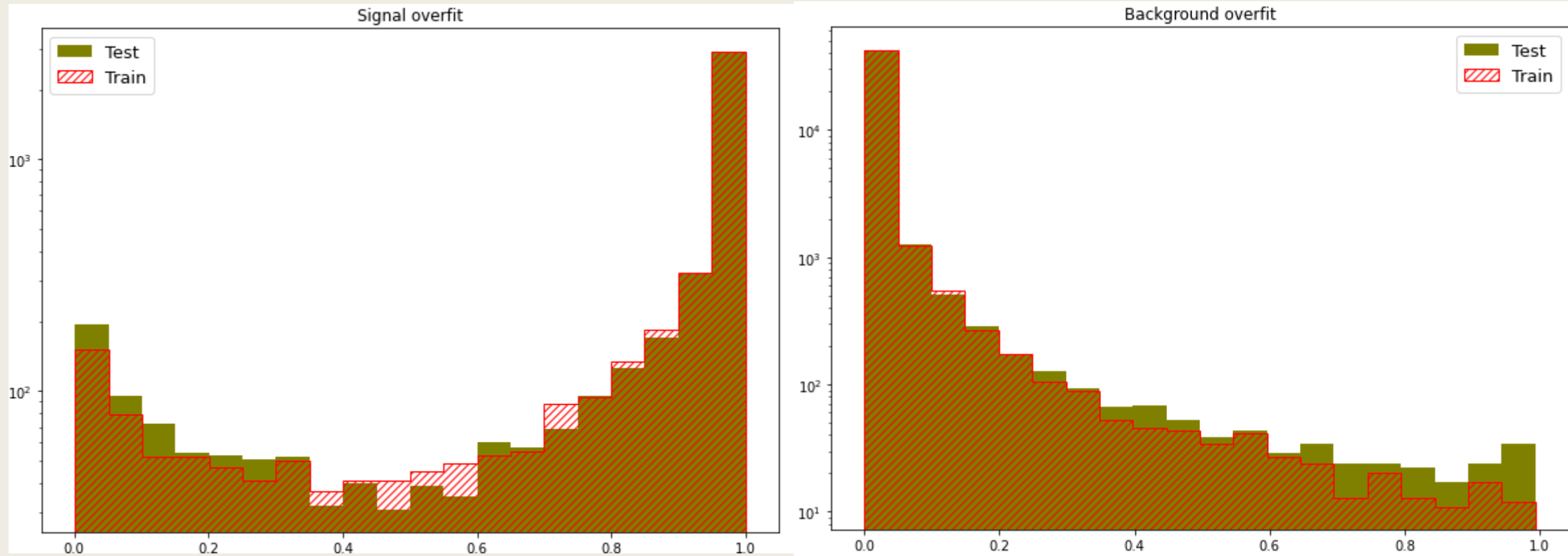
- Hyperparameters and final model

```
{'n_estimators': 200, 'max_depth': 7, 'min_child_weight': 4, 'gamma': 0.05, 'subsample': 1, 'colsample_bytree': 1, 'reg_alpha': 1e-05, 'reg_lambda': 400}
```

```
Out[16]: XGBClassifier(base_score=0.5, booster='gbtree', colsample_bylevel=1,
                        colsample_bynode=1, colsample_bytree=1, gamma=0.05, gpu_id=-1,
                        importance_type='gain', interaction_constraints='',
                        learning_rate=0.2, max_delta_step=0, max_depth=7,
                        min_child_weight=4, missing=nan, monotone_constraints='()',
                        n_estimators=200, n_jobs=0, num_parallel_tree=1, random_state=0,
                        reg_alpha=1e-05, reg_lambda=400, scale_pos_weight=1, subsample=1,
                        tree_method='exact', validate_parameters=1, verbosity=None)
```

# LS\_10\_2

- Signal and background overfitting



# LS\_10\_2

## ■ ROC Curve

Test : 0.987478350469465  
Train : 0.9922628774515592

