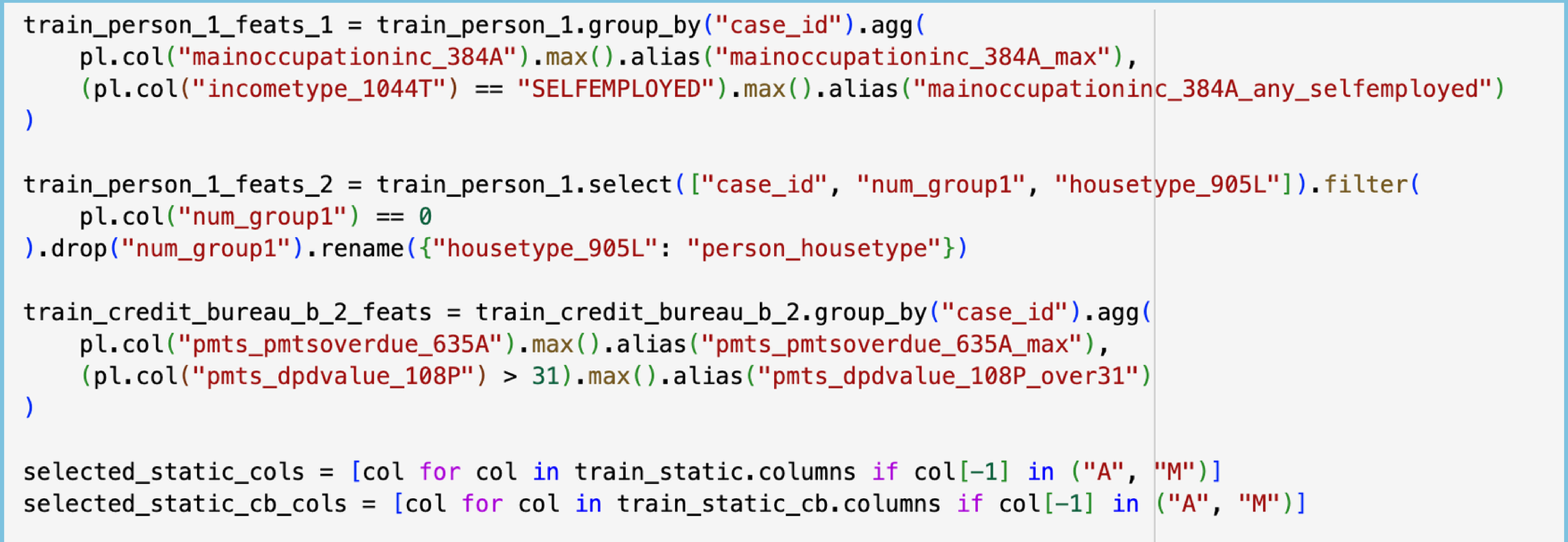
Home Credit - Credit Risk Model Stability

主題

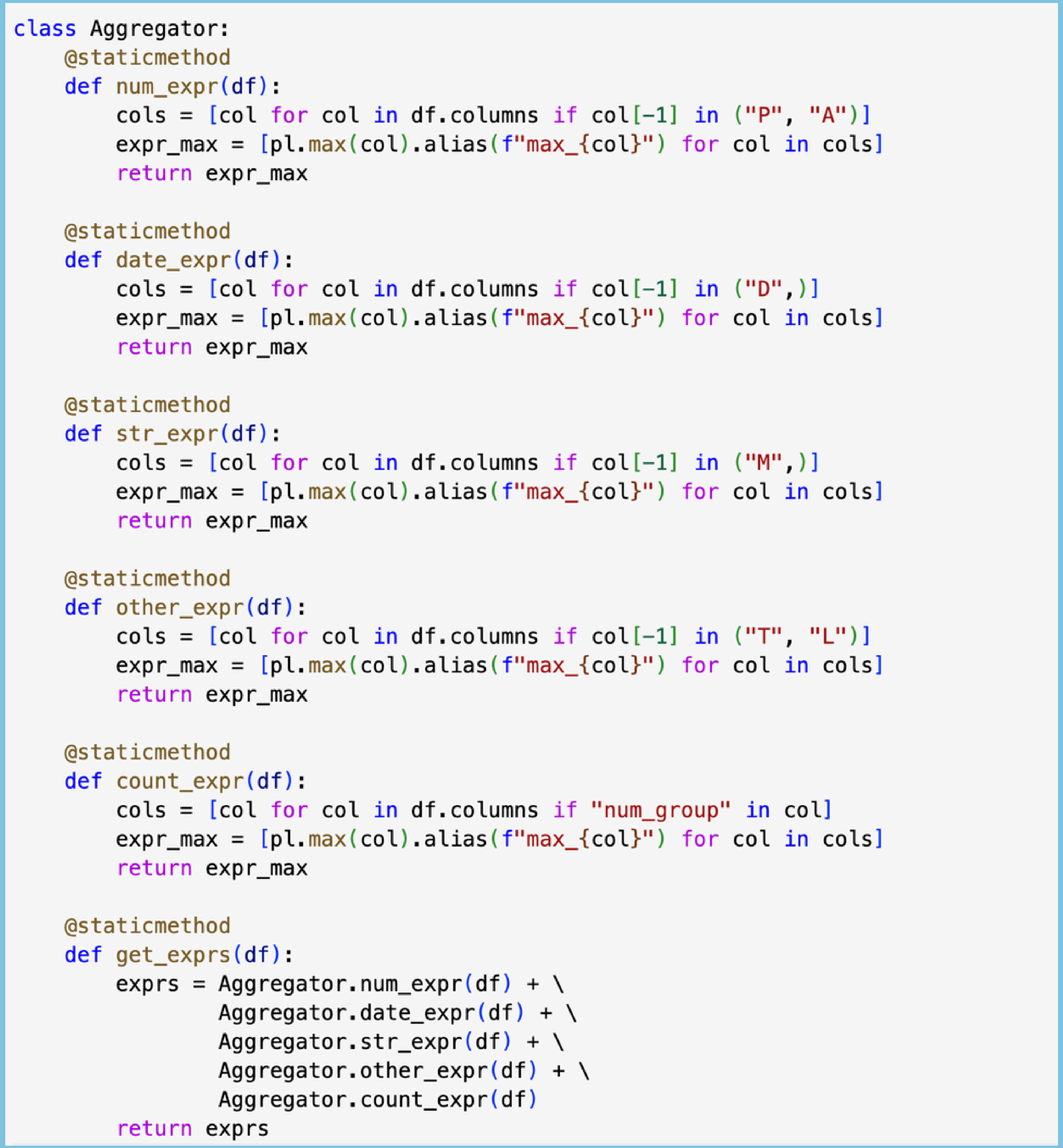
要更好地評估潛在客戶的違約風險，尤其是那些信用歷史不足或沒有信用歷史的客戶，資料科學技術（如高級統計方法和機器學習）可以發揮關鍵作用。以下是如何應用數據科學改進貸款風險預測並在模型穩定性和性能之間達到更好平衡

特徵工程

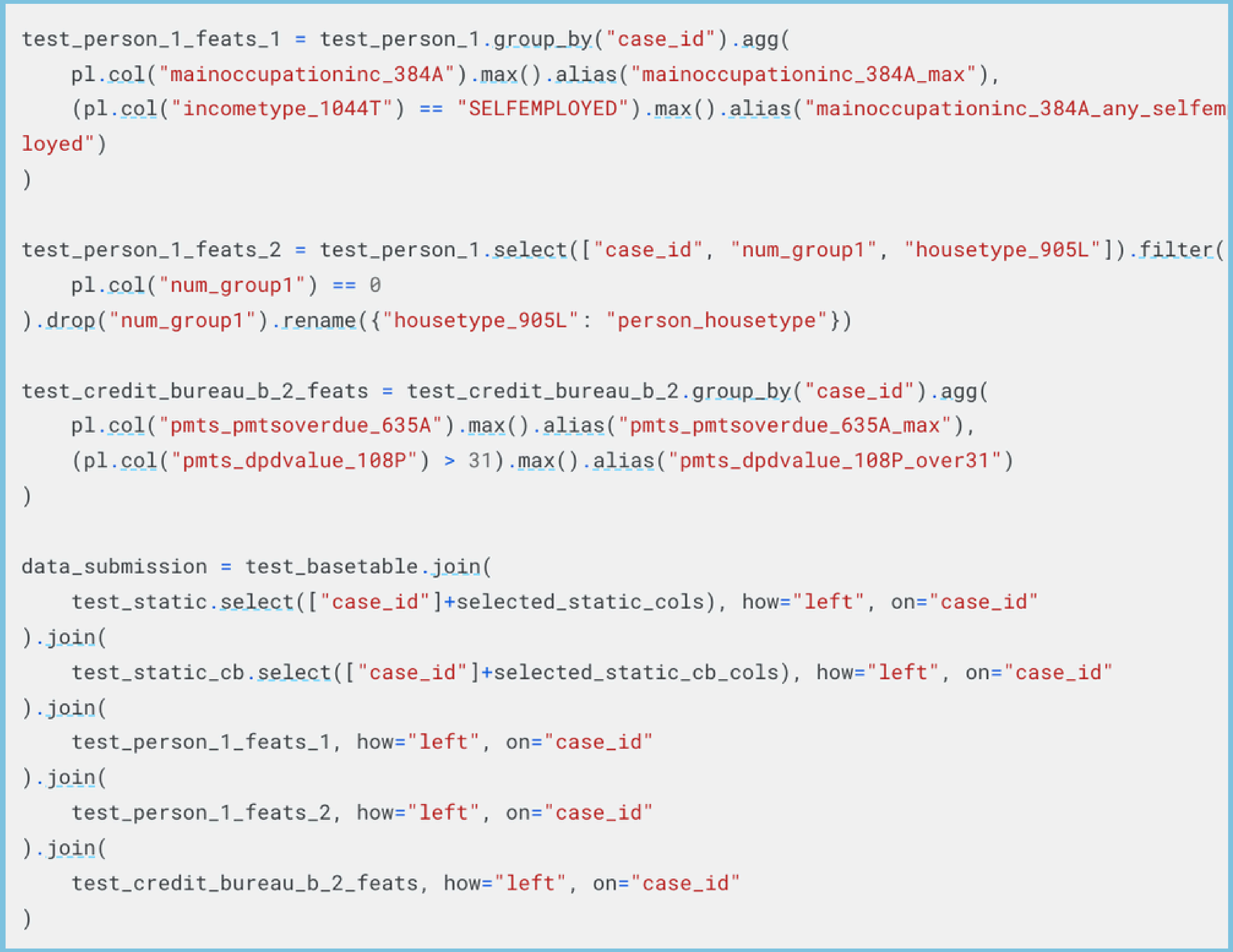


```
train_person_1_feats_1 = train_person_1.group_by("case_id").agg(
    pl.col("mainoccupationinc_384A").max().alias("mainoccupationinc_384A_max"),
    (pl.col("incometype_1044T") == "SELFEMPLOYED").max().alias("mainoccupationinc_384A_any_selfemployed")
)

train_person_1_feats_2 = train_person_1.select(["case_id", "num_group1", "housetype_905L"]).filter(
    pl.col("num_group1") == 0
).drop("num_group1").rename({"housetype_905L": "person_housetype"})

train_credit_bureau_b_2_feats = train_credit_bureau_b_2.group_by("case_id").agg(
    pl.col("pmts_pmtsoverdue_635A").max().alias("pmts_pmtsoverdue_635A_max"),
    (pl.col("pmts_dpdvalue_108P") > 31).max().alias("pmts_dpdvalue_108P_over31")
)

selected_static_cols = [col for col in train_static.columns if col[-1] in ("A", "M")]
selected_static_cb_cols = [col for col in train_static_cb.columns if col[-1] in ("A", "M")]
```

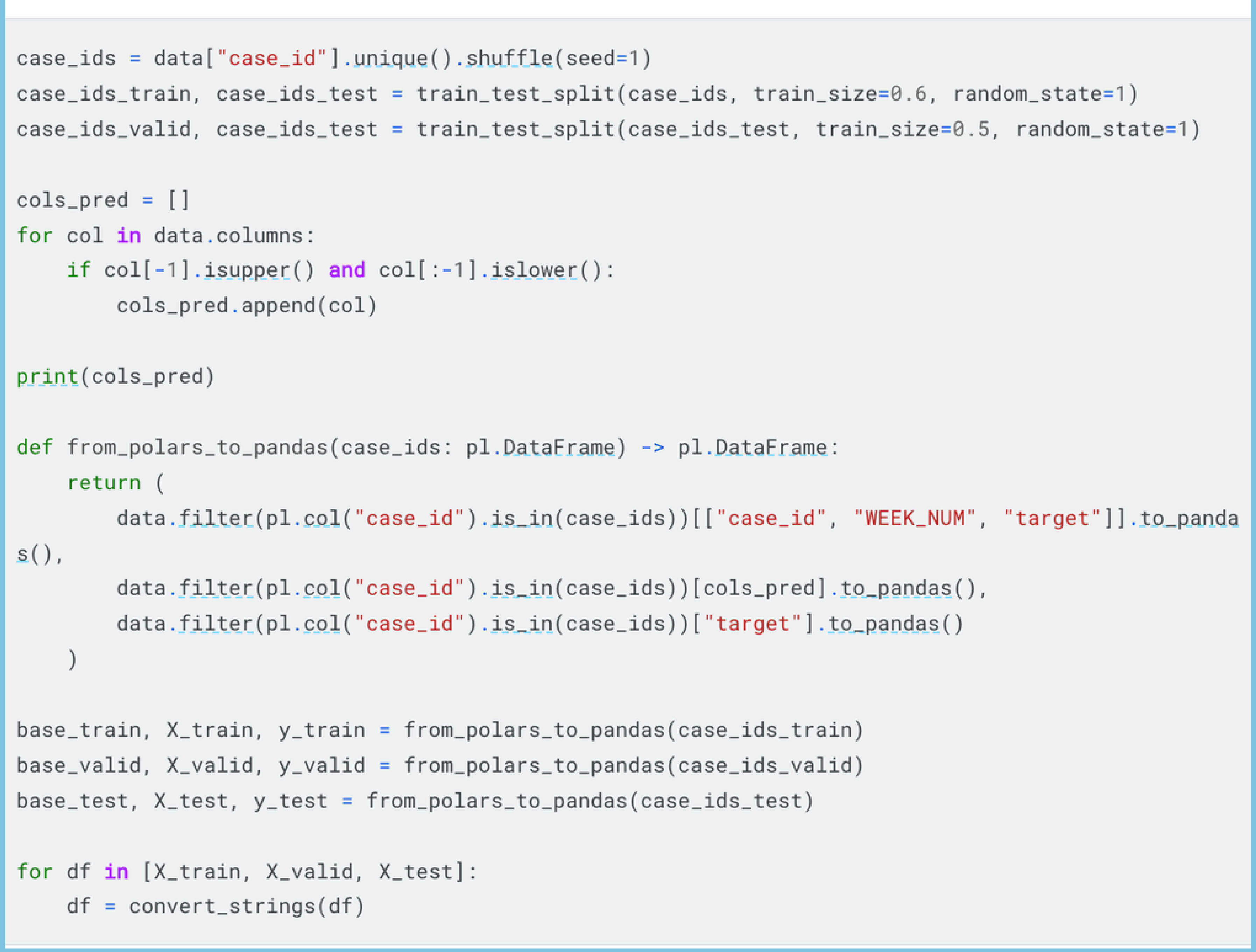
```
train_person_1_feats_1 = train_person_1.group_by("case_id").agg(
    pl.col("mainoccupationinc_384A").max().alias("mainoccupationinc_384A_max"),
    (pl.col("incometype_1044T") == "SELFEMPLOYED").max().alias("mainoccupationinc_384A_any_selfemp
loyed")
)

# Here num_group1=0 has special meaning, it is the person who applied for the loan.
train_person_1_feats_2 = train_person_1.select(["case_id", "num_group1", "housetype_905L"]).filter
(
    pl.col("num_group1") == 0
).drop("num_group1").rename({"housetype_905L": "person_housetype"})

# Here we have num_goup1 and num_group2, so we need to aggregate again.
train_credit_bureau_b_2_feats = train_credit_bureau_b_2.group_by("case_id").agg(
    pl.col("pmts_pmtsoverdue_635A").max().alias("pmts_pmtsoverdue_635A_max"),
    (pl.col("pmts_dpdvalue_108P") > 31).max().alias("pmts_dpdvalue_108P_over31")
)

# We will process in this examples only A-type and M-type columns, so we need to select them.
selected_static_cols = []
for col in train_static.columns:
    if col[-1] in ("A", "M"):
        selected_static_cols.append(col)
print(selected_static_cols)

selected_static_cb_cols = []
for col in train_static_cb.columns:
    if col[-1] in ("A", "M"):
        selected_static_cb_cols.append(col)
print(selected_static_cb_cols)

# Join all tables together.
data = train_basetable.join(
    train_static.select(["case_id"]+selected_static_cols), how="left", on="case_id"
).join(
    train_static_cb.select(["case_id"]+selected_static_cb_cols), how="left", on="case_id"
).join(
    train_person_1_feats_1, how="left", on="case_id"
).join(
    train_person_1_feats_2, how="left", on="case_id"
).join(
    train_credit_bureau_b_2_feats, how="left", on="case_id"
)
```



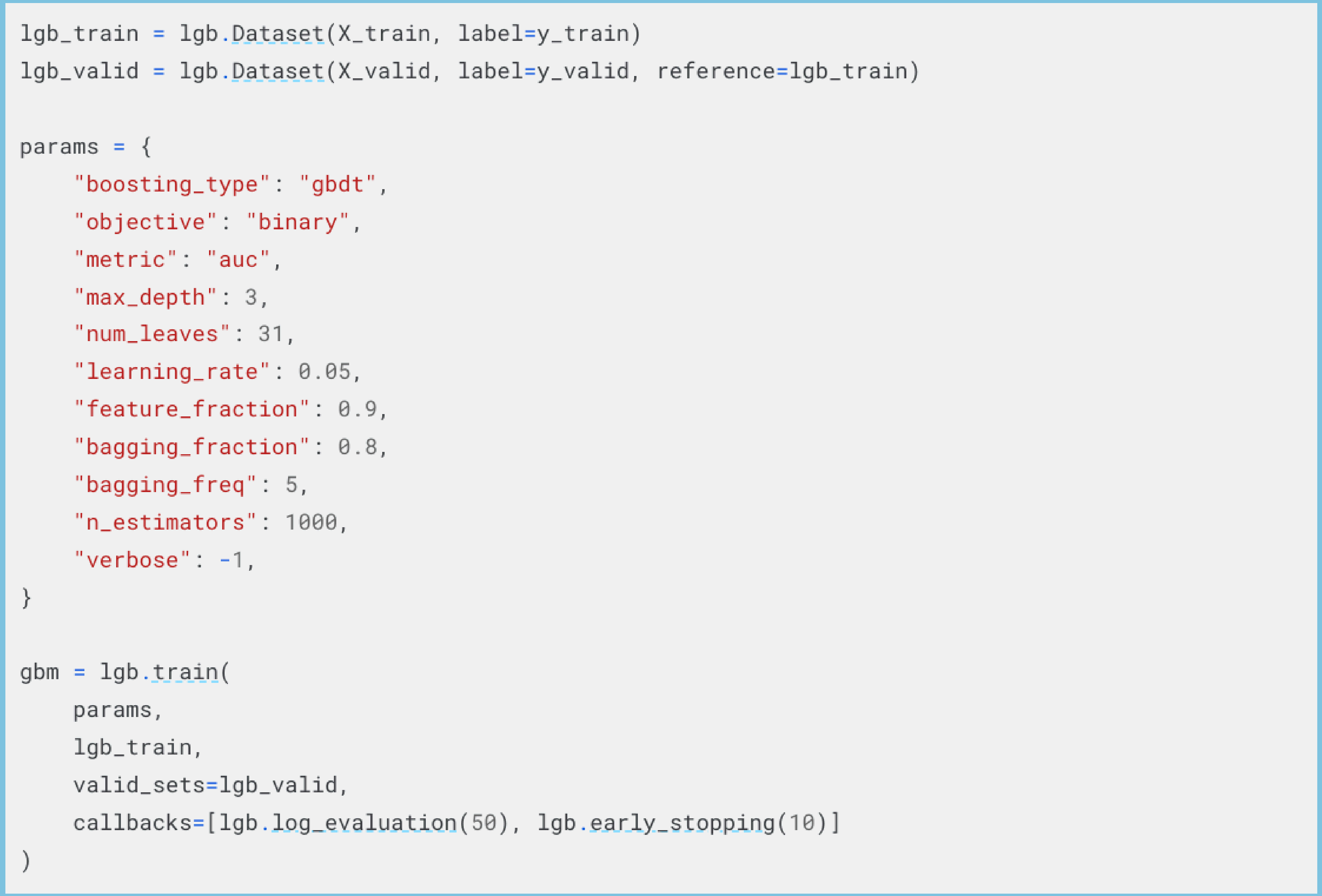
```python
class Aggregator:
    @staticmethod
    def num_expr(df):
        cols = [col for col in df.columns if col[-1] in ("P", "A")]
        expr_max = [pl.max(col).alias(f"max_{col}") for col in cols]
        return expr_max

    @staticmethod
    def date_expr(df):
        cols = [col for col in df.columns if col[-1] in ("D",)]
        expr_max = [pl.max(col).alias(f"max_{col}") for col in cols]
        return expr_max

    @staticmethod
    def str_expr(df):
        cols = [col for col in df.columns if col[-1] in ("M",)]
        expr_max = [pl.max(col).alias(f"max_{col}") for col in cols]
        return expr_max

    @staticmethod
    def other_expr(df):
        cols = [col for col in df.columns if col[-1] in ("T", "L")]
        expr_max = [pl.max(col).alias(f"max_{col}") for col in cols]
        return expr_max

    @staticmethod
    def count_expr(df):
        cols = [col for col in df.columns if "num_group" in col]
        expr_max = [pl.max(col).alias(f"max_{col}") for col in cols]
        return expr_max

    @staticmethod
    def get_exprs(df):
        exprs = Aggregator.num_expr(df) + \
                Aggregator.date_expr(df) + \
                Aggregator.str_expr(df) + \
                Aggregator.other_expr(df) + \
                Aggregator.count_expr(df)
        return exprs
```



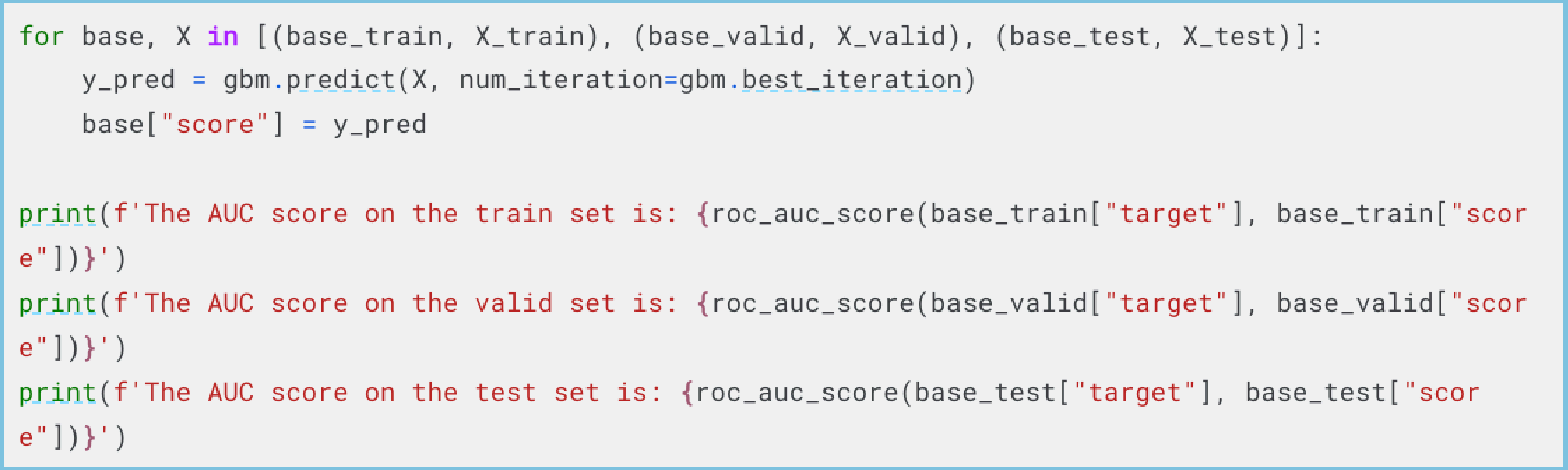
```
test_person_1_feats_1 = test_person_1.group_by("case_id").agg(
    pl.col("mainoccupationinc_384A").max().alias("mainoccupationinc_384A_max"),
    (pl.col("incometype_1044T") == "SELFEMPLOYED").max().alias("mainoccupationinc_384A_any_selfem
loyed")
)

test_person_1_feats_2 = test_person_1.select(["case_id", "num_group1", "housetype_905L"]).filter(
    pl.col("num_group1") == 0
).drop("num_group1").rename({"housetype_905L": "person_housetype"})

test_credit_bureau_b_2_feats = test_credit_bureau_b_2.group_by("case_id").agg(
    pl.col("pmts_pmtsoverdue_635A").max().alias("pmts_pmtsoverdue_635A_max"),
    (pl.col("pmts_dpdvalue_108P") > 31).max().alias("pmts_dpdvalue_108P_over31")
)

data_submission = test_basetable.join(
    test_static.select(["case_id"]+selected_static_cols), how="left", on="case_id"
).join(
    test_static_cb.select(["case_id"]+selected_static_cb_cols), how="left", on="case_id"
).join(
    test_person_1_feats_1, how="left", on="case_id"
).join(
    test_person_1_feats_2, how="left", on="case_id"
).join(
    test_credit_bureau_b_2_feats, how="left", on="case_id"
)
```



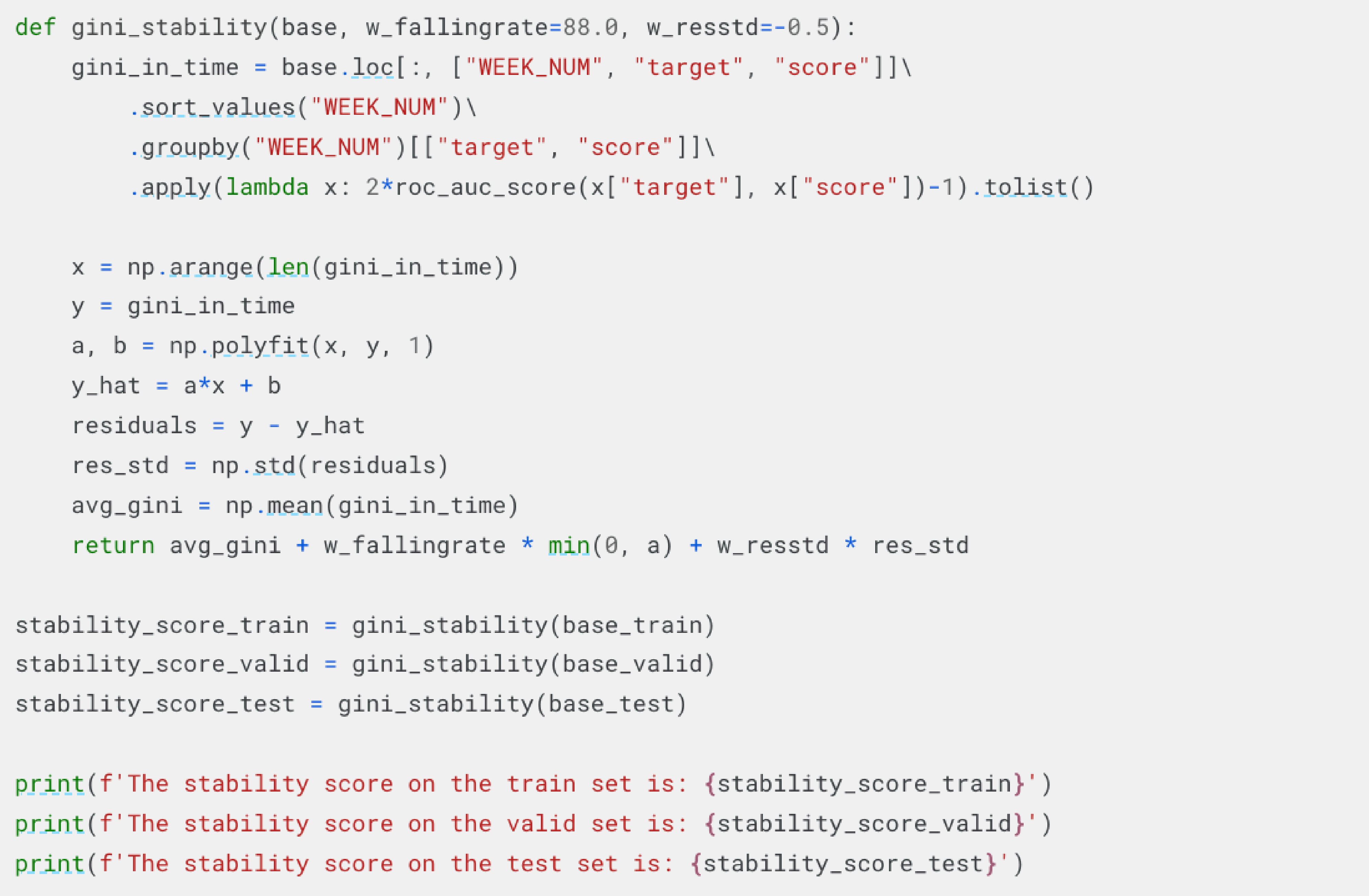
```
case_ids = data["case_id"].unique().shuffle(seed=1)
case_ids_train, case_ids_test = train_test_split(case_ids, train_size=0.6, random_state=1)
case_ids_valid, case_ids_test = train_test_split(case_ids_test, train_size=0.5, random_state=1)

cols_pred = []
for col in data.columns:
    if col[-1].isupper() and col[:-1].islower():
        cols_pred.append(col)

print(cols_pred)

def from_polars_to_pandas(case_ids: pl.DataFrame) -> pl.DataFrame:
    return (
        data.filter(pl.col("case_id").is_in(case_ids))[["case_id", "WEEK_NUM", "target"]].to_panda
s(),
        data.filter(pl.col("case_id").is_in(case_ids))[cols_pred].to_pandas(),
        data.filter(pl.col("case_id").is_in(case_ids))["target"].to_pandas()
    )

base_train, X_train, y_train = from_polars_to_pandas(case_ids_train)
base_valid, X_valid, y_valid = from_polars_to_pandas(case_ids_valid)
base_test, X_test, y_test = from_polars_to_pandas(case_ids_test)

for df in [X_train, X_valid, X_test]:
    df = convert_strings(df)
```



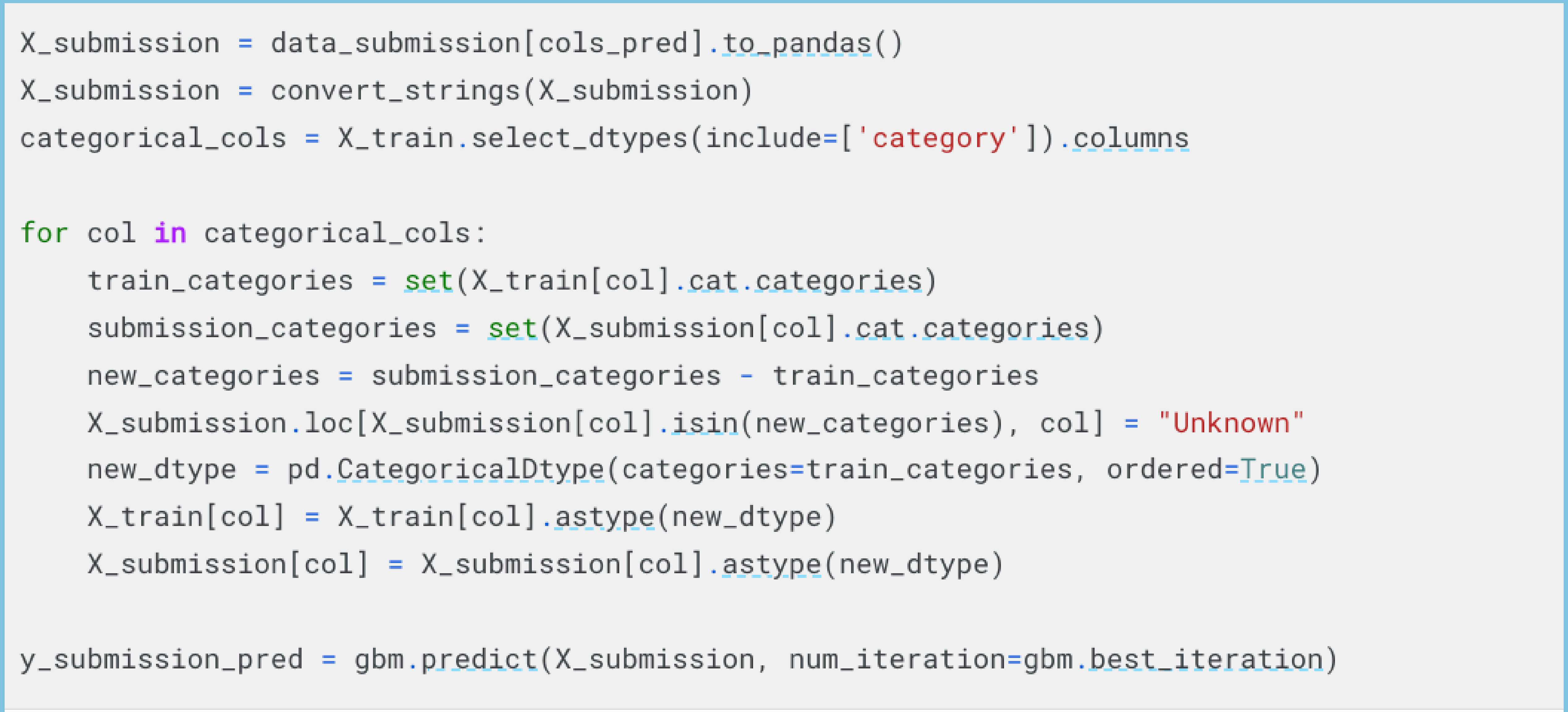
```python
lgb_train = lgb.Dataset(X_train, label=y_train)
lgb_valid = lgb.Dataset(X_valid, label=y_valid, reference=lgb_train)

params = {
    "boosting_type": "gbdt",
    "objective": "binary",
    "metric": "auc",
    "max_depth": 3,
    "num_leaves": 31,
    "learning_rate": 0.05,
    "feature_fraction": 0.9,
    "bagging_fraction": 0.8,
    "bagging_freq": 5,
    "n_estimators": 1000,
    "verbose": -1,
}

gbm = lgb.train(
    params,
    lgb_train,
    valid_sets=lgb_valid,
    callbacks=[lgb.log_evaluation(50), lgb.early_stopping(10)]
)
```



```python
for base, X in [(base_train, X_train), (base_valid, X_valid), (base_test, X_test)]:
    y_pred = gbm.predict(X, num_iteration=gbm.best_iteration)
    base["score"] = y_pred

print(f'The AUC score on the train set is: {roc_auc_score(base_train["target"], base_train["score"])}')
print(f'The AUC score on the valid set is: {roc_auc_score(base_valid["target"], base_valid["score"])}')
print(f'The AUC score on the test set is: {roc_auc_score(base_test["target"], base_test["score"])}')
```



```python
def gini_stability(base, w_fallingrate=88.0, w_resstd=-0.5):
    gini_in_time = base.loc[:, ["WEEK_NUM", "target", "score"]]\
        .sort_values("WEEK_NUM")\
        .groupby("WEEK_NUM")[["target", "score"]]\
        .apply(lambda x: 2*roc_auc_score(x["target"], x["score"])-1).tolist()

    x = np.arange(len(gini_in_time))
    y = gini_in_time
    a, b = np.polyfit(x, y, 1)
    y_hat = a*x + b
    residuals = y - y_hat
    res_std = np.std(residuals)
    avg_gini = np.mean(gini_in_time)
    return avg_gini + w_fallingrate * min(0, a) + w_resstd * res_std

stability_score_train = gini_stability(base_train)
stability_score_valid = gini_stability(base_valid)
stability_score_test = gini_stability(base_test)

print(f'The stability score on the train set is: {stability_score_train}')
print(f'The stability score on the valid set is: {stability_score_valid}')
print(f'The stability score on the test set is: {stability_score_test}')
```



```python
X_submission = data_submission[cols_pred].to_pandas()
X_submission = convert_strings(X_submission)
categorical_cols = X_train.select_dtypes(include=['category']).columns

for col in categorical_cols:
    train_categories = set(X_train[col].cat.categories)
    submission_categories = set(X_submission[col].cat.categories)
    new_categories = submission_categories - train_categories
    X_submission.loc[X_submission[col].isin(new_categories), col] = "Unknown"
    new_dtype = pd.CategoricalDtype(categories=train_categories, ordered=True)
    X_train[col] = X_train[col].astype(new_dtype)
    X_submission[col] = X_submission[col].astype(new_dtype)

y_submission_pred = gbm.predict(X_submission, num_iteration=gbm.best_iteration)
```