Import

```
In [ ]: import glob
        import pandas as pd
        from pycaret.classification import *
```

Data Preprocessing

Combine training .tsv files into a Pandas DataFrame. Merge them on column `PATIENTID`.

```
In [ ]: path_train = '/home/kevin/Code/precisionFDA/Data/Brain-Cancer-Data/Training-
        all_files = glob.glob(path_train + '/*.tsv')

        df_train = pd.DataFrame()

        for file in all_files:
            df_current_train = pd.read_csv(file, sep='\t')

            if df_train.empty:
                df_train = df_current_train
            else:
                df_train = pd.merge(df_train, df_current_train, how='outer', on='PAT
```

```
In [ ]: df_train.head()
```

Out[ ]:

	PATIENTID	SURVIVAL_STATUS	SEX	RACE	WHO_GRADING	CANCER_TYPE	A1BG
0	patient_290	1	NaN		II	ASTROCYTOMA	6.557793
1	patient_394	1	NaN		NaN	GBM	6.323015
2	patient_81	1	NaN		III	ASTROCYTOMA	6.669421
3	patient_307	1	NaN		NaN	UNCLASSIFIED	6.502573
4	patient_14	1	NaN		NaN	GBM	6.624505

5 rows × 19341 columns

Find columns that have NaN or empty values.

```
In [ ]: list_empty_null = df_train.columns[df_train.isna().any()].tolist()
        print (list_empty_null)

['SEX', 'RACE', 'WHO_GRADING']
```

Replace empty values with NaN and then drop all rows that have NaN. Check for nulls.

```
In [ ]: df_train.replace(' ', pd.NA, inplace=True)
        df_train.dropna(subset=['SEX', 'RACE', 'WHO_GRADING'], inplace=True)
```

```
df_train[['SEX', 'RACE', 'WHO_GRADING']].isnull().sum()
```

Out[ ]:
```
SEX            0
RACE           0
WHO_GRADING    0
dtype: int64
```

In the `CANCER_TYPE` column, drop rows with `UNKNOWN` and `UNCLASSIFIED` values.

In [ ]:
```
df_train['CANCER_TYPE'].replace({'UNKNOWN':pd.NA}, inplace=True)
df_train['CANCER_TYPE'].replace({'UNCLASSIFIED':pd.NA}, inplace=True)
df_train.dropna(subset=['CANCER_TYPE'], inplace=True)
```

Reset DataFrame index.

In [ ]:
```
df_train.reset_index(drop=True, inplace=True)
```

Train Model

In `setup()`, set the `target` to `SURVIVAL_STATUS` and ignore `PATIENTID` column.

In [ ]:
```
s = setup(
    df_train,
    target='SURVIVAL_STATUS',
    ignore_features=['PATIENTID'],
    session_id=1)
```

	Description	Value
0	Session id	1
1	Target	SURVIVAL_STATUS
2	Target type	Binary
3	Original data shape	(165, 19341)
4	Transformed data shape	(165, 19349)
5	Transformed train set shape	(115, 19349)
6	Transformed test set shape	(50, 19349)
7	Ignore features	1
8	Numeric features	19335
9	Categorical features	4
10	Preprocess	True
11	Imputation type	simple
12	Numeric imputation	mean
13	Categorical imputation	mode
14	Maximum one-hot encoding	25
15	Encoding method	None
16	Fold Generator	StratifiedKFold
17	Fold Number	10
18	CPU Jobs	-1
19	Use GPU	False
20	Log Experiment	False
21	Experiment Name	clf-default-name
22	USI	3bd9

Find the best model and save it.

```
In [ ]: best_model = compare_models()
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC	TT (Sec)
rf	Random Forest Classifier	0.8886	0.0000	1.0000	0.8861	0.9388	0.2866	0.3016	35.8340
et	Extra Trees Classifier	0.8879	0.0000	1.0000	0.8855	0.9384	0.2871	0.3019	36.1710
lda	Linear Discriminant Analysis	0.8795	0.7839	0.9800	0.8921	0.9327	0.2987	0.3226	25.0900
lightgbm	Light Gradient Boosting Machine	0.8788	0.0000	0.9900	0.8855	0.9332	0.2491	0.2690	57.3890
ridge	Ridge Classifier	0.8629	0.6800	0.9589	0.8890	0.9211	0.2760	0.2857	25.4010
ada	Ada Boost Classifier	0.8629	0.8044	0.9600	0.8921	0.9232	0.2516	0.2646	26.3610
dummy	Dummy Classifier	0.8530	0.0000	1.0000	0.8530	0.9203	0.0000	0.0000	37.0920
lr	Logistic Regression	0.8455	0.7783	0.9378	0.8858	0.9088	0.2528	0.2644	25.6820
gbc	Gradient Boosting Classifier	0.8455	0.7028	0.9178	0.9011	0.9085	0.3233	0.3280	30.7820
nb	Naive Bayes	0.8447	0.0000	0.8878	0.9302	0.9054	0.3945	0.4110	37.3830
knn	K Neighbors Classifier	0.8273	0.0000	0.9700	0.8491	0.9046	-0.0350	-0.0370	36.7930
svm	SVM - Linear Kernel	0.8189	0.7867	0.9500	0.8557	0.8973	0.0271	0.0313	25.6790
dt	Decision Tree Classifier	0.7841	0.0000	0.8567	0.8871	0.8691	0.2044	0.2186	36.9220
qda	Quadratic Discriminant Analysis	0.6394	0.4739	0.6644	0.8842	0.7419	0.0483	0.0628	24.7500

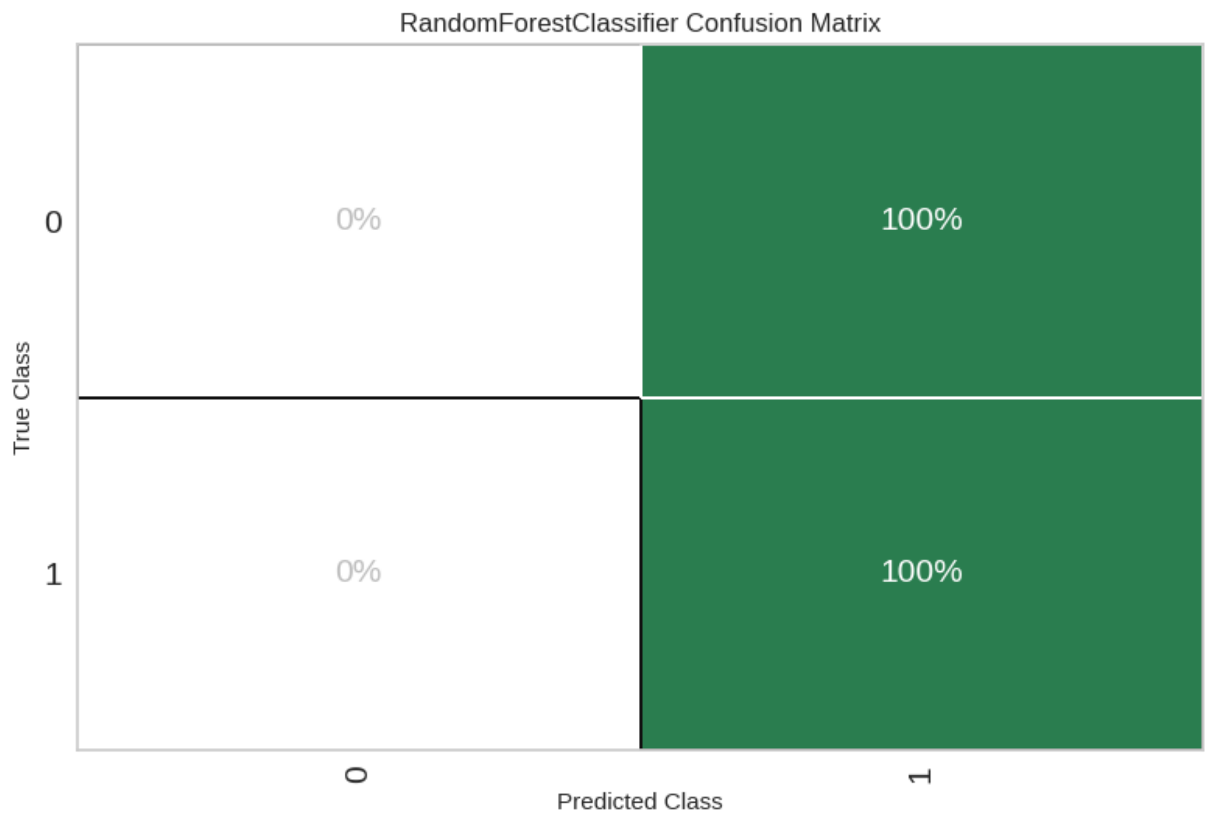
In [ ]:
```
save_model(best_model, 'best_model_v3')
```

In [ ]:
```
my_model = load_model('best_model_v3')
```

Evaluate the model.

In [ ]:
```
evaluate_model(my_model)
```

```
interactive(children=(ToggleButtons(description='Plot Type:', icons=('',), o
ptions=(('Pipeline Plot', 'pipelin…
In [ ]: plot_model(my_model, plot='confusion_matrix', plot_kwargs={'percent':True})
```



Test Model

Training Dataset

Predict on the training dataset.

```
In [ ]: predict_train = predict_model(my_model)
```

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC
0	Random Forest Classifier	0.8400	0.4673	1.0000	0.8400	0.9130	0.0000	0.0000

Test Dataset

Combine test .tsv files into a Pandas DataFrame. Merge them on column `PATIENTID`.

```
In [ ]: path_test = '/home/kevin/Code/precisionFDA/Data/Brain-Cancer-Data/Test-Datas

        all_files = glob.glob(path_test + '/*.tsv')

        df_test = pd.DataFrame()

        for file in all_files:
```

```
    df_current_test = pd.read_csv(file, sep='\t')

    if df_test.empty:
        df_test = df_current_test
    else:
        df_test = df_test.merge(df_current_test, how='outer', on='PATIENTID'
```

In [ ]:
```
df_test.head()
```

Out[ ]:

	PATIENTID	A1BG	A1BG.AS1	A1CF	A2M	A2M.AS1	A2ML1	A4GALT
0	patient_54	6.552369	6.516572	5.670704	12.696699	6.244980	5.494503	7.031448
1	patient_456	6.341531	6.403964	5.575675	11.667261	6.208729	5.516190	7.077214
2	patient_484	6.150328	6.452206	5.465605	12.384793	5.971820	5.339407	6.787843
3	patient_441	6.569596	6.428329	5.404905	12.918034	5.915066	5.295160	6.975057
4	patient_370	6.902578	6.343173	5.243564	13.215173	6.058236	5.203713	6.786196

5 rows × 19340 columns

In [ ]:
```
df_test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 96 entries, 0 to 95
Columns: 19340 entries, PATIENTID to CANCER_TYPE
dtypes: float64(19335), object(5)
memory usage: 14.2+ MB
```

Predict on the test dataset.

In [ ]:
```
predict_test = predict_model(my_model, df_test)
predict_test['prediction_score'].describe()
```

Out[ ]:
```
count    96.000000
mean      0.830417
std       0.115375
min       0.520000
25%       0.780000
50%       0.850000
75%       0.922500
max       0.990000
Name: prediction_score, dtype: float64
```