

```
In [18]: import numpy as np
import pandas as pd

from sklearn.linear_model import LinearRegression, Ridge, Lasso, LogisticRegression
from sklearn.tree import DecisionTreeClassifier, DecisionTreeRegressor

from sklearn.ensemble import RandomForestClassifier, RandomForestRegressor
from sklearn.datasets import load_boston, load_iris, load_wine, load_digits, \
    load_breast_cancer, load_diabetes
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix, precision_score, recall_score

import matplotlib.pyplot as plt
%%config InlineBackend.figure_format = 'svg'
%config InlineBackend.figure_format = 'retina'

from sklearn import tree
from dtreeviz.trees import *
from dtreeviz.models.sklearn_decision_trees import ShadowSKDTree
```

Regression

```
In [19]: df_cars = pd.read_csv("../data/cars.csv")
X = df_cars[['WGT']]
y = df_cars['MPG']
```

```
In [20]: features_reg_univar = ["WGT"]
target_reg = "MPG"
dtr_univar = DecisionTreeRegressor(max_depth=3, criterion="mae")
dtr_univar.fit(X, y)
```

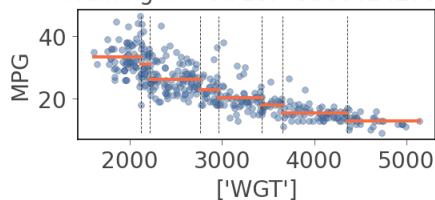
Out[20]: DecisionTreeRegressor(criterion='mae', max_depth=3)

```
In [21]: fig, ax = plt.subplots(1,1, figsize=(4,2.5))

rtreeviz_univar(dtr_univar, X, y, ['WGT'], 'MPG', ax=ax)

plt.tight_layout()
plt.show()
```

Regression tree depth 3, samples per leaf 1,
Training $R^2=0.7257759664142764$



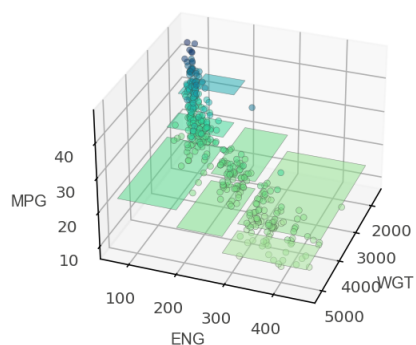
```
In [22]: features_reg_bivar_3d = ["WGT", "ENG"]
target_reg_bivar_3d = "MPG"
X = df_cars[features_reg_bivar_3d]
dtr_bivar_3d = DecisionTreeRegressor(max_depth=3, criterion="mae")
dtr_bivar_3d.fit(X, y)
```

Out[22]: DecisionTreeRegressor(criterion='mae', max_depth=3)

```
In [23]: rtreeviz_bivar_3D(dtr_bivar_3d,
    df_cars[features_reg_bivar_3d], y,
    feature_names=features_reg_bivar_3d,
    target_name=target_reg_bivar_3d,
    fontsize=10,
    elev=30,
    azim=20,
```

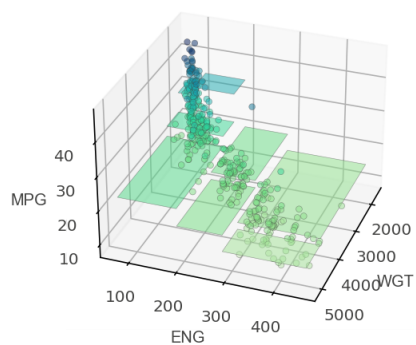
```
dist=10,
show={'splits','title'},
colors={'tessellation_alpha':.5})
```

Regression tree depth 3, training $R^2=0.742$

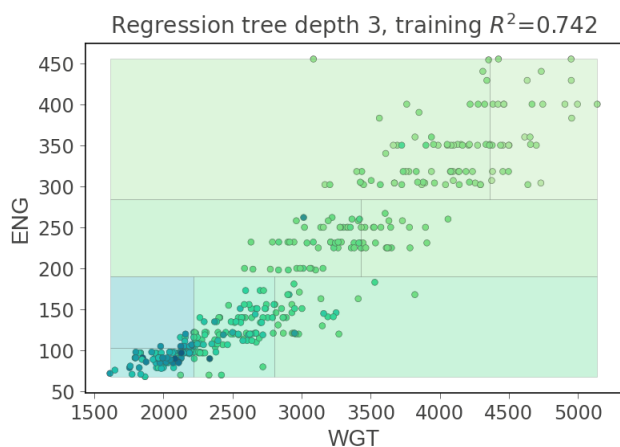


```
In [24]: skdtree_bivar_3d = ShadowSKDTree(dtr_bivar_3d, X, y, features_reg_bivar_3d, target_reg_bivar_3d)
rtreeviz_bivar_3D(skdtree_bivar_3d,
                  fontsize=10,
                  elev=30,
                  azim=20,
                  dist=10,
                  show={'splits','title'},
                  colors={'tessellation_alpha':.5})
```

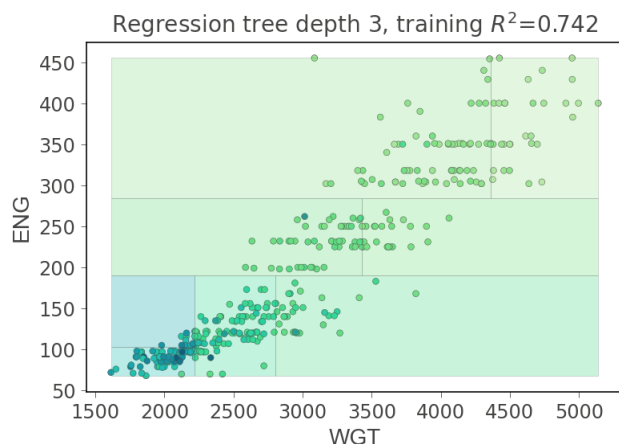
Regression tree depth 3, training $R^2=0.742$



```
In [25]: rtreeviz_bivar_heatmap(dtr_bivar_3d, X, y, feature_names=features_reg_bivar_3d, target_name=target_reg_b
```



```
In [26]: rtreeviz_bivar_heatmap(skdtree_bivar_3d)
```



Classification

```
In [27]: iris = load_iris()
X = iris.data
X = X[:,2].reshape(-1,1) # petal length (cm)
y = iris.target
len(X), len(y)

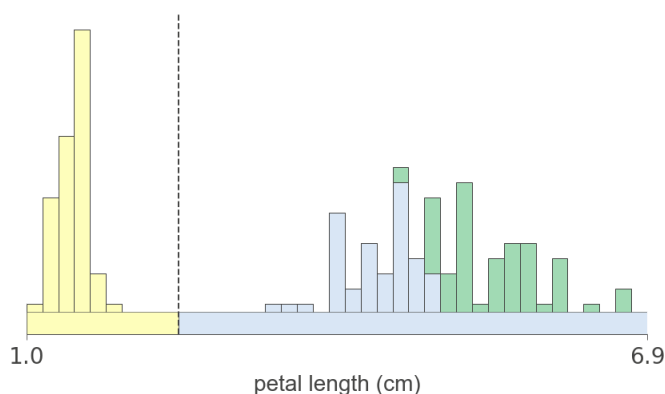
feature_c_univar = "petal length (cm)"
target_c_univar = "iris"
class_names_univar = list(iris.target_names)
```

```
In [28]: dtc_univar = DecisionTreeClassifier(max_depth=1, min_samples_leaf=1)
dtc_univar.fit(X, y)

skdtree_c_univar = ShadowSKDTree(dtc_univar, X, y, feature_c_univar, target_c_univar, class_names_univar)
```

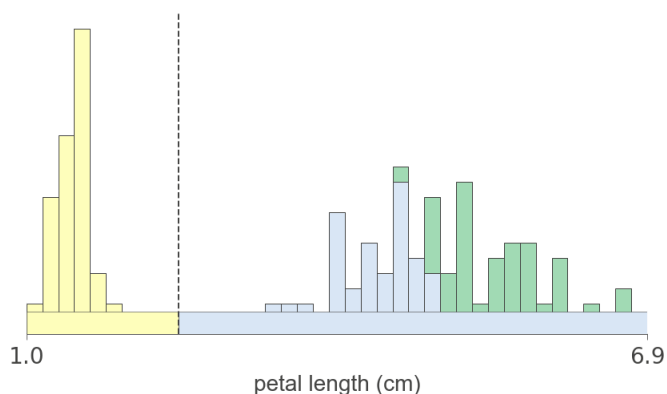
```
In [29]: figsize = (6,2)
ctreeviz_univar(dtc_univar, X, y,
                feature_names=feature_c_univar, target_name=target_c_univar, class_names=class_names_uni
                nbins=40, gtype='barstacked',
                show={'splits', 'title'})
plt.tight_layout()
plt.show()
```

Classifier tree depth 1, training accuracy=66.67%



```
In [30]: figsize = (6,2)
ctreeviz_univar(skdtree_c_univar,
                nbins=40, gtype='barstacked',
                show={'splits', 'title'})
plt.tight_layout()
plt.show()
```

Classifier tree depth 1, training accuracy=66.67%



```
In [31]: wine = load_wine()
X = wine.data
X = X[:, [12, 6]]
y = wine.target
len(X), len(y)

colors = {'classes':
          [None, # 0 classes
           None, # 1 class
           ["#FEFEBB", "#aldab4"], # 2 classes
           ["#FEFEBB", "#D9E6F5", "#aldab4"], # 3
          ]
        }

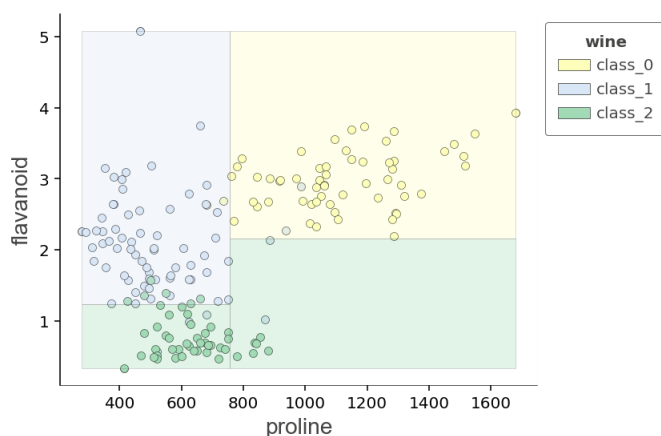
feature_c_bivar = ['proline', 'flavanoid']
target_c_bivar = "wine"
class_name_bivar = list(wine.target_names)
feature_c_bivar, target_c_bivar, class_name_bivar
```

```
Out[31]: (['proline', 'flavanoid'], 'wine', ['class_0', 'class_1', 'class_2'])
```

```
In [32]: dtc_bivar = DecisionTreeClassifier(max_depth=2)
dtc_bivar.fit(X, y)

skdtree_c_bivar = ShadowSKDTree(dtc_bivar, X, y, feature_c_bivar, target_c_bivar, class_name_bivar)
```

```
In [33]: ctreeviz_bivar(dtc_bivar, X, y,
                        feature_names=feature_c_bivar, target_name=target_c_bivar, class_names=class_name_bivar,
                        show={'splits', "legend"},
                        colors={'scatter_edge': 'black'})
plt.tight_layout()
plt.show()
```



```
In [34]: ctreeviz_bivar(skdtree_c_bivar,
                        show={'splits', "legend"},
```

```
colors={'scatter_edge': 'black'})  
plt.tight_layout()  
plt.show()
```

