3.3.1 Árbol de decisión de regresión

December 26, 2020

1 Árboles de decisión de regresión

[11]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
data_frame = pd.read_csv("3.3.2 turbines_df.csv")
data_frame.head()
```

[11]:
```
   turbine_capacity  rotor_diameter_m  hub_height_m  commissioning_date  \
0               150              23.0          30.0                1993
1               600              44.0          40.0                1997
2               600              44.0          50.0                1998
3               600              44.0          50.0                1998
4               600              44.0          50.0                1998

  province_territory  model
0            Alberta  Other
1            Alberta  Other
2            Alberta  Other
3            Alberta  Other
4            Alberta  Other
```

[2]:
```
data_frame.shape
```

[2]:
```
(6478, 6)
```

[22]:
```
data_frame.dtypes
```

[22]:
```
turbine_capacity        int64
rotor_diameter_m      float64
hub_height_m          float64
commissioning_date      int64
province_territory     object
model                  object
dtype: object
```

[3]:
```python
# Valores nulos
for feature in data_frame.columns:
    print('Total de valores nulos de', feature, '=', data_frame[feature].isna().
 ↪sum())
```

```
Total de valores nulos de turbine_capacity = 0
Total de valores nulos de rotor_diameter_m = 0
Total de valores nulos de hub_height_m = 0
Total de valores nulos de commissioning_date = 0
Total de valores nulos de province_territory = 0
Total de valores nulos de model = 0
```

[6]:
```python
# Valores únicos
for feature in data_frame.columns:
    print('Valores únicos de', feature, '=', data_frame[feature].unique())
```

```
Valores únicos de turbine_capacity = [ 150  600  660 1300 1800 3000 1500  750
1600 2300 2310 2000 1700 2750
 3200 3750 1650 2350 3300   65  100  800 1200  900 2100 1990 1400 1680
 1900  650 2500 2221 2126 1620 2850 2050 2648 2483 1824 1903 2030 1880
  500 2772 2942 3450 2200]
Valores únicos de rotor_diameter_m = [ 23.    44.    47.    60.    40.    50.
80.    90.    77.    51.5
 100.    71.    82.5  101.   103.    82.   120.   114.   141.    92.
 126.    15.5   15.    48.    62.    70.    52.    54.    52.9   97.
 116.   110.    43.    93.    83.    99.8  113.    92.5  136.    48.25
 107.   117.  ]
Valores únicos de hub_height_m = [ 30.   40.   50.   46.   48.   47.   60.   65.
67.   75.   80.   85.
  54.   90.   78.   95.  110.  100.   99.   98.  117.   24.5  25.   64.
  69.   55.   92.   76.   99.5  96.   98.5 124.   92.5 132.   81.  101.
  84.   83.  116.5  73.   79.5  37. ]
Valores únicos de commissioning_date = [1993 1997 1998 2000 2001 2002 2003 2004
2006 2007 2009 2010 2011 2012
 2014 2015 2017 2019 2005 2008 2018 2013 2016 1995 1999]
Valores únicos de province_territory = ['Alberta' 'British Columbia' 'Manitoba'
'New Brunswick'
 'Newfoundland and Labrador' 'Other' 'Nova Scotia' 'Ontario'
 'Prince Edward Island' 'Quebec' 'Saskatchewan']
Valores únicos de model = ['Other' 'V47/660' 'GE 1.5SLE' 'GE 1.6-100' 'V90/1800'
'SWT 2.3-101'
 'E-82' 'V82/1650' 'MM92' 'MM82' 'V80']
```

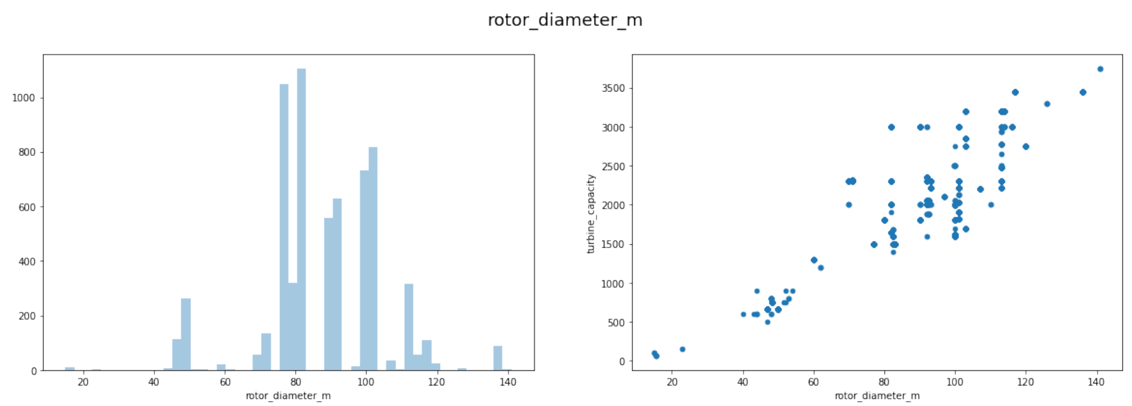
[13]:
```python
# Medidas estadísticas
data_frame.describe()
```

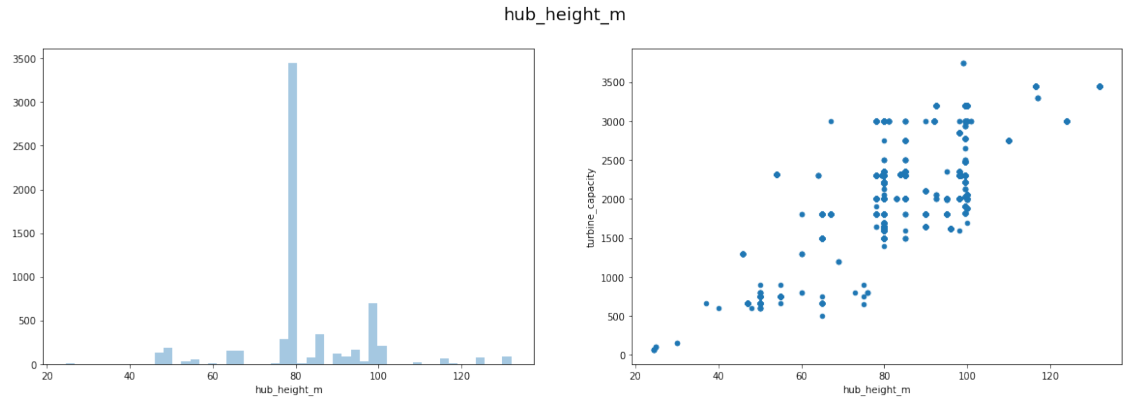
[13]:
```
       turbine_capacity  rotor_diameter_m  hub_height_m  commissioning_date
count       6478.000000       6478.000000   6478.000000         6478.000000
mean        1967.307194         88.203520     82.790908         2011.019142
std          605.933839         16.566686     14.366232            4.340453
min           65.000000         15.000000     24.500000         1993.000000
25%         1600.000000         77.000000     80.000000         2009.000000
50%         1880.000000         90.000000     80.000000         2012.000000
75%         2300.000000        100.000000     85.000000         2014.000000
max         3750.000000        141.000000    132.000000         2019.000000
```

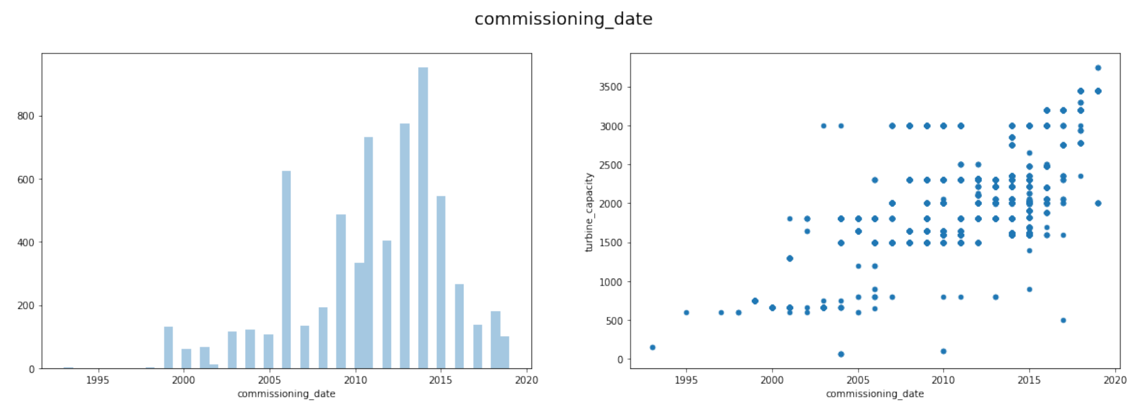
[14]:
```python
# Considerando solo las columnas de tipo object
import numpy as np
data_frame.describe(include=[np.object])
```

[14]:
```
       province_territory  model
count                6478   6478
unique                 11     11
top               Ontario  Other
freq                 2443   2789
```

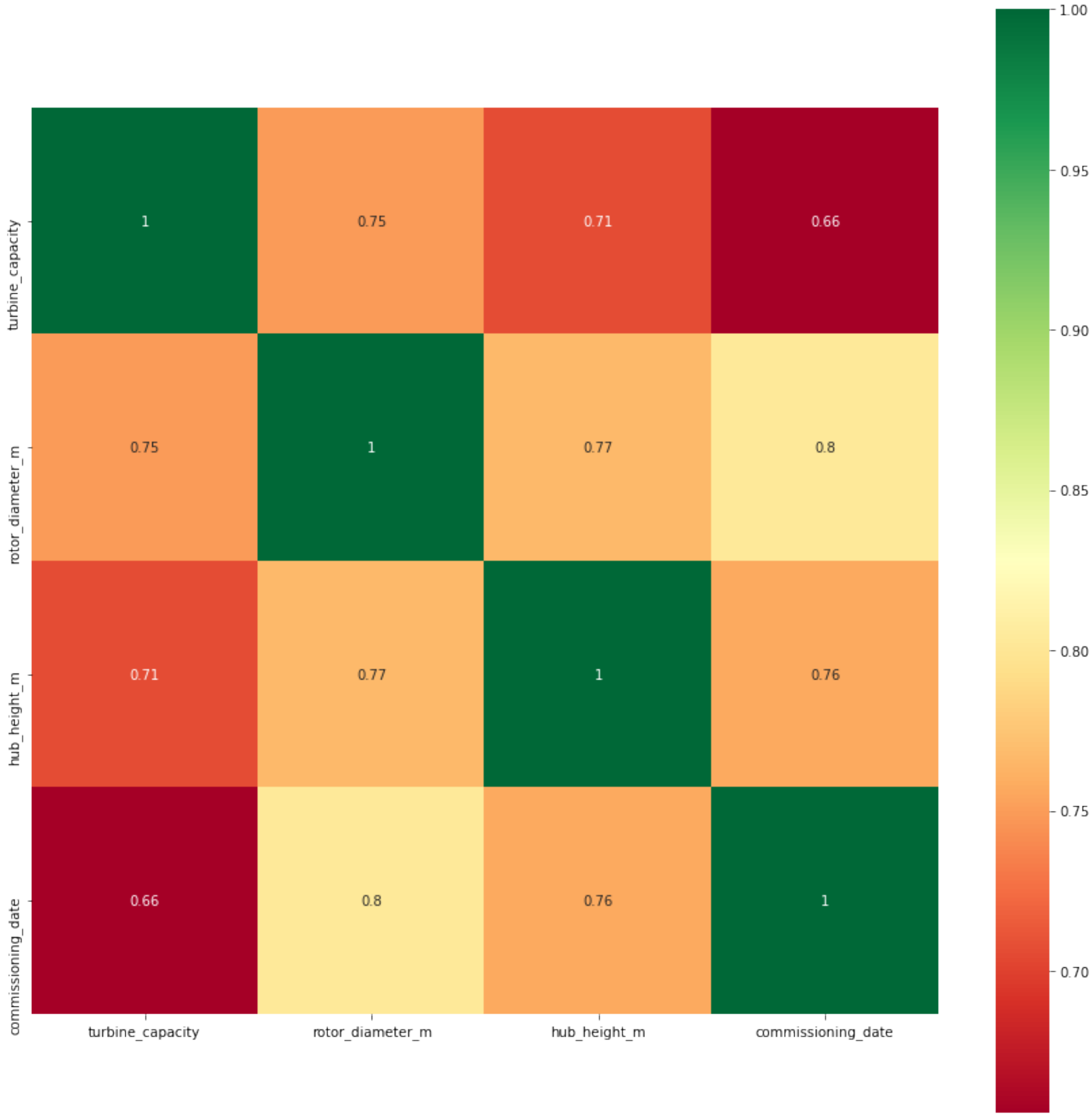
[12]:
```python
for col in ['rotor_diameter_m','hub_height_m', 'commissioning_date']:
    fig, ax =plt.subplots(1, 2, figsize=(20, 6))
    fig.suptitle(col, fontsize=18)
    sns.distplot(data_frame[col], ax=ax[0], kde=False)
    data_frame[[col]+['turbine_capacity']].plot.scatter(x=col,␣
 ↪y='turbine_capacity', ax=ax[1])
    plt.show()
```







[15]:
```python
## Correlación de las variables
plt.figure(figsize=(15,15))
p=sns.heatmap(data_frame.corr(), annot=True,cmap='RdYlGn',square=True)
```



[47]:
```
from sklearn.tree import DecisionTreeRegressor
from sklearn.model_selection import train_test_split

X = data_frame[['rotor_diameter_m','hub_height_m']]
y = data_frame.turbine_capacity

# Separar los datos de "train" en entrenamiento y prueba para probar el modelo
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state = 29)
modelo = DecisionTreeRegressor(max_depth = 5, random_state = 29)

# Entrenamiento del modelo
```

```
modelo.fit(X_train, y_train)

# Validación del modelo
Y_pred = modelo.predict(X_test)

# Evaluación del modelo
print('Precisión del modelo (en entrenamiento):', modelo.score(X_train, y_train))
print('Precisión del modelo (en validación):', modelo.score(X_test, y_test))
```

```
Precisión del modelo (en entrenamiento): 0.8249428738688777
Precisión del modelo (en validación): 0.83418586620569
```

1.1 Representación gráfica del árbol

[48]:
```
from sklearn.tree import plot_tree
fig, ax = plt.subplots(figsize=(30, 10))

print(f"Profundidad del árbol: {modelo.get_depth()}")
print(f"Número de nodos terminales: {modelo.get_n_leaves()}")

plot = plot_tree(
            decision_tree = modelo,
            feature_names = data_frame.drop(columns = ["province_territory", "model", "turbine_capacity"]).columns,
            class_names   = 'turbine_capacity',
            filled        = True,
            impurity      = False,
            fontsize      = 10,
            precision     = 2,
            ax            = ax
       )
```

```
Profundidad del árbol: 5
Número de nodos terminales: 26
```