In [ ]:
```
!pip install pandas
!pip install -U scikit-learn matplotlib seaborn
```

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn import preprocessing
import seaborn as sns
```

In [ ]:
```
dataset = pd.read_csv('Dataset_spine.csv')
```

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 310 entries, 0 to 309
Data columns (total 14 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   Col1         310 non-null    float64
 1   Col2         310 non-null    float64
 2   Col3         310 non-null    float64
 3   Col4         310 non-null    float64
 4   Col5         310 non-null    float64
 5   Col6         310 non-null    float64
 6   Col7         310 non-null    float64
 7   Col8         310 non-null    float64
 8   Col9         310 non-null    float64
 9   Col10        310 non-null    float64
 10  Col11        310 non-null    float64
 11  Col12        310 non-null    float64
 12  Class_att    310 non-null    object 
 13  Unnamed: 13  14 non-null     object 
dtypes: float64(12), object(2)
memory usage: 34.0+ KB
```

We have one unnamed column which has 14 non-null values

In [ ]:
```
dataset.isna().sum()
```

Out[ ]:
```
Col1             0
Col2             0
Col3             0
Col4             0
Col5             0
Col6             0
Col7             0
Col8             0
Col9             0
Col10            0
Col11            0
Col12            0
Class_att        0
Unnamed: 13    296
dtype: int64
```

In [ ]:
```
dataset['Unnamed: 13'].info
```

Out[ ]:
```
<bound method Series.info of 0                                                  NaN
1                                                     NaN
2      Prediction is done by using binary classificat...
3                                                     NaN
4                                                     NaN
                              ...
305                                                   NaN
306                                                   NaN
307                                                   NaN
308                                                   NaN
309                                                   NaN
Name: Unnamed: 13, Length: 310, dtype: object>
```

We will drop the Unnamed: 13 column

In [ ]:
```
dataset = dataset.drop(['Unnamed: 13'], axis=1)
```

The columns name are not very informative, so using the information present at Kaggle , we will rename our columns

In [ ]:
```
dataset.columns = [
    'pelvic_incidence',
    'pelvic tilt',
    'lumbar_lordosis_angle',
    'sacral_slope',
    'pelvic_radius',
    'degree_spondylolisthesis',
    'pelvic_slop',
    'Direct_tilt',
    'thoracic_slope',
    'cervical_tilt',
    'sacrum_angle',
    'scoliosis_slope',
    'label'
]
```

In [ ]:
```
dataset.describe
```

Out[ ]:
```
<bound method NDFrame.describe of      pelvic_incidence  pelvic tilt  lumbar_lordosis
_angle  sacral_slope  \
0           63.027817    22.552586              39.609117     40.475232
1           39.056951    10.060991              25.015378     28.995960
2           68.832021    22.218482              50.092194     46.613539
3           69.297008    24.652878              44.311238     44.644130
4           49.712859     9.652075              28.317406     40.060784
..                ...          ...                    ...          ...
305         47.903565    13.616688              36.000000     34.286877
306         53.936748    20.721496              29.220534     33.215251
307         61.446597    22.694968              46.170347     38.751628
308         45.252792     8.693157              41.583126     36.559635
309         33.841641     5.073991              36.641233     28.767649

     pelvic_radius  degree_spondylolisthesis  pelvic_slop  Direct_tilt  \
0        98.672917                 -0.254400     0.744503      12.5661
1       114.405425                  4.564259     0.415186      12.8874
2       105.985135                 -3.530317     0.474889      26.8343
3       101.868495                 11.211523     0.369345      23.5603
4       108.168725                  7.918501     0.543360      35.4940
..             ...                       ...          ...          ...
305     117.449062                 -4.245395     0.129744       7.8433
306     114.365845                 -0.421010     0.047913      19.1986
307     125.670725                 -2.707880     0.081070      16.2059
308     118.545842                  0.214750     0.159251      14.7334
309     123.945244                 -0.199249     0.674504      19.3825

     thoracic_slope  cervical_tilt  sacrum_angle  scoliosis_slope     label
0           14.5386       15.30468    -28.658501          43.5123  Abnormal
1           17.5323       16.78486    -25.530607          16.1102  Abnormal
2           17.4861       16.65897    -29.031888          19.2221  Abnormal
3           12.7074       11.42447    -30.470246          18.8329  Abnormal
4           15.9546        8.87237    -16.378376          24.9171  Abnormal
..              ...            ...           ...              ...       ...
305         14.7484        8.51707    -15.728927          11.5472    Normal
306         18.1972        7.08745      6.013843          43.8693    Normal
307         13.5565        8.89572      3.564463          18.4151    Normal
308         16.0928        9.75922      5.767308          33.7192    Normal
309         17.6963       13.72929      1.783007          40.6049    Normal

[310 rows x 13 columns]>
```

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

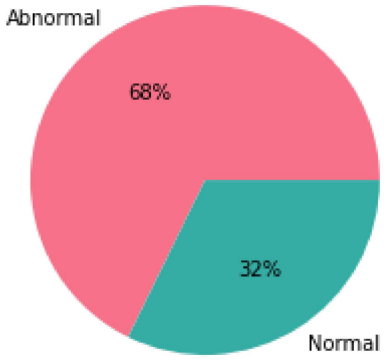
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 310 entries, 0 to 309
Data columns (total 13 columns):
 #   Column                    Non-Null Count  Dtype  
---  ------                    --------------  -----  
 0   pelvic_incidence          310 non-null    float64
 1   pelvic tilt               310 non-null    float64
 2   lumbar_lordosis_angle     310 non-null    float64
 3   sacral_slope              310 non-null    float64
 4   pelvic_radius             310 non-null    float64
 5   degree_spondylolisthesis  310 non-null    float64
 6   pelvic_slop               310 non-null    float64
 7   Direct_tilt               310 non-null    float64
 8   thoracic_slope            310 non-null    float64
 9   cervical_tilt             310 non-null    float64
 10  sacrum_angle              310 non-null    float64
 11  scoliosis_slope           310 non-null    float64
 12  label                     310 non-null    object 
dtypes: float64(12), object(1)
memory usage: 31.6+ KB
```

In [ ]:
```
dataset.describe(include='all')
```

Out[ ]:

	pelvic_incidence	pelvic tilt	lumbar_lordosis_angle	sacral_slope	pelvic_radius	degree_spond
count	310.000000	310.000000	310.000000	310.000000	310.000000	
unique	NaN	NaN	NaN	NaN	NaN	
top	NaN	NaN	NaN	NaN	NaN	
freq	NaN	NaN	NaN	NaN	NaN	
mean	60.496653	17.542822	51.930930	42.953831	117.920655	
std	17.236520	10.008330	18.554064	13.423102	13.317377	
min	26.147921	-6.554948	14.000000	13.366931	70.082575	
25%	46.430294	10.667069	37.000000	33.347122	110.709196	
50%	58.691038	16.357689	49.562398	42.404912	118.268178	
75%	72.877696	22.120395	63.000000	52.695888	125.467674	
max	129.834041	49.431864	125.742385	121.429566	163.071041	

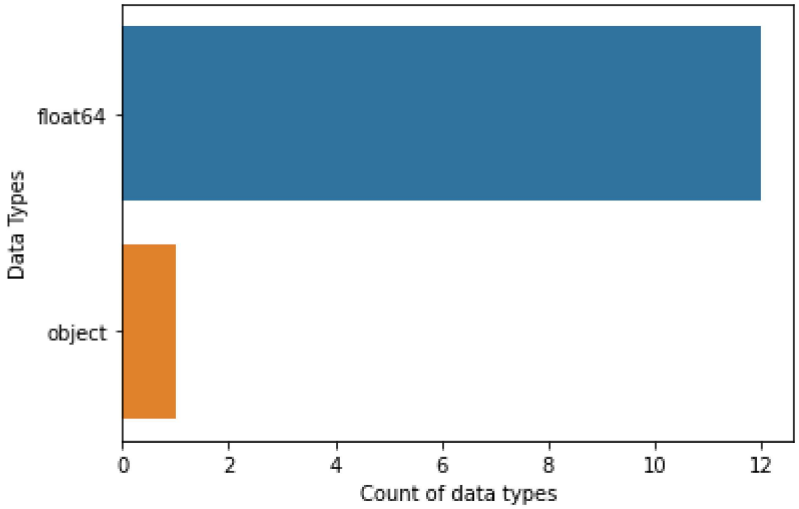
In [ ]:
```
plt.pie(list(dataset.label.value_counts().to_dict().values()),
        labels=list(dataset.label.value_counts().to_dict().keys()),
        colors=sns.color_palette('husl',2),
        autopct='%.0f%%')
plt.show()
```



Our dataset it's unbalanced. We expect that this may affect our model perform

Let's verify the data types present in our dataset. In order to run our MLP model we need to have only float numbers

In [ ]:
```
sns.countplot(y=dataset.dtypes, data=dataset)
plt.xlabel("Count of data types")
plt.ylabel("Data Types")
plt.show()
```



And now we will replace the object values by float values

In [ ]:
```
dataset['label'].head
```

Out[ ]:
```
<bound method NDFrame.head of 0      Abnormal
1      Abnormal
2      Abnormal
3      Abnormal
4      Abnormal
        ...
305      Normal
306      Normal
307      Normal
308      Normal
309      Normal
Name: label, Length: 310, dtype: object>
```

In [ ]:
```
dataset['label_val'] = preprocessing.LabelEncoder().fit_transform(
    dataset['label']
)
```

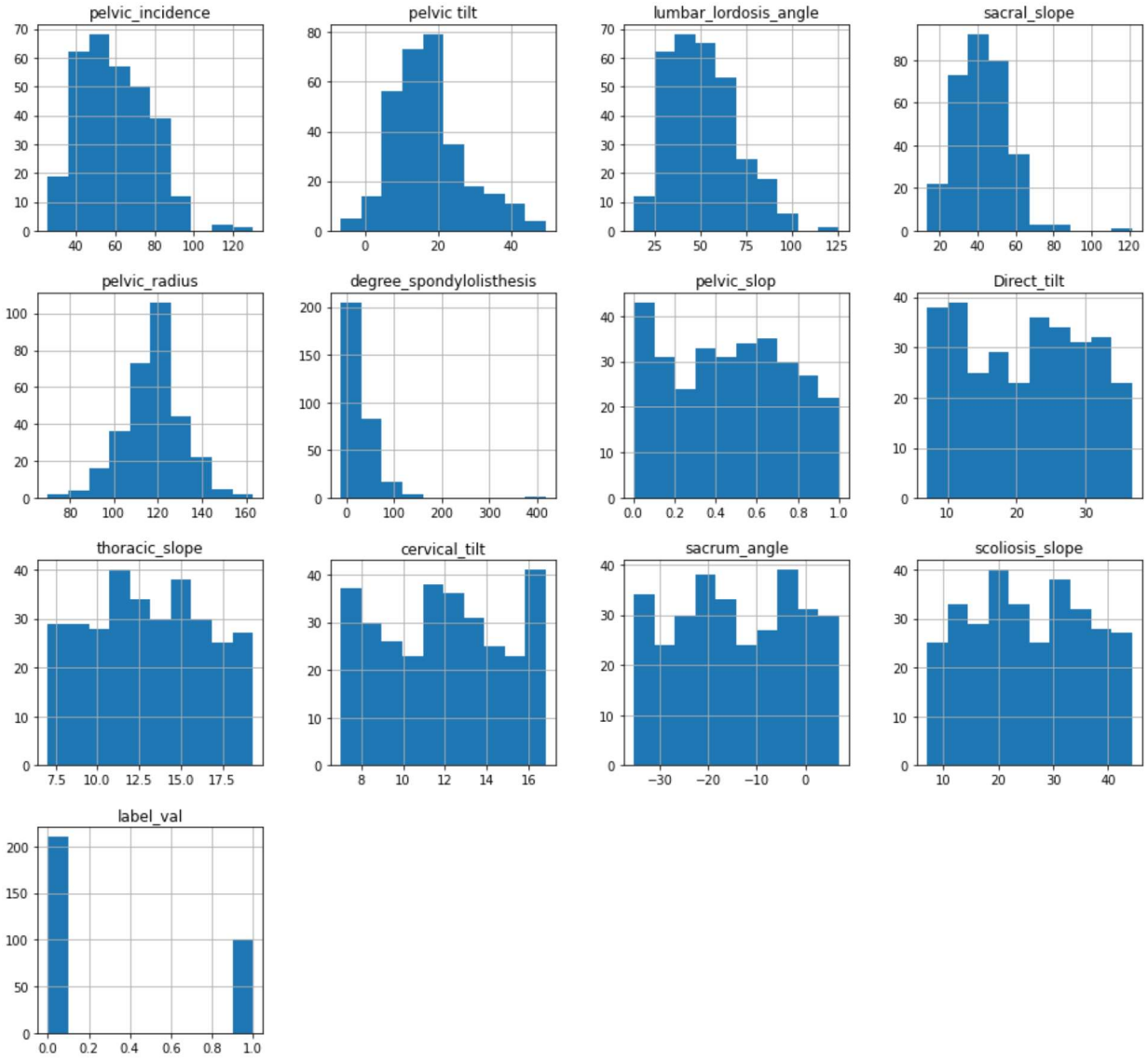
In [ ]:
```
dataset['label_val'].head
```

Out[ ]:
```
<bound method NDFrame.head of 0      0
1      0
2      0
3      0
4      0
      ..
305    1
306    1
307    1
308    1
309    1
Name: label_val, Length: 310, dtype: int32>
```

So in the `label val` column we have 1 for normal and 0 for abnormal

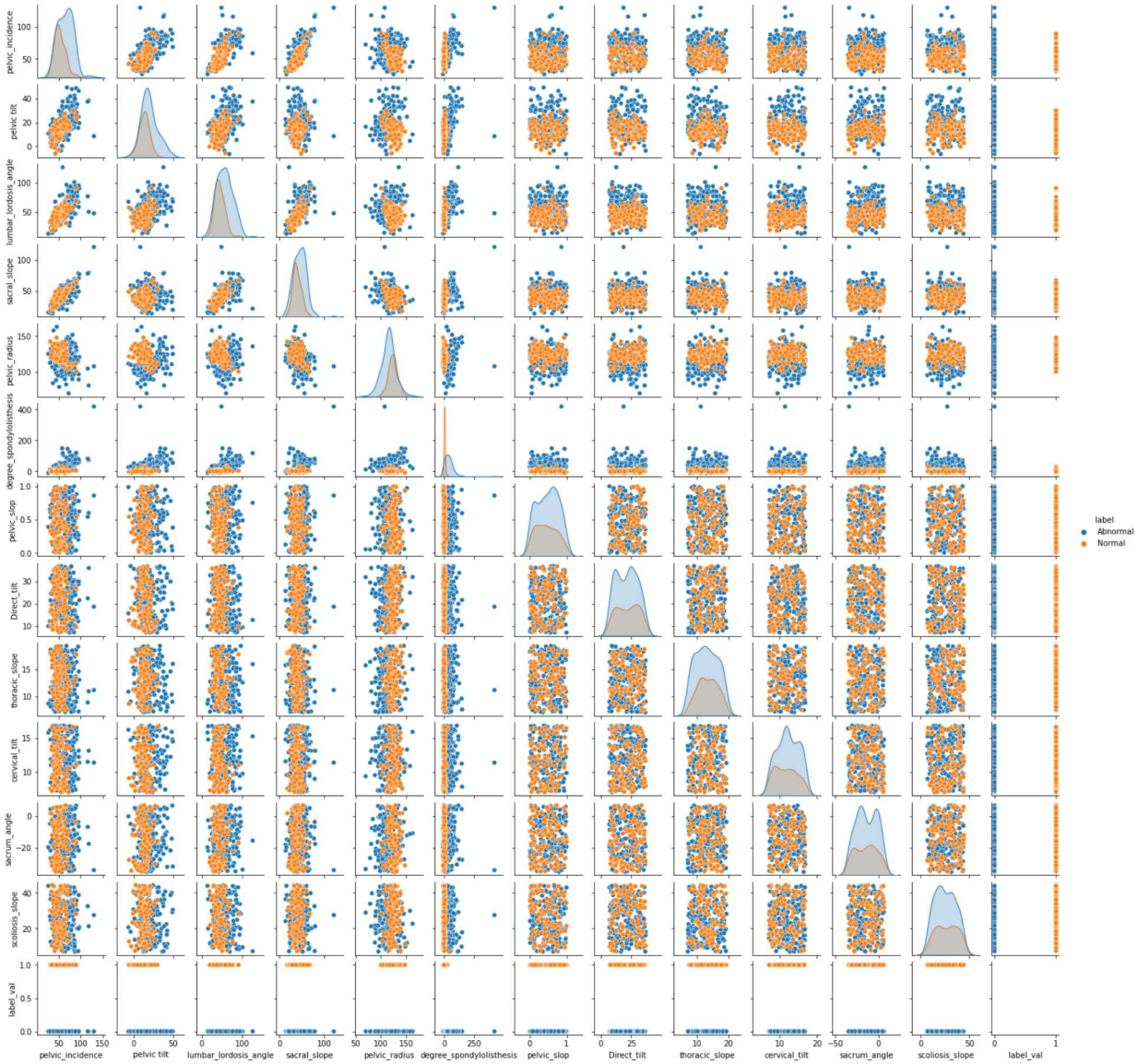
Now we will check the distribution of the features

In [ ]:
```
dataset.hist(figsize=(16,15))
plt.title("Features distribution")
plt.show()
```



In [ ]:
```
sns.pairplot(dataset,height=1.5, hue='label')
```

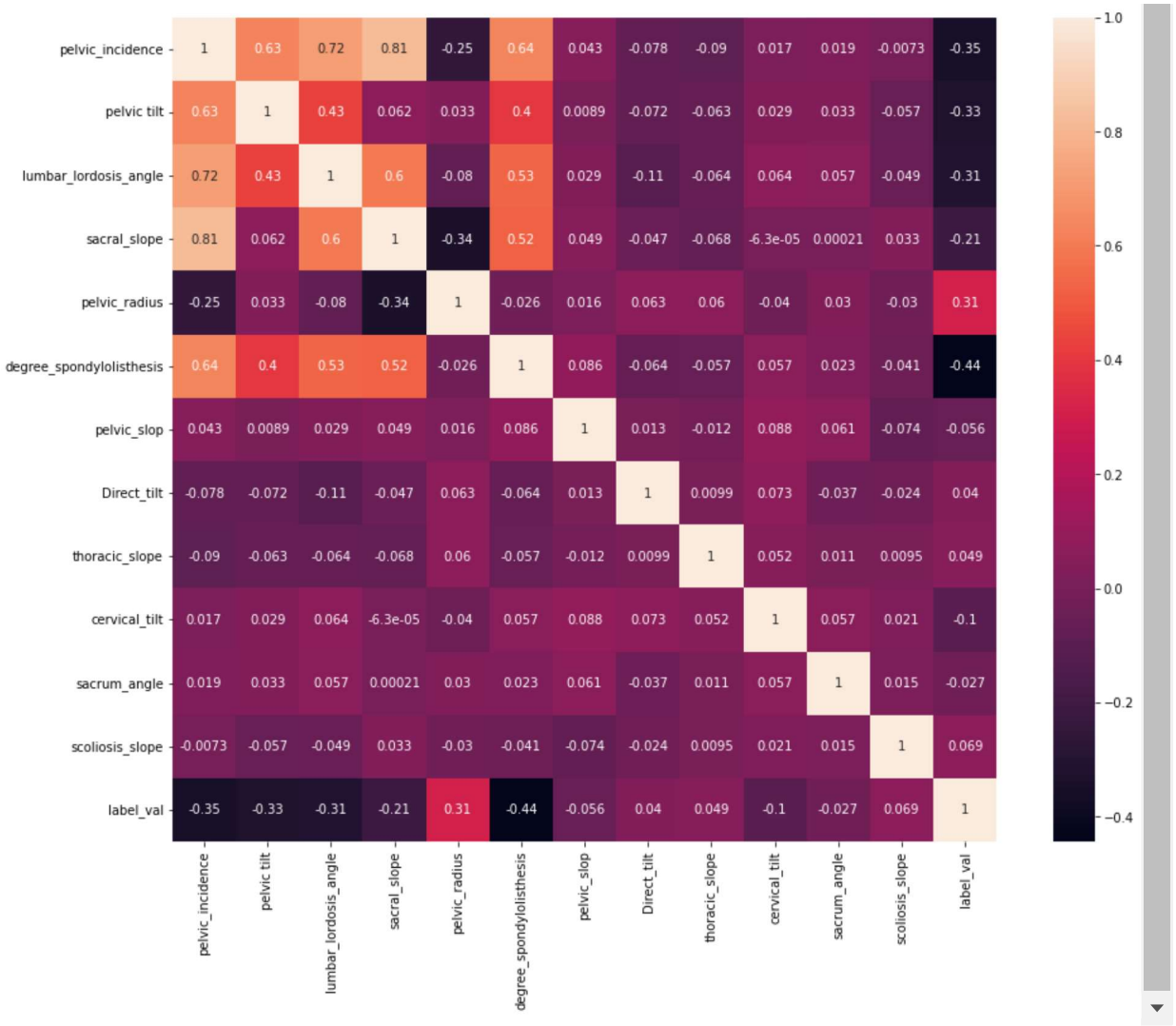
Out[ ]:
```
<seaborn.axisgrid.PairGrid at 0x193c5066310>
```



Now we can verify the relation between features

In [ ]:
```
plt.subplots(figsize=(16,12))
sns.heatmap(
    dataset.corr(),
    annot=True,
    square=True,
    cbar=True
)
```

Out[ ]:
```
<AxesSubplot:>
```



In [ ]:
```
dataset.isna().sum()
```

Out[ ]:
```
pelvic_incidence            0
pelvic tilt                 0
lumbar_lordosis_angle       0
sacral_slope                0
pelvic_radius               0
degree_spondylolisthesis    0
pelvic_slop                 0
Direct_tilt                 0
thoracic_slope              0
cervical_tilt               0
sacrum_angle                0
scoliosis_slope             0
label                       0
label_val                   0
dtype: int64
```

Now we can export our clean dataset

In [ ]:
```
dataset.to_csv('dataset_spine_clean.csv')
```

In [ ]:
```
```