data_analysis

February 18, 2022

[ ]:
```
# try:
#   %load_ext autotime
# except:
#   print("Console warning-- Autotime is jupyter platform specific")
```

0.1 Notebook synopsis

This Notebook takes tabular data and location of image files, checks distribution of classes, and applies weights to each class to be trained. In addition it tries to take takes as close to an equal distribution of a test data set to properly match test results through all classes. During analysis it notifies and suggests of any skewness of a dataset and suggests different ways of handling the dataset. Lastly a custom split function is written to split data according to parameters and prepare datasets for training, testing and validation.

Skills

- Dataset import
- Dataframe manipulation and analysis
- Custom function creation

[ ]:
```
from comet_ml import Experiment
import math
from pyforest import *
lazy_imports()
from pydicom import dcmread
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
df = pd.read_csv('/media/gyasis/Drive 2/Data/vinbigdata/train.csv')
df.head(10)
```

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<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
```

[ ]:
```
                           image_id          class_name  class_id rad_id  \
0  50a418190bc3fb1ef1633bf9678929b3          No finding        14    R11
1  21a10246a5ec7af151081d0cd6d65dc9          No finding        14     R7
2  9a5094b2563a1ef3ff50dc5c7ff71345        Cardiomegaly         3    R10
```

```
3  051132a778e61a86eb147c7c6f564dfe  Aortic enlargement         0    R10
4  063319de25ce7edb9b1c6b8881290140          No finding        14    R10
5  1c32170b4af4ce1a3030eb8167753b06  Pleural thickening        11     R9
6  0c7a38f293d5f5e4846aa4ca6db4daf1                ILD         5    R17
7  47ed17dcb2cbeec15182ed335a8b5a9e         Nodule/Mass         8     R9
8  d3637a1935a905b3c326af31389cb846  Aortic enlargement         0    R10
9  afb6230703512afc370f236e8fe98806  Pulmonary fibrosis        13     R9

    x_min   y_min   x_max   y_max
0     NaN     NaN     NaN     NaN
1     NaN     NaN     NaN     NaN
2   691.0  1375.0  1653.0  1831.0
3  1264.0   743.0  1611.0  1019.0
4     NaN     NaN     NaN     NaN
5   627.0   357.0   947.0   433.0
6  1347.0   245.0  2188.0  2169.0
7   557.0  2352.0   675.0  2484.0
8  1329.0   743.0  1521.0   958.0
9  1857.0  1607.0  2126.0  2036.0

<IPython.core.display.Javascript object>
```

[ ]:
```
import seaborn as sns
plt.xticks(rotation=90)
sns.set_theme(style="dark")
sns.histplot(x=df.class_name, data=df)
```

```
<IPython.core.display.Javascript object>

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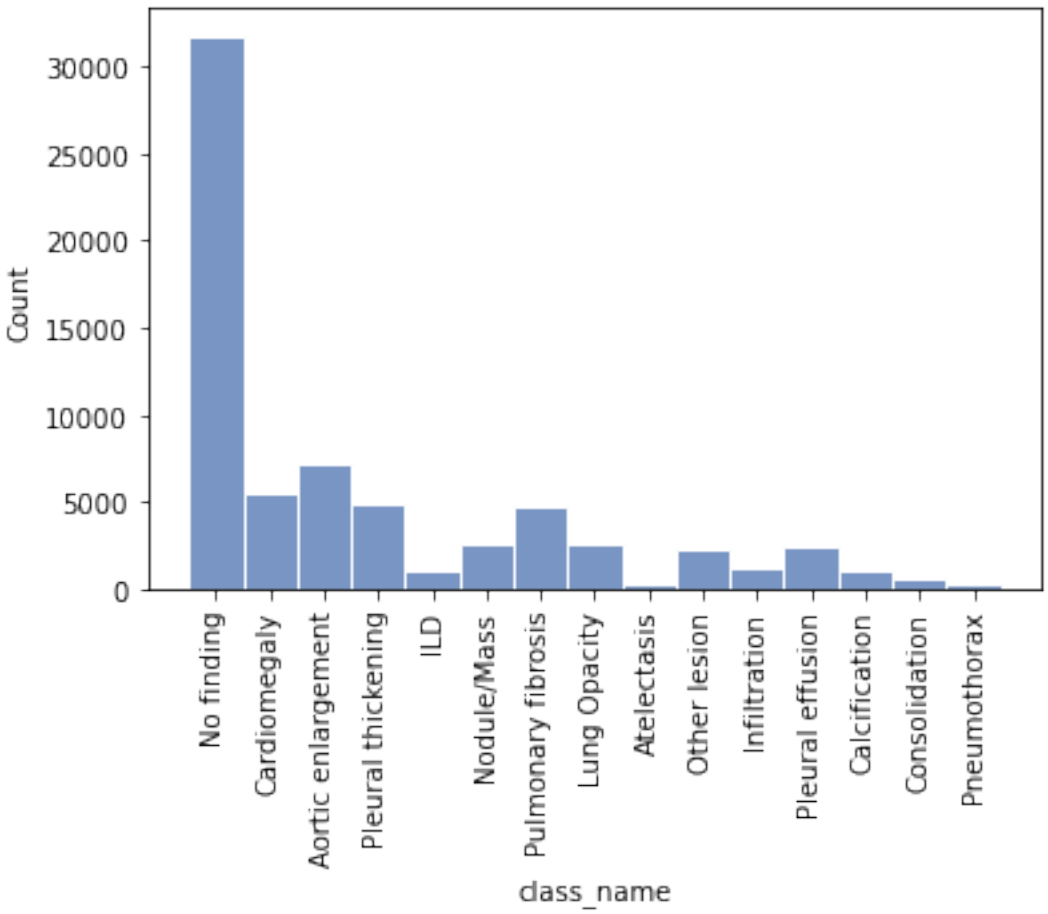
```

[ ]:
```
<AxesSubplot:xlabel='class_name', ylabel='Count'>
```




```
<IPython.core.display.Javascript object>
```

[ ]:
```
df=df[['class_name','class_id','image_id']]
```

```
<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
```

[ ]:
```
def build_path(x):
    path_ = '/media/gyasis/Drive 2/Data/vinbigdata/train/'
    filetype = '.dicom'
    x = (path_+x+filetype)
    return x

df['imagepath'] = df['image_id'].apply(lambda x: build_path(x))
df=df[['class_name', 'class_id','imagepath']]
df.head()
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
            class_name  class_id  \
0          No finding        14
1          No finding        14
2        Cardiomegaly         3
3  Aortic enlargement         0
4          No finding        14

                                             imagepath
0  /media/gyasis/Drive 2/Data/vinbigdata/train/50…
1  /media/gyasis/Drive 2/Data/vinbigdata/train/21…
2  /media/gyasis/Drive 2/Data/vinbigdata/train/9a…
3  /media/gyasis/Drive 2/Data/vinbigdata/train/05…
4  /media/gyasis/Drive 2/Data/vinbigdata/train/06…
```

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<IPython.core.display.Javascript object>
```

[ ]:
```
pd.get_dummies(df['class_name'])
```

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<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
```

[ ]:
```
       Aortic enlargement  Atelectasis  Calcification  Cardiomegaly  \
0                       0            0              0             0
1                       0            0              0             0
2                       0            0              0             1
3                       1            0              0             0
4                       0            0              0             0
…                     …          …              …             …
67909                   0            0              0             0
67910                   0            0              0             0
67911                   0            0              0             0
67912                   0            0              0             1
67913                   0            0              0             0

       Consolidation  ILD  Infiltration  Lung Opacity  No finding  \
0                  0    0             0             0           1
1                  0    0             0             0           1
2                  0    0             0             0           0
3                  0    0             0             0           0
4                  0    0             0             0           1
…                …  …          …             …         …
67909              0    0             0             0           1
67910              0    0             0             0           1
67911              0    0             0             0           1
67912              0    0             0             0           0
67913              0    0             0             0           1
```

```
       Nodule/Mass  Other lesion  Pleural effusion  Pleural thickening  \
0                0             0                 0                   0
1                0             0                 0                   0
2                0             0                 0                   0
3                0             0                 0                   0
4                0             0                 0                   0
…              …             …                 …                   …
67909            0             0                 0                   0
67910            0             0                 0                   0
67911            0             0                 0                   0
67912            0             0                 0                   0
67913            0             0                 0                   0

       Pneumothorax  Pulmonary fibrosis
0                 0                   0
1                 0                   0
2                 0                   0
3                 0                   0
4                 0                   0
…               …                   …
67909             0                   0
67910             0                   0
67911             0                   0
67912             0                   0
67913             0                   0

[67914 rows x 15 columns]
```

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<IPython.core.display.Javascript object>
```

[ ]:
```
df1 = pd.get_dummies(df['class_id'].astype(str))
```

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<IPython.core.display.Javascript object>
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```

[ ]:
```
#mapping for later use
disease= ["Aortic enlargement"
,"Atelectasis"
,"Calcification"
,"Cardiomegaly"
,"Consolidation"
,"ILD"
,"Infiltration"
,"Lung Opacity"
,"Nodule/Mass"
```

```
,"Other lesion"
,"Pleural effusion"
,"Pleural thickening"
,"Pneumothorax"
,"Pulmonary fibrosis"
,"No_finding"]

#map df.class_id to disease
# df['class_id_test'] = df['class_id'].map(lambda x: disease[x])
df.head()
df1.columns = df1.columns.astype("int").map(lambda x: disease[x])
sample_array = np.array(df1)
```

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```

[ ]:
```
def get_class_frequencies():
  positive_freq = sample_array.sum(axis=0) / sample_array.shape[0]
  negative_freq = np.ones(positive_freq.shape) - positive_freq
  return positive_freq, negative_freq

p,n = get_class_frequencies()
```

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[ ]:
```
data = pd.DataFrame({"Class": df1.columns, "Label": "Positive", "Value": p})
data = data.append([{"Class": df1.columns[l], "Label": "Negative", "Value": v}␣
 ↪for l, v in enumerate(n)], ignore_index=True)
plt.xticks(rotation=90)
f = sns.barplot(x="Class", y="Value",hue="Label", data=data)
```

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<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
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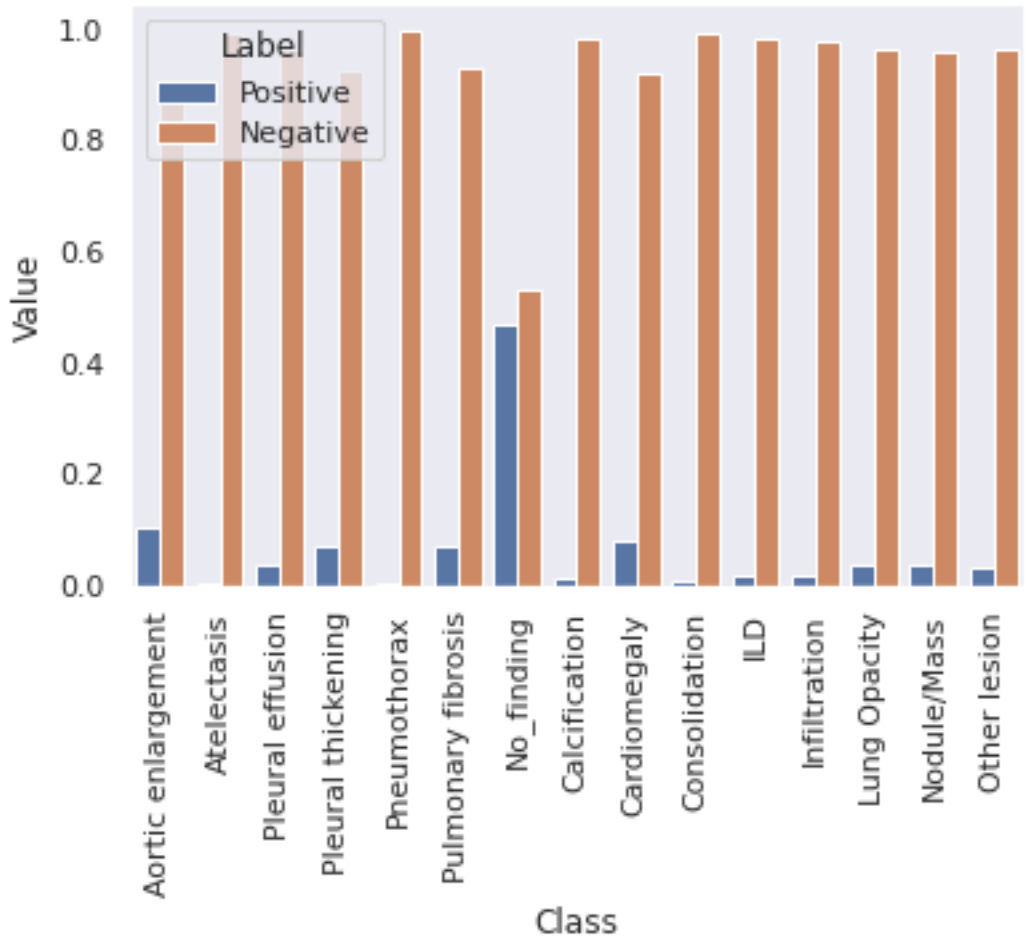
<IPython.core.display.Javascript object>
```




```
<IPython.core.display.Javascript object>
```

[ ]:
```
pos_weights = n
neg_weights = p
pos_contribution = p * pos_weights
neg_contribution = n * neg_weights
print(p)
print(n)

print("Weight to be added:  ",pos_contribution)
```

```
<IPython.core.display.Javascript object>
[0.1054569  0.00410814 0.03645787 0.07129605 0.00332774 0.06854257
 0.46850428 0.01413552 0.07990989 0.00818682 0.0147245  0.01836146
 0.03656094 0.03798922 0.03243808]
[0.8945431  0.99589186 0.96354213 0.92870395 0.99667226 0.93145743
 0.53149572 0.98586448 0.92009011 0.99181318 0.9852755  0.98163854
```

```
 0.96343906 0.96201078 0.96756192]
Weight to be added:   [0.09433574 0.00409126 0.0351287  0.06621292 0.00331666
0.06384448
 0.24900802 0.01393571 0.0735243  0.0081198  0.01450769 0.01802431
 0.03522424 0.03654604 0.03138585]
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
data = pd.DataFrame({"Class": df1.columns, "Label": "Positive", "Value":␣
 ↪pos_contribution})
data = data.append([{"Class": df1.columns[l], "Label": "Negative", "Value": v}␣
 ↪for l, v in enumerate(neg_contribution)], ignore_index=True)
plt.xticks(rotation=90)
g = sns.barplot(x="Class", y="Value",hue="Label", data=data)
```

```
<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
```

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<IPython.core.display.Javascript object>
```

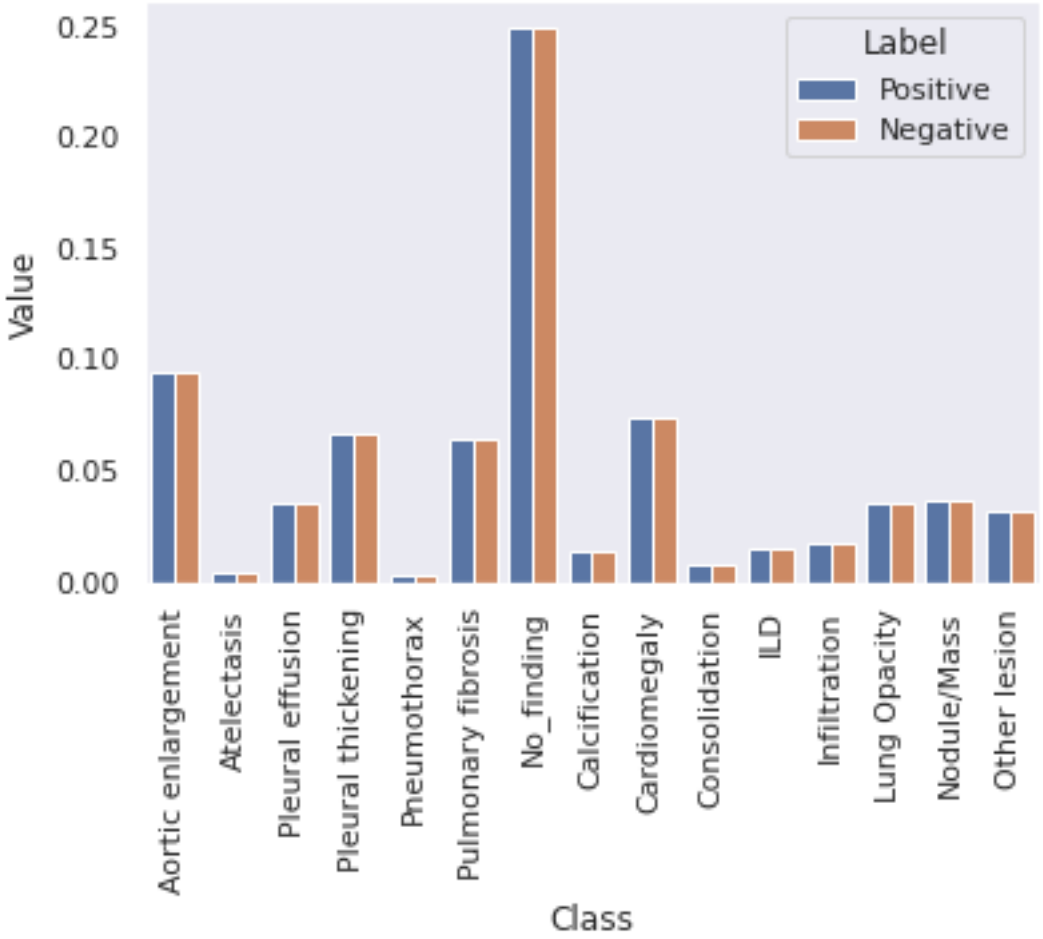

```
<IPython.core.display.Javascript object>
```

[ ]:
```
from sklearn.model_selection import train_test_split

X, y = df.imagepath, df.class_id
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)
```

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<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>
```

[ ]:
```
print(f"Numbers of train instances by class: {np.bincount(y_train)}")
print(f"Numbers of test instances by class: {np.bincount(y_test)}")
```

```
<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

Numbers of train instances by class: [ 5805   223   764  4361   453   805  1003
2006  2026  1763  1963  3918
   180  3704 25357]

<IPython.core.display.Javascript object>

Numbers of test instances by class: [1357   56  196 1066  103  195  244  477
554  440  513  924   46  951
 6461]

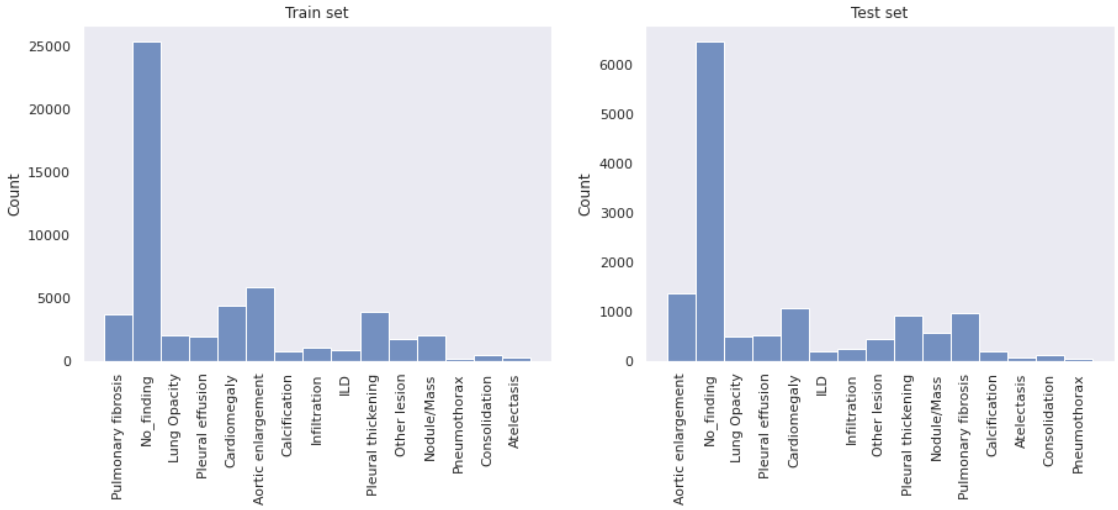
<IPython.core.display.Javascript object>
```

[ ]:
```
f, (ax1, ax2) = plt.subplots(1, 2, figsize=(15, 5))
ax1.tick_params(axis='x', labelrotation=90)
ax2.tick_params(axis='x', labelrotation=90)
g1 = sns.histplot(x=(list(map(lambda y_train: disease[y_train], y_train))),␣
↪ax=ax1 )
g2= sns.histplot(x=(list(map(lambda y_test: disease[y_test], y_test))), ax=ax2,␣
↪)
g2.set_title("Test set")
g1.set_title("Train set")
```

```
<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>
```

[ ]:
```
Text(0.5, 1.0, 'Train set')
```



<IPython.core.display.Javascript object>

[ ]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42, stratify=y)
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

[ ]:
```
print(len(df))
```

<IPython.core.display.Javascript object>

67914

<IPython.core.display.Javascript object>

[ ]:
```
print(len(df)/len(df.class_id.unique()))
```

<IPython.core.display.Javascript object>

4527.6

<IPython.core.display.Javascript object>

[ ]:
```
proposed_split = (len(df)*0.20)
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

[ ]:
```
proposed_split / len(df.class_id.unique())
```

<IPython.core.display.Javascript object>

[ ]: 905.5200000000001

<IPython.core.display.Javascript object>

[ ]:
```
print(len(df.class_id.unique()))
```

<IPython.core.display.Javascript object>

15

<IPython.core.display.Javascript object>

[ ]:
```
def prepare_class_split(dataframe, target="class_name", p_split=0.30,␣
↪test_target_split=0.50, verbose=False, helpers="dataframe"):
  dataframe = dataframe.copy()
  df_len = len(dataframe)
  class_amount = len(dataframe[target].unique())
  df_split = int(df_len * p_split)
  class_list = list(dataframe[target].unique())

  proposed_split = df_split/class_amount

  class_counts = dataframe[target].value_counts()
  # print(df_len,df_split,proposed_split,class_counts)

  outcomes = []
  total = []

  print("Total of Test Split is {} and Proposed split is {}".
↪format(df_split,proposed_split))


  for lable in class_list:
    print('-----------------------------------------------------' + '\n')
    percent_split = class_counts[lable] / df_len
    proposed_percent_split = class_counts[lable] / df_split
    total.append(class_counts[lable])
    if class_counts[lable] >= proposed_split * 2:
      if verbose == True:
        print(f"Class {lable} has {class_counts[lable]} instances, which is␣
↪greater than the proposed split of {proposed_split}")
        print(f"Class {lable} has {percent_split} of the total data, which is␣
↪greater than the proposed split of {proposed_percent_split}")
        print("Class {} is OK!!".format(lable))
      outcomes.append("OK!!")
```

```
   elif class_counts[lable] < proposed_split * 2 and class_counts[lable] >␣
↪proposed_split:
     if verbose == True:
       print("Class {} fails equity threshold, look to augment training␣
↪dataset ".format(lable))
     outcomes.append("Augment??")
   elif class_counts[lable] < proposed_split:
     if verbose == True:
       print("Class {} fails equity threshold, look to remove training dataset␣
↪".format(lable))
       print("Class {} is {} and Proposed split is {}".
↪format(lable,class_counts[lable],proposed_split))
       print("Class " + lable + " is less than the proposed split")
       print("Class {} is {} and the proposed split is {}".
↪format(lable,class_counts[lable],proposed_split))
       print("Both augmentation and weights may be necessary!!")
     outcomes.append("Weights/Augment/Split!!")
   print('-----------------------------------------------------' + '\n'+'\n')
 outcomes_df = pd.DataFrame()
 outcomes_df["Class"] = class_list
 outcomes_df["Split"] = math.floor(proposed_split)
 outcomes_df["Set_Number"] = total
 outcomes_df["Outcome"] = outcomes
 outcomes_df.set_index("Class", inplace=True)


 # Change dataframe based on outcomes
 for i, out in enumerate(outcomes_df.Outcome):
   print(i)

   if out == "Augment??":
     outcomes_df.iat[i,0] = outcomes_df.Split[i] * 0.80
     # print(outcomes_df.iat[i,1])
   elif out == "Weights/Augment/Split!!":
     outcomes_df.iat[i, 0] = math.floor(outcomes_df.Set_Number[i]*0.50)
     # outcomes_df = outcomes_df.append(outcomes_df.at[i,"Set Number"] == math.
↪floor(temp/0.5))
     # dataframe = dataframe.append(dataframe.loc[dataframe[target] == i])
   elif out == "OK!!":
     pass
   else:
     print("Error")


 if helpers == "dataframe":
   return outcomes_df
```

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<IPython.core.display.Javascript object>
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<IPython.core.display.Javascript object>
```

[ ]:
```
test = prepare_class_split(df, target="class_name", p_split=0.20,␣
 ↪test_target_split=0.50, verbose=True, helpers="dataframe")
df['class'] = df['class_id'].apply(lambda x:disease[x])
```

```
<IPython.core.display.Javascript object>
```

```
Total of Test Split is 13582 and Proposed split is 905.4666666666667
-----------------------------------------------------

Class No finding has 31818 instances, which is greater than the proposed split
of 905.4666666666667
Class No finding has 0.46850428483081547 of the total data, which is greater
than the proposed split of 2.3426594021499043
Class No finding is OK!!
-----------------------------------------------------


-----------------------------------------------------

Class Cardiomegaly has 5427 instances, which is greater than the proposed split
of 905.4666666666667
Class Cardiomegaly has 0.07990988603233501 of the total data, which is greater
than the proposed split of 0.3995729642173465
Class Cardiomegaly is OK!!
-----------------------------------------------------


-----------------------------------------------------

Class Aortic enlargement has 7162 instances, which is greater than the proposed
split of 905.4666666666667
Class Aortic enlargement has 0.10545690137526872 of the total data, which is
greater than the proposed split of 0.5273155647180091
Class Aortic enlargement is OK!!
-----------------------------------------------------


-----------------------------------------------------

Class Pleural thickening has 4842 instances, which is greater than the proposed
split of 905.4666666666667
Class Pleural thickening has 0.07129605088788762 of the total data, which is
greater than the proposed split of 0.35650125165660435
Class Pleural thickening is OK!!
-----------------------------------------------------
```

```
--------------------------------------------------

Class ILD fails equity threshold, look to augment training dataset
--------------------------------------------------


--------------------------------------------------

Class Nodule/Mass has 2580 instances, which is greater than the proposed split
of 905.4666666666667
Class Nodule/Mass has 0.03798922166269105 of the total data, which is greater
than the proposed split of 0.18995729642173464
Class Nodule/Mass is OK!!
--------------------------------------------------


--------------------------------------------------

Class Pulmonary fibrosis has 4655 instances, which is greater than the proposed
split of 905.4666666666667
Class Pulmonary fibrosis has 0.06854256854256854 of the total data, which is
greater than the proposed split of 0.3427330290089825
Class Pulmonary fibrosis is OK!!
--------------------------------------------------


--------------------------------------------------

Class Lung Opacity has 2483 instances, which is greater than the proposed split
of 905.4666666666667
Class Lung Opacity has 0.03656094472421003 of the total data, which is greater
than the proposed split of 0.18281549109115006
Class Lung Opacity is OK!!
--------------------------------------------------


--------------------------------------------------

Class Atelectasis fails equity threshold, look to remove training dataset
Class Atelectasis is 279 and Proposed split is 905.4666666666667
Class Atelectasis is less than the proposed split
Class Atelectasis is 279 and the proposed split is 905.4666666666667
Both augmentation and weights may be necessary!!
--------------------------------------------------
```

```
--------------------------------------------------

Class Other lesion has 2203 instances, which is greater than the proposed split
of 905.4666666666667
Class Other lesion has 0.03243808345849162 of the total data, which is greater
than the proposed split of 0.16219997054925636
Class Other lesion is OK!!
--------------------------------------------------


--------------------------------------------------

Class Infiltration fails equity threshold, look to augment training dataset
--------------------------------------------------


--------------------------------------------------

Class Pleural effusion has 2476 instances, which is greater than the proposed
split of 905.4666666666667
Class Pleural effusion has 0.03645787319256707 of the total data, which is
greater than the proposed split of 0.18230010307760272
Class Pleural effusion is OK!!
--------------------------------------------------


--------------------------------------------------

Class Calcification fails equity threshold, look to augment training dataset
--------------------------------------------------


--------------------------------------------------

Class Consolidation fails equity threshold, look to remove training dataset
Class Consolidation is 556 and Proposed split is 905.4666666666667
Class Consolidation is less than the proposed split
Class Consolidation is 556 and the proposed split is 905.4666666666667
Both augmentation and weights may be necessary!!
--------------------------------------------------


--------------------------------------------------

Class Pneumothorax fails equity threshold, look to remove training dataset
Class Pneumothorax is 226 and Proposed split is 905.4666666666667
Class Pneumothorax is less than the proposed split
Class Pneumothorax is 226 and the proposed split is 905.4666666666667
```

```
Both augmentation and weights may be necessary!!
--------------------------------------------------


<IPython.core.display.Javascript object>

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

<IPython.core.display.Javascript object>
```

[ ]:
```python
def custom_split(dataframe1,dataframe2):
  dataframe2 = dataframe2.copy(deep=True)
  dataframe3 = dataframe2.copy(deep=True)
  dataframe2 = dataframe2.sample(frac=1)


  test_idx = []
  temp = list(dataframe1.index)
  print(temp)
  for i, class_ in enumerate(temp):
    total = dataframe1.iat[i, 0]
    print(total)
    for index, row in dataframe2.iterrows():
      if row["class_name"] == class_ and total > 0 :
        total -= 1
        test_idx.append(index)
        dataframe2.drop(index, inplace=True)

        # print("drop")
    print("Finished ", class_)

  print(len(dataframe2))

  dataframe3 = dataframe3.loc[dataframe3.index[test_idx]]
```

```
  dataframe2 = dataframe2.sample(frac=1)
  dataframe3 = dataframe3.sample(frac=1)
  print(len(dataframe3))
  return dataframe2, dataframe3
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
train_df, test_df= custom_split(test, df)
```

```
<IPython.core.display.Javascript object>
```

```
['No finding', 'Cardiomegaly', 'Aortic enlargement', 'Pleural thickening',
'ILD', 'Nodule/Mass', 'Pulmonary fibrosis', 'Lung Opacity', 'Atelectasis',
'Other lesion', 'Infiltration', 'Pleural effusion', 'Calcification',
'Consolidation', 'Pneumothorax']
905
Finished  No finding
905
Finished  Cardiomegaly
905
Finished  Aortic enlargement
905
Finished  Pleural thickening
724
Finished  ILD
905
Finished  Nodule/Mass
905
Finished  Pulmonary fibrosis
905
Finished  Lung Opacity
139
Finished  Atelectasis
905
Finished  Other lesion
724
Finished  Infiltration
905
Finished  Pleural effusion
724
Finished  Calcification
278
Finished  Consolidation
113
Finished  Pneumothorax
57067
10847
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
train_df.head()
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
             class_name  class_id  \
25473        No finding        14
38910        No finding        14
34413        No finding        14
61409  Pleural effusion        10
52312      Infiltration         6

                                                imagepath             class
25473  /media/gyasis/Drive 2/Data/vinbigdata/train/70…        No_finding
38910  /media/gyasis/Drive 2/Data/vinbigdata/train/46…        No_finding
34413  /media/gyasis/Drive 2/Data/vinbigdata/train/63…        No_finding
61409  /media/gyasis/Drive 2/Data/vinbigdata/train/bf…  Pleural effusion
52312  /media/gyasis/Drive 2/Data/vinbigdata/train/d9…      Infiltration
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
train_df["class_name"].value_counts()
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
No finding            30913
Aortic enlargement     6257
Cardiomegaly           4522
Pleural thickening     3937
Pulmonary fibrosis     3750
Nodule/Mass            1675
Lung Opacity           1578
Pleural effusion       1571
Other lesion           1298
Infiltration            523
Consolidation           278
ILD                     276
Calcification           236
Atelectasis             140
Pneumothorax            113
Name: class_name, dtype: int64
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
test_df.head()
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
               class_name  class_id  \
29261          No finding        14
18245        Other lesion         9
64472          No finding        14
22349          No finding        14
7595   Pulmonary fibrosis        13

                                                  imagepath                class
29261  /media/gyasis/Drive 2/Data/vinbigdata/train/03…          No_finding
18245  /media/gyasis/Drive 2/Data/vinbigdata/train/da…        Other lesion
64472  /media/gyasis/Drive 2/Data/vinbigdata/train/63…          No_finding
22349  /media/gyasis/Drive 2/Data/vinbigdata/train/72…          No_finding
7595   /media/gyasis/Drive 2/Data/vinbigdata/train/1a…  Pulmonary fibrosis
```

<IPython.core.display.Javascript object>

[ ]:
```
test_df["class_name"].value_counts()
```

<IPython.core.display.Javascript object>

[ ]:
```
Pleural effusion      905
No finding            905
Aortic enlargement    905
Other lesion          905
Pleural thickening    905
Cardiomegaly          905
Pulmonary fibrosis    905
Nodule/Mass           905
Lung Opacity          905
Infiltration          724
ILD                   724
Calcification         724
Consolidation         278
Atelectasis           139
Pneumothorax          113
Name: class_name, dtype: int64
```

<IPython.core.display.Javascript object>

[ ]:
```
train_dummies = pd.get_dummies(train_df.class_name)
test_dummies = pd.get_dummies(test_df.class_name)
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

[ ]:
```
train_dummies.head(20)
```

```
<IPython.core.display.Javascript object>
```

[ ]:

	Aortic enlargement	Atelectasis	Calcification	Cardiomegaly	\
25473	0	0	0	0	
38910	0	0	0	0	
34413	0	0	0	0	
61409	0	0	0	0	
52312	0	0	0	0	
45451	0	0	0	1	
7601	0	0	0	0	
4057	0	0	0	0	
54490	0	0	0	1	
7857	1	0	0	0	
95	0	0	0	0	
46370	0	0	0	0	
47622	0	0	0	0	
59379	0	0	0	0	
45189	1	0	0	0	
58967	0	0	0	0	
18140	0	0	0	0	
9980	0	0	0	0	
27559	1	0	0	0	
27653	0	0	0	0	

	Consolidation	ILD	Infiltration	Lung Opacity	No finding	\
25473	0	0	0	0	1	
38910	0	0	0	0	1	
34413	0	0	0	0	1	
61409	0	0	0	0	0	
52312	0	0	1	0	0	
45451	0	0	0	0	0	
7601	0	0	0	1	0	
4057	0	0	0	0	0	
54490	0	0	0	0	0	
7857	0	0	0	0	0	
95	0	0	0	0	0	
46370	0	0	0	0	1	
47622	0	0	0	0	1	
59379	0	0	0	0	0	
45189	0	0	0	0	0	
58967	0	0	0	0	1	
18140	0	0	0	0	1	
9980	0	0	0	0	1	
27559	0	0	0	0	0	
27653	0	0	0	0	0	

	Nodule/Mass	Other lesion	Pleural effusion	Pleural thickening	\
25473	0	0	0	0	
38910	0	0	0	0	
34413	0	0	0	0	
61409	0	0	1	0	
52312	0	0	0	0	
45451	0	0	0	0	
7601	0	0	0	0	
4057	0	0	0	1	
54490	0	0	0	0	
7857	0	0	0	0	
95	0	0	0	0	
46370	0	0	0	0	
47622	0	0	0	0	
59379	0	0	0	1	
45189	0	0	0	0	
58967	0	0	0	0	
18140	0	0	0	0	
9980	0	0	0	0	
27559	0	0	0	0	
27653	0	0	0	1	

	Pneumothorax	Pulmonary fibrosis
25473	0	0
38910	0	0
34413	0	0
61409	0	0
52312	0	0
45451	0	0
7601	0	0
4057	0	0
54490	0	0
7857	0	0
95	0	1
46370	0	0
47622	0	0
59379	0	0
45189	0	0
58967	0	0
18140	0	0
9980	0	0
27559	0	0
27653	0	0

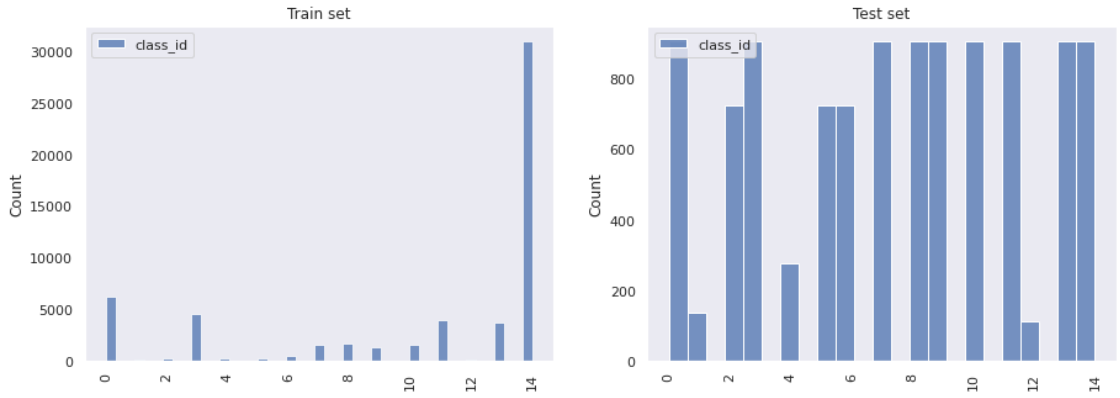
<IPython.core.display.Javascript object>

[ ]:
```
f, (ax1, ax2) = plt.subplots(1, 2, figsize=(15, 5))
ax1.tick_params(axis='x', labelrotation=90)
ax2.tick_params(axis='x', labelrotation=90)
g1 = sns.histplot(train_df, ax=ax1)
g2= sns.histplot(test_df, ax=ax2)
g2.set_title("Test set")
g1.set_title("Train set")
# g1.set_xticklabels(disease)
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
Text(0.5, 1.0, 'Train set')
```




```
<IPython.core.display.Javascript object>
```

[ ]:
```
def get_class_frequencies(dataframe,target):
  try:
    dataframe = pd.get_dummies(dataframe[target].astype(str))
  except:
    dataframe = pd.get_dummies(dataframe[target])

  f, (ax1, ax2) = plt.subplots(1, 2, figsize=(15, 5))
  sample_array = np.array(dataframe)
  positive_freq = sample_array.sum(axis=0) / sample_array.shape[0]
  negative_freq = np.ones(positive_freq.shape) - positive_freq
  data = pd.DataFrame({"Class": dataframe.columns, "Label": "Positive", "Value":
 ↪ positive_freq})
  data = data.append([{"Class": dataframe.columns[l], "Label": "Negative",␣
 ↪"Value": v} for l, v in enumerate(negative_freq)], ignore_index=True)
  plt.xticks(rotation=90)
  sns.barplot(x="Class", y="Value",hue="Label", data=data, ax=ax1)
  pos_weights = negative_freq
```

```
    neg_weights = positive_freq
    pos_contribution = positive_freq * pos_weights
    neg_contribution = negative_freq * neg_weights

    # print("Weight to be added:  ",pos_contribution)

    data1 = pd.DataFrame({"Class": dataframe.columns, "Label": "Positive",␣
↪"Value": pos_contribution})
    data1 = data1.append([{"Class": dataframe.columns[l], "Label": "Negative",␣
↪"Value": v} for l, v in enumerate(neg_contribution)], ignore_index=True)
    ax1.tick_params(axis='x', labelrotation=90)
    ax2.tick_params(axis='x', labelrotation=90)
    sns.barplot(x="Class", y="Value",hue="Label", data=data1, ax=ax2)

    return pos_contribution
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
weights = get_class_frequencies(df, "class_name")
```

```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```

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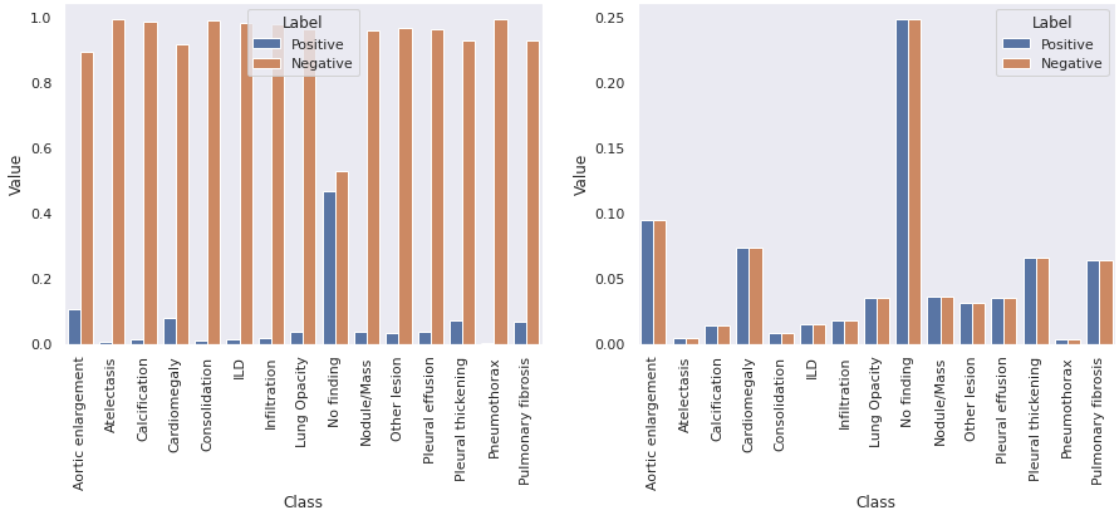
```
<IPython.core.display.Javascript object>
```

```
<IPython.core.display.Javascript object>
```



<IPython.core.display.Javascript object>

[ ]:
```
X, y = test_df.imagepath, test_df.class_id
X_valid, X_test, y_valid, y_test = train_test_split(X, y, test_size=0.5,␣
↪random_state=42, stratify=y)
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

[ ]:
```
valid = pd.concat([X_valid, y_valid], axis=1, join='inner')
#reset index
valid = valid.reset_index(drop=True)
test = pd.concat([X_test, y_test], axis=1, join='inner')
test = test.reset_index(drop=True)
train = train_df[['imagepath', 'class_id']]
train = train.reset_index(drop=True)
```

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>

<IPython.core.display.Javascript object>