Divergents_Eval3_EDA&Preprocessing(1)

December 14, 2022

0.1 Project Title: Machine learning model to foresee which web pages will receive extortionate, enduring traffic.

1 Project Description:

Aim is to choose websites that would attract steady online traffic so that their adverts can be seen for a long time.

The agency has generated a dataset of **raw HTML, metadata, and a binary label for each webpage** to help with this. The binary label indicates whether or not the website was chosen for ad placement. In order to determine which online pages are worthy of posing an advertisement on, this assignment aims to select the pertinent, high-quality websites from a pool of user-curated web pages.

Building large-scale, end-to-end machine learning models that can categorise websites as “relevant” or “irrelevant” based on factors like the **alchemy category and its score, meta-data about the web pages, and a one-line summary of each page’s content is required for the challenge**. By having you translate the dataset’s textual properties into some kind of numerical data and then build your machine learning models using this numerical data

2 Dataset Description

This dataset includes rows of web pages, their descriptions, meta-statistics, and a label designating whether or not those pages are “ad-worthy” in binary form, with values 0 and 1, respectively.

1. train.csv - The training dataset which contains the target variable ‘label’.
2. test.csv - The test dataset which does not contain the target variable ‘label’.
3. sample_submission.csv - A sample submission file in the correct format. Note that final predictions should be probability scores and not the class labels!
4. page_information.zip - A .zip file containing the raw HTML content for each URL. Each URL’s raw content is stored in a tab-delimited text file, named with the link_id as indicated in train.csv and test.csv

#Column Description

1. **link:** URL of the webpage to be classified
2. **link_id**: 3.**page_description**: Description of the webpage
3. **alchemy_category**: Alchemy category (per the publicly available Alchemy API found at www.alchemyapi.com)

4. **alchemy_category_score**: Alchemy category score (per the publicly available Alchemy API found at www.alchemyapi.com)
5. **avg_link_size:** Average number of words in a webpage
6. **common_word_link_ratio_1**: # of links sharing at least 1 word with 1 other links / # of links
7. **common_word_link_ratio_2**: # of links sharing at least 1 word with 2 other links / # of links
8. **common_word_link_ratio_3**: # of links sharing at least 1 word with 3 other links / # of links
9. **common_word_link_ratio_4**: # of links sharing at least 1 word with 4 other links / # of links 11.**compression_ratio**: Measure of redundancy computed by finding the 12. compression achieved on this web page via gzip
10. **embed_ratio**: Count of tags or simply the number of usages.
11. **frame_based**: Binary indication of whether a webpage has frameset markup
12. **frame_tag_ratio:** Ratio of frameset markups over total markups
13. **has_domain_link:** Binary indication of whether the webpage contains in URL with a domain
14. **html_ratio:** Ratio of tags vs text on the page
15. **image_ratio**: Ratio of tags vs text in the page
16. **is_news:** This is true(1) if this webpage is news
17. **lengthy_link_domain:** This is true (1) if the webpage's text contains more than 30 alphanumeric characters
18. **link_word_score:** Percentage of words on the webpage that are also in the hyperlink text
19. **news_front_page:** True (1) if StumbleUpon's news classifier determines that this webpage is front-page news
20. **non_markup_alphanumeric_characters:** Number of alpha-numeric characters in webpage's text
21. **count_of_links**: Number of markups
22. **number_of_words_in_url:** Number of words in URL
23. **parametrized_link_ratio:** A link is parametrized if its URL contains parameters or has an attached onClick event
24. **spelling_mistakes_ratio:** Ratio of words not found in the wiki (considered to be a spelling mistake)
25. label: The label value of 0 represents that the webpage is not "ad-worthy", and a label value of 1 represents that the webpage is "ad-worthy". This is available only for train.csv.

[2]:

```python
#Importing necessary libraries
import numpy as np
import pandas as pd
from sklearn.preprocessing import LabelEncoder
import matplotlib.pyplot as plt
import seaborn as sns
```

[3]:

```python
df = pd.read_csv("/content/train.csv")
```

[4]:

```python
df.head()
```

```
[4]:                                                   link  link_id  \
     0  http://www.cbc.ca/stevenandchris/2012/11/peggy…     7426
     1  http://www.instructables.com/id/Vegan-Baked-Po…     8430
     2  http://www.oled-info.com/toshiba-shows-ultra-t…     3469
     3  http://www.collegehumor.com/videos/playlist/64…     1326
     4  http://sports.yahoo.com/nba/blog/ball_dont_lie…     3580

                                     page_description    alchemy_category  \
     0  {"url":"cbc ca stevenandchris 2012 11 peggy ks…  arts_entertainment
     1  {"title":"Vegan Potato Spinach Balls Fat Free …          recreation
     2  {"title":"Toshiba shows an ultra thin flexible…            business
     3  {"url":"collegehumor videos playlist 6472556 e…  arts_entertainment
     4  {"title":"Shaq admits to taking performance en…              sports

       alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
     0               0.471752       1.725275                  0.469388
     1               0.885088       0.847134                  0.134783
     2               0.716379       2.613333                  0.546667
     3               0.562999       1.434286                  0.369792
     4               0.893246       1.781333                  0.530713

        common_word_link_ratio_2  common_word_link_ratio_3  \
     0                  0.204082                  0.112245
     1                  0.043478                  0.021739
     2                  0.293333                  0.160000
     3                  0.088542                  0.000000
     4                  0.208845                  0.071253

        common_word_link_ratio_4  …  is_news  lengthy_link_domain  \
     0                  0.010204  …        1                    0
     1                  0.000000  …        1                    1
     2                  0.120000  …        1                    1
     3                  0.000000  …        1                    0
     4                  0.019656  …        1                    1

        link_word_score  news_front_page  non_markup_alphanumeric_characters  \
     0               39                0                                1236
     1               15                0                                3887
     2               57                0                                 780
     3               35                0                                2388
     4               39                0                                5020

        count_of_links  number_of_words_in_url parametrized_link_ratio  \
     0              98                       8                0.061224
     1             230                       8                0.330435
     2              75                       8                0.160000
     3             192                       6                0.005208
```

```
4             407                      11                 0.299754

   spelling_mistakes_ratio  label
0                 0.076125      1
1                 0.130742      1
2                 0.076471      0
3                 0.090909      0
4                 0.093023      0

[5 rows x 27 columns]
```

[5]:
```
df.replace("?", np.nan, inplace=True)
```

[6]:
```
df.isna().sum()
```

[6]:
```
link                                     0
link_id                                  0
page_description                         0
alchemy_category                      1397
alchemy_category_score                1397
avg_link_size                            0
common_word_link_ratio_1                 0
common_word_link_ratio_2                 0
common_word_link_ratio_3                 0
common_word_link_ratio_4                 0
compression_ratio                        0
embed_ratio                              0
frame_based                              0
frame_tag_ratio                          0
has_domain_link                          0
html_ratio                               0
image_ratio                              0
is_news                               1688
lengthy_link_domain                      0
link_word_score                          0
news_front_page                        727
non_markup_alphanumeric_characters       0
count_of_links                           0
number_of_words_in_url                   0
parametrized_link_ratio                  0
spelling_mistakes_ratio                  0
label                                    0
dtype: int64
```

[7]:
```
df[df.isna().any(axis=1)]
```

```
[7]:                                                   link  link_id  \
     6     http://wallpaper-pics-you-love.group.stumbleup…     4092
     12    http://www.chow.com/recipes/13499-creamy-carro…     1472
     13    http://funnyfoto.org/how-everything-seems-livi…     1037
     15    http://www.namelymarly.com/2011/06/gluten-free…     4662
     16    http://www.pauladeen.com/recipes/recipe_view/c…     9297
     …                                                  …       …
     4426  http://www.lifeinpleasantville.com/homemade-fl…     7035
     4430                       http://www.innovadiscs.com/      591
     4431  http://www.dailygifblog.com/2010/07/pythagorea…     7143
     4433  http://tastykitchen.com/blog/2011/11/coconut-g…     9697
     4435  http://www.huffingtonpost.com/2012/10/12/pumpk…     2308

                                       page_description   alchemy_category  \
     6     {"title":"Espn Sports Moments You Love ","body…               NaN
     12    {"title":"Creamy Carrot Casserole Recipe CHOW …               NaN
     13    {"title":"How everything seems living in New O…               NaN
     15    {"title":"Gluten Free Caramel Pecan Rolls Name…               NaN
     16    {"title":"Chocolate Gooey Butter Cookies Paula…               NaN
     …                                                  …                 …
     4426  {"url":"lifeinpleasantville homemade flour tor…               NaN
     4430  {"url":"innovadiscs","title":"Innova Disc Golf…        recreation
     4431  {"title":"Your daily gif blog Pythagorean Anim…  computer_internet
     4433  {"title":"Coconut Granola Tasty Kitchen Blog "…               NaN
     4435  {"url":"huffingtonpost 2012 10 12 pumpkin seed…   culture_politics

          alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
     6                       NaN       1.063830                  0.528169
     12                      NaN       1.804000                  0.436090
     13                      NaN       2.400000                  0.000000
     15                      NaN       2.490000                  0.643564
     16                      NaN       2.336207                  0.526316
     …                       …            …                        …
     4426                    NaN       1.551724                  0.400000
     4430               0.479557       0.513447                  0.141148
     4431               0.167697       1.016667                  0.201550
     4433                    NaN       1.704698                  0.506579
     4435                0.84594       3.097222                  0.678241

           common_word_link_ratio_2  common_word_link_ratio_3  \
     6                     0.028169                  0.007042
     12                    0.086466                  0.007519
     13                    0.000000                  0.000000
     15                    0.435644                  0.287129
     16                    0.210526                  0.090226
     …                        …                        …
     4426                  0.177778                  0.111111
```

```
4430                  0.074163                  0.033493
4431                  0.093023                  0.046512
4433                  0.177632                  0.046053
4435                  0.266204                  0.085648

      common_word_link_ratio_4  …  is_news  lengthy_link_domain  \
6                     0.000000  …      NaN                    0
12                    0.003759  …        1                    1
13                    0.000000  …        1                    0
15                    0.247525  …        1                    0
16                    0.037594  …      NaN                    1
…                        …  …      …                   …
4426                  0.088889  …        1                    0
4430                  0.026316  …      NaN                    1
4431                  0.015504  …      NaN                    0
4433                  0.000000  …        1                    1
4435                  0.048611  …      NaN                    1

      link_word_score  news_front_page  non_markup_alphanumeric_characters  \
6                  22              NaN                                2778
12                 25                0                                6611
13                 44                0                                  75
15                  9                0                               10664
16                 18                0                                5472
…               …              …                                  …
4426               13                0                                4279
4430               16              NaN                                5753
4431               10              NaN                                6442
4433               11                0                                8767
4435               45              NaN                                7637

      count_of_links  number_of_words_in_url parametrized_link_ratio  \
6                142                       1                0.007042
12               266                       4                0.406015
13                 5                       8                0.200000
15               101                       5                0.069307
16               133                       7                0.323308
…              …                     …                     …
4426              90                       3                0.177778
4430             418                       0                0.076555
4431             129                       2                0.248062
4433             152                       3                0.026316
4435             432                       3                0.229167

      spelling_mistakes_ratio  label
6                    0.076087      0
12                   0.068306      1
```

```
13                    0.227273     0
15                    0.084783     1
16                    0.048544     1
…                        …    …
4426                  0.092527     1
4430                  0.033019     1
4431                  0.112360     0
4433                  0.080820     1
4435                  0.129252     1

[2282 rows x 27 columns]
```

[8]:
```
df.columns
```

[8]:
```
Index(['link', 'link_id', 'page_description', 'alchemy_category',
       'alchemy_category_score', 'avg_link_size', 'common_word_link_ratio_1',
       'common_word_link_ratio_2', 'common_word_link_ratio_3',
       'common_word_link_ratio_4', 'compression_ratio', 'embed_ratio',
       'frame_based', 'frame_tag_ratio', 'has_domain_link', 'html_ratio',
       'image_ratio', 'is_news', 'lengthy_link_domain', 'link_word_score',
       'news_front_page', 'non_markup_alphanumeric_characters',
       'count_of_links', 'number_of_words_in_url', 'parametrized_link_ratio',
       'spelling_mistakes_ratio', 'label'],
      dtype='object')
```

[9]:
```
df.dtypes
```

[9]:
```
link                                   object
link_id                                 int64
page_description                       object
alchemy_category                       object
alchemy_category_score                 object
avg_link_size                         float64
common_word_link_ratio_1              float64
common_word_link_ratio_2              float64
common_word_link_ratio_3              float64
common_word_link_ratio_4              float64
compression_ratio                     float64
embed_ratio                           float64
frame_based                             int64
frame_tag_ratio                       float64
has_domain_link                         int64
html_ratio                            float64
image_ratio                           float64
is_news                                object
lengthy_link_domain                     int64
link_word_score                         int64
```

```
news_front_page                           object
non_markup_alphanumeric_characters         int64
count_of_links                             int64
number_of_words_in_url                     int64
parametrized_link_ratio                  float64
spelling_mistakes_ratio                  float64
label                                      int64
dtype: object
```

[9]:

```

```

2.1 1. 'alchemy_category' column

[10]:

```
df["alchemy_category"].value_counts()
```

[10]:

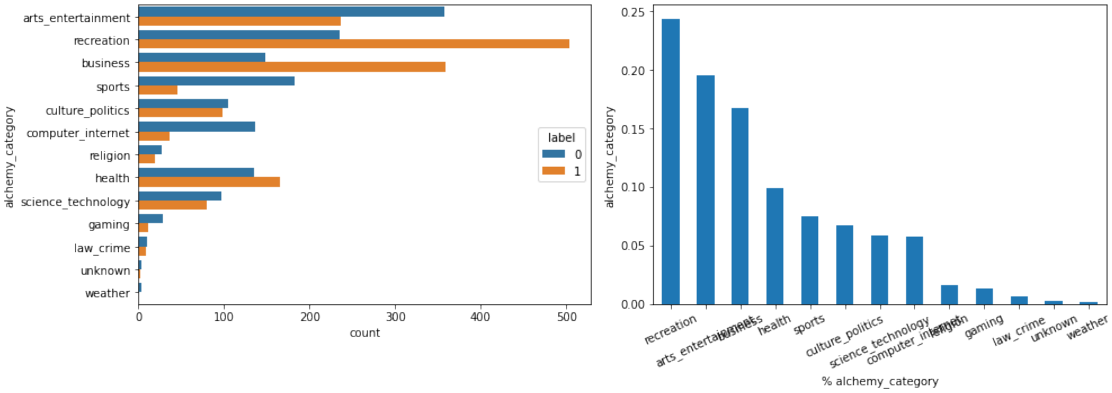
```
recreation            739
arts_entertainment    593
business              508
health                301
sports                228
culture_politics      204
science_technology    177
computer_internet     173
religion               47
gaming                 41
law_crime              19
unknown                 6
weather                 4
Name: alchemy_category, dtype: int64
```

[11]:

```
import seaborn as sns
import matplotlib.pyplot as plt

stats_target = df['alchemy_category'].value_counts(normalize=True)
print(stats_target)

plt.figure(figsize=(14,5))
plt.subplot(1,2,1)
sns.countplot(data=df,y='alchemy_category',hue='label')
plt.subplot(1,2,2)
stats_target.plot.bar(rot=25)
plt.ylabel('alchemy_category')
plt.xlabel('% alchemy_category')
plt.tight_layout()
plt.show()
```

```
recreation            0.243092
```

```
arts_entertainment    0.195066
business              0.167105
health                0.099013
sports                0.075000
culture_politics      0.067105
science_technology    0.058224
computer_internet     0.056908
religion              0.015461
gaming                0.013487
law_crime             0.006250
unknown               0.001974
weather               0.001316
Name: alchemy_category, dtype: float64
```



3 2. “Page_Description” & “link”

```
[12]: #Page_description column
      df["page_description"]
```

```
[12]: 0       {"url":"cbc ca stevenandchris 2012 11 peggy ks…
      1       {"title":"Vegan Potato Spinach Balls Fat Free …
      2       {"title":"Toshiba shows an ultra thin flexible…
      3       {"url":"collegehumor videos playlist 6472556 e…
      4       {"title":"Shaq admits to taking performance en…
                                    …
      4432    {"title":"VIDEO Fauja Singh 100 Finishes a Mar…
      4433    {"title":"Coconut Granola Tasty Kitchen Blog "…
      4434    {"title":"Parallels H Sphere Account has been …
      4435    {"url":"huffingtonpost 2012 10 12 pumpkin seed…
      4436    {"title":"Bike Parkour Is The Only Parkour Bro…
      Name: page_description, Length: 4437, dtype: object
```

```
[13]: #Converting page_description column into lowercase
      df['pd_lower']= df['page_description'].apply(lambda x: x.lower())
```

```
[14]: df['pd_lower']
```

```
[14]: 0       {"url":"cbc ca stevenandchris 2012 11 peggy ks…
      1       {"title":"vegan potato spinach balls fat free …
      2       {"title":"toshiba shows an ultra thin flexible…
      3       {"url":"collegehumor videos playlist 6472556 e…
      4       {"title":"shaq admits to taking performance en…
                                    …
      4432    {"title":"video fauja singh 100 finishes a mar…
      4433    {"title":"coconut granola tasty kitchen blog "…
      4434    {"title":"parallels h sphere account has been …
      4435    {"url":"huffingtonpost 2012 10 12 pumpkin seed…
      4436    {"title":"bike parkour is the only parkour bro…
      Name: pd_lower, Length: 4437, dtype: object
```

```
[15]: # #Retaining only alphabetic words
      # import re
      # re.sub("[\W,\d]"," ",df['pd_lower'][0])
```

```
[16]: #Removing special characters using regex
      import re
      def special_rem(text):
        spec = re.sub("[\W,\d]"," ",text)
        return spec

      #applying the above function to column to df['pd_lower']
      df['pd_spec_rem'] = df["pd_lower"].apply(lambda x: special_rem(x))
      df['link_new'] = df["link"].apply(lambda x: special_rem(x))
```

```
[17]: df['pd_spec_rem']
```

```
[17]: 0         url   cbc ca stevenandchris         peggy ks…
      1         title   vegan potato spinach balls fat free …
      2         title   toshiba shows an ultra thin flexible…
      3         url   collegehumor videos playlist         e…
      4         title   shaq admits to taking performance en…
                                    …
      4432      title   video fauja singh     finishes a mar…
      4433      title   coconut granola tasty kitchen blog  …
      4434      title   parallels h sphere account has been …
      4435      url   huffingtonpost            pumpkin seed…
      4436      title   bike parkour is the only parkour bro…
      Name: pd_spec_rem, Length: 4437, dtype: object
```

[18]:

```
df['link_new']
```

[18]:

```
0       http   www cbc ca stevenandchris          peggy…
1       http   www instructables com id Vegan Baked Po…
2       http   www oled info com toshiba shows ultra t…
3       http   www collegehumor com videos playlist    …
4       http   sports yahoo com nba blog ball_dont_lie…
                               …
4432    http   newsfeed time com            a     year…
4433    http   tastykitchen com blog          coconut g…
4434    http   ecoble com              offbeat off the…
4435    http   www huffingtonpost com             pumpk…
4436    http   www bromygod com             bike parkou…
Name: link_new, Length: 4437, dtype: object
```

[19]:

```
#FRequency distribution plot of page_description column post tokenization
import nltk
from nltk.probability import FreqDist
def frequency_dist(s):
    for i in range(len(s)):
        tokens = nltk.tokenize.word_tokenize(s[i])
        #print(tokens)

        fdist1 = FreqDist(tokens)
        fdist1.plot(20, cumulative=True)
pd_freq_dist = list(df['pd_spec_rem'][0:3])
link_dist = list(df['link_new'][0:3])
```

[20]:

```
#frequency_dist(pd_freq_dist)
```

[21]:

```
#frequency_dist(link_dist)
```

[22]:

```
import nltk
nltk.download('punkt')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data…
[nltk_data]   Unzipping tokenizers/punkt.zip.
```

[22]:

```
True
```

[23]:

```
# import re
# def tokenization(text):
#     tokens = re.split('W+',text)
#     return tokens
# #applying function to the column
# df['pd_tokens']= df['pd_spec_rem'].apply(lambda x: tokenization(x))
# df['link_tokens'] = df['link_new'].apply(lambda x: tokenization(x))
```

[24]:
```python
#page_description
l = []
for ele in df['pd_spec_rem']:
    l.append(ele.split())
```

[25]:
```python
#link
l1 = []
for ele in df['link_new']:
    l1.append(ele.split())
```

[26]:
```python
#page_description
for ele in df['pd_spec_rem']:
    ele = ele.split()

print(df['pd_spec_rem'][0])
```

```
  url   cbc ca stevenandchris         peggy ks sexy mood boosting cupcakes html
title   steven and chris peggy k s sexy mood boosting cupcakes peggy k s sexy
mood boosting cupcakes from steven and chris   body   if you re ready to give
your libido a boost with a sweet treat then you re going to want to try peggy k
s sexy mood boosting cupcakes wet ingredients   tablespoon ground chia mixed
with     cup water      ripe banana  tablespoons coconut oil u  bd cup walnut
butter   teaspoon s vanilla extract  cup almond milk  u  bd cup coconut sugar
dry ingredients   cup brown rice flour u  bd cup cooked quinoa   tablespoon maca
powder    cup cocoa powder  teaspoon baking powder  teaspoon non aluminum baking
soda u  bd teaspoon saltchopped walnuts raspberry frosting   cups raw cashews
cup maple syrup   cups raspberries almond milk for the cupcakes preheat the oven
to     f place ground chia in a small bowl add warm water and mix with a fork
set aside for gel to form mash banana in large bowl then add oil nut butter
vanilla and milk and stir to mix add the rest of the ingredients and mix until
well incorporated grease rubber mini muffin tins with coconut oil drop in batter
and bake       minutes until toothpick comes out clean for the frosting add all
ingredients to high power blender and blend until smooth add a splash of almond
milk just to blend the ingredients but frosting should be thick transfer to
piping bag and pipe onto cupcakes whether the subject is home decor  health
beauty  cooking  relationships  finance or entertaining  steven and chris want
to help you add some fabulous to your life  if you re ready to give your libido
a boost with a sweet treat  then you re going to want to try peggy k s sexy mood
boosting cupcakes  wet ingredients    tablespoon ground chia  mixed with
cup water        ripe banana
```

[27]:
```python
#link
for ele in df['link_new']:
    ele = ele.split()

print(df['link_new'][0])
```

```
http   www cbc ca stevenandchris         peggy ks sexy mood boosting cupcakes
```

html

[28]:
```
def unusual_words(text):
    text_vocab = set(w.lower() for w in text if w.isalpha())
    english_vocab = set(w.lower() for w in nltk.corpus.words.words())
    unusual = text_vocab.difference(english_vocab)
    return sorted(unusual)
```

[29]:
```
nltk.download('words')
#unusual_words(l[56])
```

```
[nltk_data] Downloading package words to /root/nltk_data…
[nltk_data]   Unzipping corpora/words.zip.
```

[29]: True

[30]:
```
from nltk.corpus import stopwords
```

[31]:
```
#stopwords.words('english')
```

[32]:
```
def relevant_content(text):
    new_list = []
    stopwords = nltk.corpus.stopwords.words('english')
    for i in range(len(l)):
        a = []
        for word in l[i]:
            if word not in stopwords:
                a.append(word)
        new_list.append(set(a))
    return new_list
```

[33]:
```
nltk.download('stopwords')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data…
[nltk_data]   Unzipping corpora/stopwords.zip.
```

[33]: True

[34]:
```
r_c = relevant_content(l)
print(r_c[87])
```

```
{'teaspoon', 'title', 'seeded', 'spray', 'fat', 'shredded', 'cup', 'copyright',
'occasionally', 'enchiladas', 'make', 'teaspoons', 'warmed', 'cooked',
'traditionally', 'minutes', 'ahead', 'filling', 'along', 'stir', 'flour',
'stick', 'dish', 'great', 'f', 'x', 'large', 'wine', 'tortillas', 'grain',
'salsa', 'part', 'cooking', 'turn', 'heat', 'oven', 'soften', 'juices',
'leaves', 'begin', 'uncovered', 'recipe', 'preheat', 'cheese', 'oil', 'wrap',
'gently', 'clove', 'baked', 'lay', 'coat', 'oregano', 'download', 'garlic',
'ingredients', 'tortilla', 'inside', 'mixture', 'url', 'rose', 'mix', 'serves',
'u', 'seam', 'baby', 'breasts', 'meal', 'gew', 'white', 'small', 'cups', 'warm',
'chile', 'green', 'skim', 'begins', 'tops', 'iserloh', 'savory', 'version',
'serving', 'set', 'chopped', 'juice', 'recipes', 'aside', 'side', 'directions',
'chicken', 'image', 'whole', 'spoon', 'bake', 'baking', 'jennifer', 'jalape',
'olive', 'mozarella', 'dipped', 'cook', 'yellow', 'pairings', 'brown',
'tortillasnon', 'skinny', 'body', 'skillet', 'tablespoon', 'medium', 'reduced',
'onions', 'peppers', 'serve', 'high', 'sprinkle', 'ounce', 'tomato', 'bd',
'skinnychef', 'hot', 'spinach', 'stirring', 'thinly', 'fcrztraminer', 'chef',
'cream', 'salt', 'add', 'filled', 'immediately', 'soft', 'sour', 'coats',
'onion', 'sliced', 'tomatoes'}
```

[35]:

```
r_c1 = relevant_content(l1)
print(r_c1[87])
```

```
{'teaspoon', 'title', 'seeded', 'spray', 'fat', 'shredded', 'cup', 'copyright',
'occasionally', 'enchiladas', 'make', 'teaspoons', 'warmed', 'cooked',
'traditionally', 'minutes', 'ahead', 'filling', 'along', 'stir', 'flour',
'stick', 'dish', 'great', 'f', 'x', 'large', 'wine', 'tortillas', 'grain',
'salsa', 'part', 'cooking', 'turn', 'heat', 'oven', 'soften', 'juices',
'leaves', 'begin', 'uncovered', 'recipe', 'preheat', 'cheese', 'oil', 'wrap',
'gently', 'clove', 'baked', 'lay', 'coat', 'oregano', 'download', 'garlic',
'ingredients', 'tortilla', 'inside', 'mixture', 'url', 'rose', 'mix', 'serves',
'u', 'seam', 'baby', 'breasts', 'meal', 'gew', 'white', 'small', 'cups', 'warm',
'chile', 'green', 'skim', 'begins', 'tops', 'iserloh', 'savory', 'version',
'serving', 'set', 'chopped', 'juice', 'recipes', 'aside', 'side', 'directions',
'chicken', 'image', 'whole', 'spoon', 'bake', 'baking', 'jennifer', 'jalape',
'olive', 'mozarella', 'dipped', 'cook', 'yellow', 'pairings', 'brown',
'tortillasnon', 'skinny', 'body', 'skillet', 'tablespoon', 'medium', 'reduced',
'onions', 'peppers', 'serve', 'high', 'sprinkle', 'ounce', 'tomato', 'bd',
'skinnychef', 'hot', 'spinach', 'stirring', 'thinly', 'fcrztraminer', 'chef',
'cream', 'salt', 'add', 'filled', 'immediately', 'soft', 'sour', 'coats',
'onion', 'sliced', 'tomatoes'}
```

[36]:

```
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
```

[37]:

```
from nltk.corpus import wordnet
lemmatizer = WordNetLemmatizer()
def get_wordnet_pos(word):
    """Map POS tag to first character lemmatize() accepts"""
    tag = nltk.pos_tag([word])[0][1][0].lower()
    tag_dict = {"a": wordnet.ADJ,
                "n": wordnet.NOUN,
                "v": wordnet.VERB,
                "r": wordnet.ADV}
    return tag_dict.get(tag, wordnet.NOUN)
```

[38]:

```
# from nltk.corpus import wordnet
# import nltk
# lemmatizer = WordNetLemmatizer()
# def get_wordnet_pos(word):
#     """Map POS tag to first character lemmatize() accepts"""
#     tag = nltk.pos_tag([word])[0][1][0].lower()
#     tag_dict = {"a": wordnet.ADJ,
#                 "n": wordnet.NOUN,
#                 "v": wordnet.VERB,
#                 "r": wordnet.ADV}
#     return tag_dict.get(tag, wordnet.NOUN)
```

[39]:

```
nltk.download('omw-1.4')
```

```
[nltk_data] Downloading package omw-1.4 to /root/nltk_data…
```

[39]:

```
True
```

[40]:

```
nltk.download('averaged_perceptron_tagger')
```

```
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data]     /root/nltk_data…
[nltk_data]   Unzipping taggers/averaged_perceptron_tagger.zip.
```

[40]:

```
True
```

[41]:

```
nltk.download('wordnet')
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data…
```

[41]:

```
True
```

[42]:

```
#Lemmatization for page description

lemmetized_content = []
for ele in r_c:
    x =[]
    for w in ele:
        x.append(lemmatizer.lemmatize(w, pos=get_wordnet_pos(w)))
    lemmetized_content.append(x)
#print(lemmetized_content[0])
```

[43]:

```
#Lemmatization for link

lemmetized_content1 = []
for ele in r_c1:
    x =[]
    for w in ele:
        x.append(lemmatizer.lemmatize(w, pos=get_wordnet_pos(w)))
    lemmetized_content1.append(x)
print(lemmetized_content1[0])
```

```
['toothpick', 'pipe', 'teaspoon', 'title', 'wet', 'saltchopped', 'sugar',
'entertain', 'raspberry', 'form', 'gel', 'fork', 'incorporate', 'health',
'powder', 'walnut', 'cup', 'life', 'try', 'peggy', 'bowl', 'walnut', 'cooked',
'milk', 'minute', 'maca', 'stevenandchris', 'cocoa', 'ready', 'stir', 'mood',
'flour', 'k', 'pip', 'finance', 'soda', 'f', 'boost', 'large', 'non', 'whether',
'thick', 'boost', 'cooking', 'tablespoon', 'frost', 'oven', 'aluminum',
'smooth', 'preheat', 'mini', 'oil', 'grease', 'nut', 'ca', 'sexy', 'rubber',
'splash', 'coconut', 'html', 'ingredient', 'dry', 'almond', 'bag', 'butter',
'url', 'mix', 'u', 'mash', 'come', 'power', 'beauty', 'rest', 'well', 'cupcake',
'raw', 'blender', 'cbc', 'banana', 'small', 'fabulous', 'cup', 'go', 'warm',
'decor', 'quinoa', 'maple', 'mixed', 'cashew', 'give', 'libido', 'set',
'muffin', 'blend', 'ripe', 'rice', 'chris', 'k', 'aside', 'syrup', 'raspberry',
'ground', 'bake', 'baking', 'relationship', 'want', 'transfer', 'brown',
'steven', 'body', 'tin', 'onto', 'tablespoon', 'vanilla', 'clean', 'high', 'bd',
'drop', 'treat', 'batter', 'chia', 'home', 'water', 'add', 'subject', 'place',
'sweet', 'extract', 'help']
```

```
[44]: print(len(lemmetized_content[67]))
```

```
8
```

```
[45]: print(len(lemmetized_content1[67]))
```

```
8
```

```
[46]: df['page_description'] = [x for x in lemmetized_content]
```

```
[47]: df['link'] = [x for x in lemmetized_content1]
```

```
[48]: df.head()
```

```
[48]:                                                  link  link_id  \
0  [toothpick, pipe, teaspoon, title, wet, saltch…     7426
1  [also, title, evt, fat, excuse, regular, prev,…     8430
2  [title, interest, ultra, color, start, product…     3469
3  [dollar, pay, url, fails, title, watch, bigges…     1326
4  [title, rumor, lie, basketball, take, body, co…     3580

                                 page_description    alchemy_category  \
0  [toothpick, pipe, teaspoon, title, wet, saltch…  arts_entertainment
1  [also, title, evt, fat, excuse, regular, prev,…          recreation
2  [title, interest, ultra, color, start, product…            business
```

```
3  [dollar, pay, url, fails, title, watch, bigges…  arts_entertainment
4  [title, rumor, lie, basketball, take, body, co…              sports

  alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
0               0.471752       1.725275                  0.469388
1               0.885088       0.847134                  0.134783
2               0.716379       2.613333                  0.546667
3               0.562999       1.434286                  0.369792
4               0.893246       1.781333                  0.530713

   common_word_link_ratio_2  common_word_link_ratio_3  \
0                  0.204082                  0.112245
1                  0.043478                  0.021739
2                  0.293333                  0.160000
3                  0.088542                  0.000000
4                  0.208845                  0.071253

   common_word_link_ratio_4  …  news_front_page  \
0                  0.010204  …                0
1                  0.000000  …                0
2                  0.120000  …                0
3                  0.000000  …                0
4                  0.019656  …                0

   non_markup_alphanumeric_characters  count_of_links  number_of_words_in_url  \
0                                1236              98                       8
1                                3887             230                       8
2                                 780              75                       8
3                                2388             192                       6
4                                5020             407                      11

   parametrized_link_ratio  spelling_mistakes_ratio  label  \
0                 0.061224                 0.076125      1
1                 0.330435                 0.130742      1
2                 0.160000                 0.076471      0
3                 0.005208                 0.090909      0
4                 0.299754                 0.093023      0

                                          pd_lower  \
0  {"url":"cbc ca stevenandchris 2012 11 peggy ks…
1  {"title":"vegan potato spinach balls fat free …
2  {"title":"toshiba shows an ultra thin flexible…
3  {"url":"collegehumor videos playlist 6472556 e…
4  {"title":"shaq admits to taking performance en…

                                       pd_spec_rem  \
0    url   cbc ca stevenandchris         peggy ks…
```

```
1    title   vegan potato spinach balls fat free …
2    title   toshiba shows an ultra thin flexible…
3    url   collegehumor videos playlist         e…
4    title   shaq admits to taking performance en…

                                            link_new
0  http   www cbc ca stevenandchris         peggy…
1  http   www instructables com id Vegan Baked Po…
2  http   www oled info com toshiba shows ultra t…
3  http   www collegehumor com videos playlist   …
4  http   sports yahoo com nba blog ball_dont_lie…

[5 rows x 30 columns]
```

[49]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4437 entries, 0 to 4436
Data columns (total 30 columns):
 #   Column                              Non-Null Count  Dtype
---  ------                              --------------  -----
 0   link                                4437 non-null   object
 1   link_id                             4437 non-null   int64
 2   page_description                    4437 non-null   object
 3   alchemy_category                    3040 non-null   object
 4   alchemy_category_score              3040 non-null   object
 5   avg_link_size                       4437 non-null   float64
 6   common_word_link_ratio_1            4437 non-null   float64
 7   common_word_link_ratio_2            4437 non-null   float64
 8   common_word_link_ratio_3            4437 non-null   float64
 9   common_word_link_ratio_4            4437 non-null   float64
 10  compression_ratio                   4437 non-null   float64
 11  embed_ratio                         4437 non-null   float64
 12  frame_based                         4437 non-null   int64
 13  frame_tag_ratio                     4437 non-null   float64
 14  has_domain_link                     4437 non-null   int64
 15  html_ratio                          4437 non-null   float64
 16  image_ratio                         4437 non-null   float64
 17  is_news                             2749 non-null   object
 18  lengthy_link_domain                 4437 non-null   int64
 19  link_word_score                     4437 non-null   int64
 20  news_front_page                     3710 non-null   object
 21  non_markup_alphanumeric_characters  4437 non-null   int64
 22  count_of_links                      4437 non-null   int64
 23  number_of_words_in_url              4437 non-null   int64
 24  parametrized_link_ratio             4437 non-null   float64
 25  spelling_mistakes_ratio             4437 non-null   float64
 26  label                               4437 non-null   int64
 27  pd_lower                            4437 non-null   object
 28  pd_spec_rem                         4437 non-null   object
 29  link_new                            4437 non-null   object
dtypes: float64(12), int64(9), object(9)
memory usage: 1.0+ MB
```

[50]:
```
df.isna().sum()
```

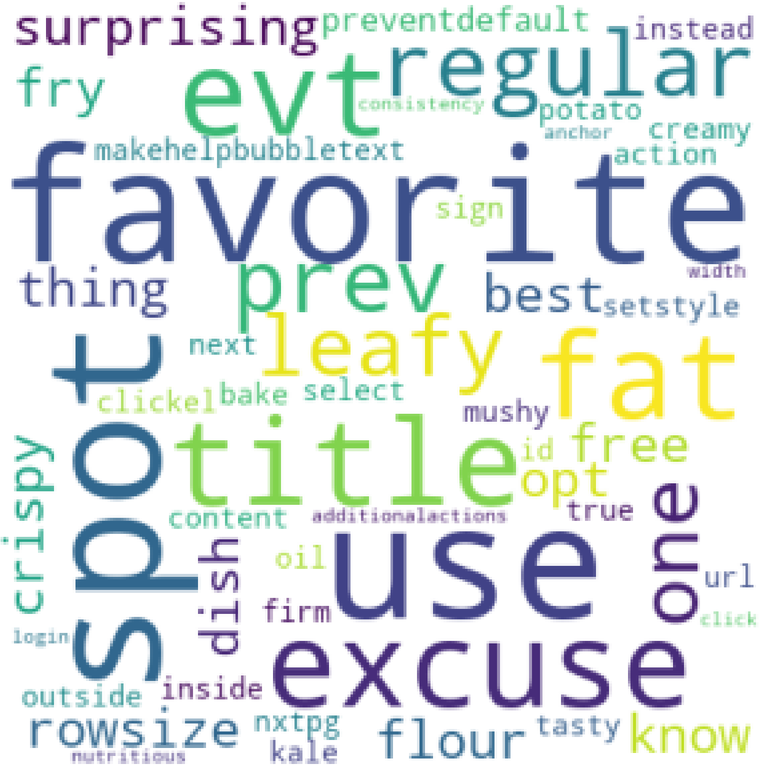
[50]:
```
link                                     0
link_id                                  0
page_description                         0
alchemy_category                      1397
alchemy_category_score                1397
avg_link_size                            0
common_word_link_ratio_1                 0
common_word_link_ratio_2                 0
common_word_link_ratio_3                 0
common_word_link_ratio_4                 0
compression_ratio                        0
embed_ratio                              0
frame_based                              0
frame_tag_ratio                          0
has_domain_link                          0
html_ratio                               0
image_ratio                              0
is_news                               1688
lengthy_link_domain                      0
link_word_score                          0
news_front_page                        727
non_markup_alphanumeric_characters       0
count_of_links                           0
number_of_words_in_url                   0
parametrized_link_ratio                  0
spelling_mistakes_ratio                  0
label                                    0
pd_lower                                 0
pd_spec_rem                              0
link_new                                 0
dtype: int64
```

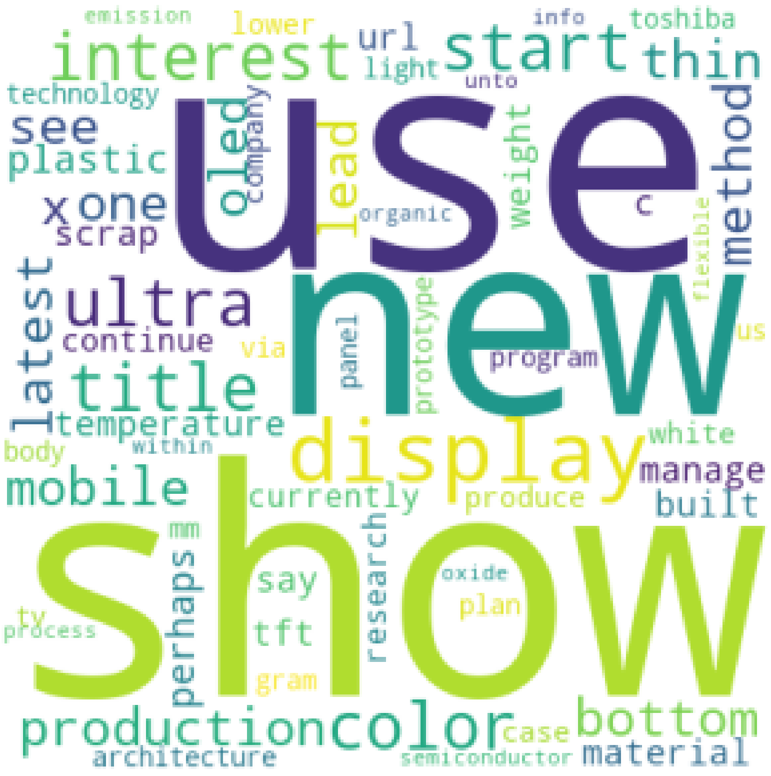
[51]:
```
#df.duplicated().sum()
```

[52]:
```
from wordcloud import WordCloud, STOPWORDS
import matplotlib.pyplot as plt
def wordcloud_relevant(lemmetized_content):
    for i in range(len(lemmetized_content)):
        comment_words = ''
        comment_words += " ".join(lemmetized_content[i])+" "
        stopwords = set(STOPWORDS)
        wordcloud = WordCloud(width = 400, height = 400,
                        background_color ='white',
                        stopwords = stopwords,
                        min_font_size = 10).generate(comment_words)

        # plot the WordCloud image
        plt.figure(figsize = (4, 4), facecolor = None)
        plt.imshow(wordcloud)
        plt.axis("off")
        plt.tight_layout(pad = 0)

        plt.show()
```

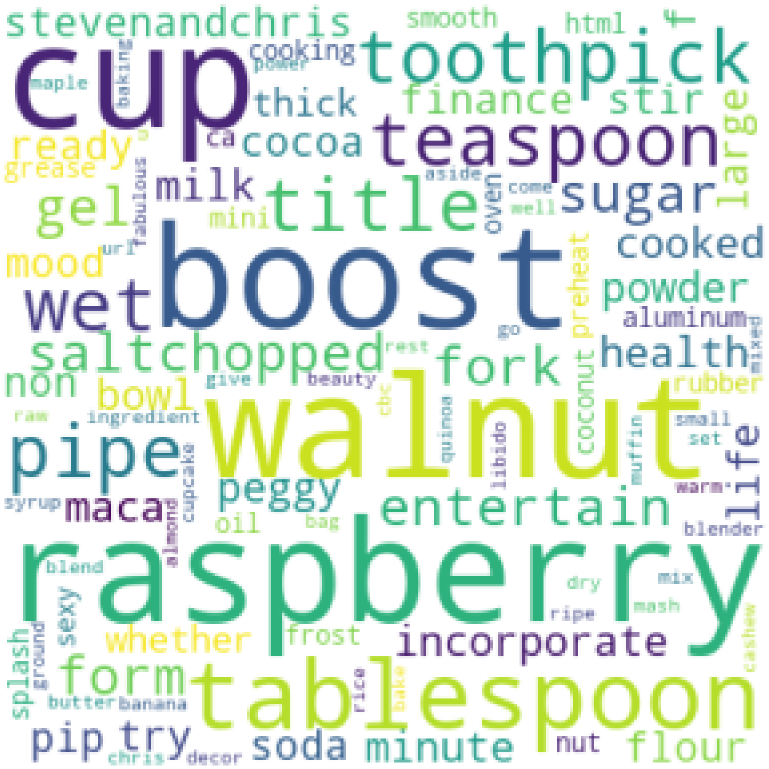
[53]:
```
#wordcloud for page description column
wordcloud_relevant(lemmetized_content[0:3])
```

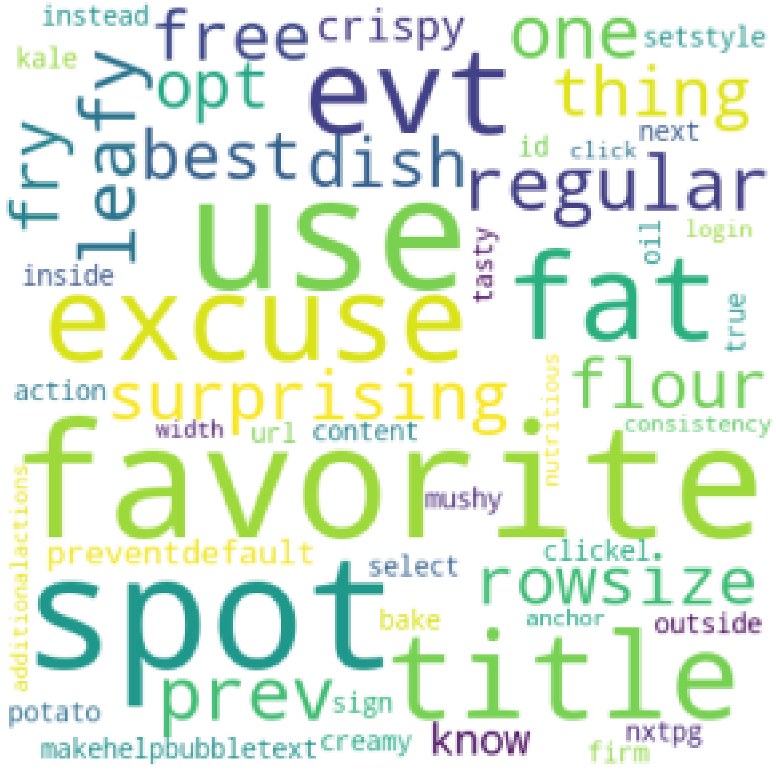
bowl
rest
walnut
cbc
tablespoon
maple
quinoa
set
ecoconut
saltchopped
mash
cupcake
maca
f
whether
blend
large
oven
mixed
rice
peggy
smooth
boost
titlewet
pip
non
ground
chris
libido
cashew
oil
try
fork
rubber
muffin
entertain
preheat
ingredient
ripe
cup
give
aside
warm
finance
baking
go
bag
grease
small
cooking
blender
decor
nut
form
soda
splash
stir
mood
gel
pipe
sexy
beauty
ready
minute
life
fabulous
butter
teaspoon
aluminum
banana
cooked
cocoa
ca
powder
url
milk
raspberry
mix
well
almond
dry
syrup
power
come
stevenandchris
bake
sugar
mini
toothpick
flour
thick
raw
html
incorporate
frost
health

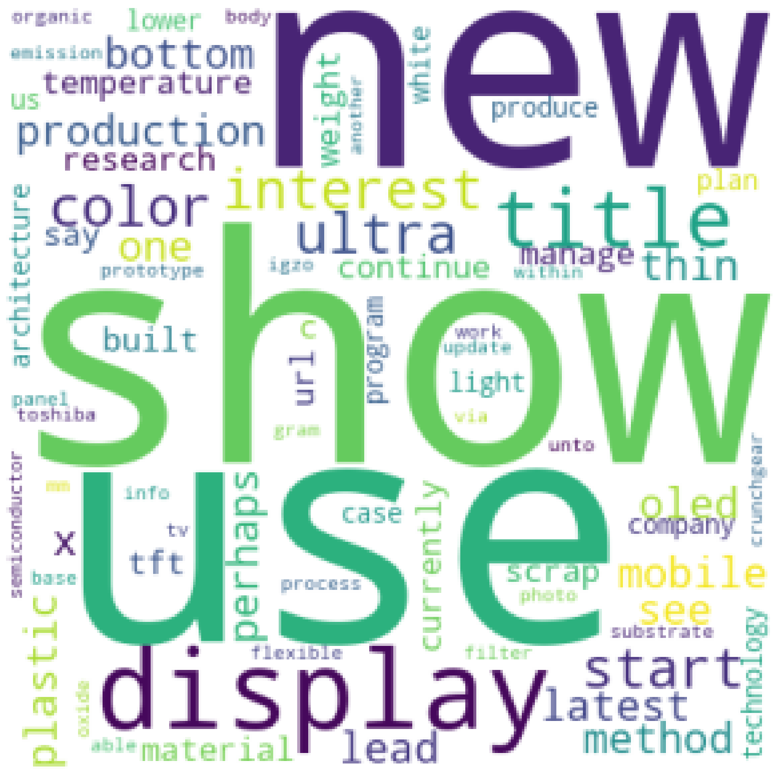

surprising
preventdefault
instead
evt
regular
fry
consistency
potato
anchor
creamy
makehelpbubbletext
action
favorite
sign
width
thing
prev
best
setstyle
spot
next
leafy
fat
clickel
bake
select
mushy
title
id
free
crispy
opt
content
additionalactions
true
one
use
oil
url
dish
firm
click
login
excuse
outside
inside
rowsize
nxtpg
flour
tasty
know
nutritious
kale


emission
lower
info
toshiba
interest
url
start
thin
light
unto
technology
use
company
oled
see
plastic
weight
method
x
one
lead
organic
c
scrap
flexible
latest
ultra
new
us
continue
via
panel
prototype
program
title
temperature
white
body
within
display
manage
mobile
currently
produce
built
mm
show
oxide
say
research
plan
ty
process
perhaps
tft
gram
production
color
case
bottom
architecture
semiconductor
material

```
[54]: #wordcloud for link column
      wordcloud_relevant(lemmetized_content1[0:3])
```




instead
free
crispy
one
setstyle
kale
leafy
opt
evt
thing
fry
best
dish
id
click
next
regular
use
oil
login
inside
tasty
excuse
fat
true
action
surprising
flour
nutritious
width
url
content
consistency
favorite
additionalactions
mushy
preventdefault
clickel
select
rowsize
anchor
outside
bake
spot
title
potato
prev
sign
nxtpg
makehelpbubbletext
creamy
know
firm


organic
lower
body
new
emission
bottom
white
temperature
weight
another
produce
us
production
research
plan
interest
color
title
architecture
say
one
ultra
manage
prototype
igzo
continue
within
thin
show
built
c
program
work
update
url
light
panel
toshiba
via
gram
unto
semiconductor
mm
info
oled
case
crunchgear
company
x
tv
perhaps
use
tft
currently
base
process
scrap
mobile
photo
see
plastic
substrate
flexible
filter
technology
start
display
latest
oxide
able
material
lead
method

[55]:

```
#Categorical features
cat_features=[feature for feature in df.columns if df[feature].dtypes=='object']
```

[56]:

```
cat_features
```

[56]:

```
['link',
 'page_description',
 'alchemy_category',
 'alchemy_category_score',
 'is_news',
 'news_front_page',
 'pd_lower',
 'pd_spec_rem',
 'link_new']
```

[57]:

```
#Numerical Features
numerical_features=[feature for feature in df.columns if df[feature].dtypes!
 ↪='O']
```

[58]:

```
numerical_features
```

[58]:

```
['link_id',
 'avg_link_size',
 'common_word_link_ratio_1',
 'common_word_link_ratio_2',
 'common_word_link_ratio_3',
 'common_word_link_ratio_4',
 'compression_ratio',
 'embed_ratio',
 'frame_based',
 'frame_tag_ratio',
 'has_domain_link',
 'html_ratio',
 'image_ratio',
 'lengthy_link_domain',
 'link_word_score',
 'non_markup_alphanumeric_characters',
 'count_of_links',
 'number_of_words_in_url',
 'parametrized_link_ratio',
 'spelling_mistakes_ratio',
 'label']
```

[59]:

```
### numerical variables- 2 Types
##1. Continuous variable and Discrete variable


###Discrete variables
discrete_feature=[feature for feature in numerical_features if len(df[feature].
 ↪unique())<=25]
print(discrete_feature)

###Continuous Variables
continuous_feature=[feature for feature in numerical_features if feature not in␣
 ↪discrete_feature]
print(continuous_feature)
```

```
['frame_based', 'has_domain_link', 'lengthy_link_domain',
'number_of_words_in_url', 'label']
['link_id', 'avg_link_size', 'common_word_link_ratio_1',
'common_word_link_ratio_2', 'common_word_link_ratio_3',
'common_word_link_ratio_4', 'compression_ratio', 'embed_ratio',
'frame_tag_ratio', 'html_ratio', 'image_ratio', 'link_word_score',
'non_markup_alphanumeric_characters', 'count_of_links',
'parametrized_link_ratio', 'spelling_mistakes_ratio']
```

[60]:

```
df[discrete_feature].head()
```

[60]:

```
   frame_based  has_domain_link  lengthy_link_domain  number_of_words_in_url  \
0            0                0                    0                       8
1            0                0                    1                       8
2            0                0                    1                       8
3            0                0                    0                       6
4            0                0                    1                      11

   label
0      1
1      1
2      0
3      0
4      0
```

[61]:

```
###Continuous Variables

continuous_feature=[feature for feature in numerical_features if feature not in␣
 ↪discrete_feature]
print(len(continuous_feature))
print(continuous_feature)
```

```
16
```

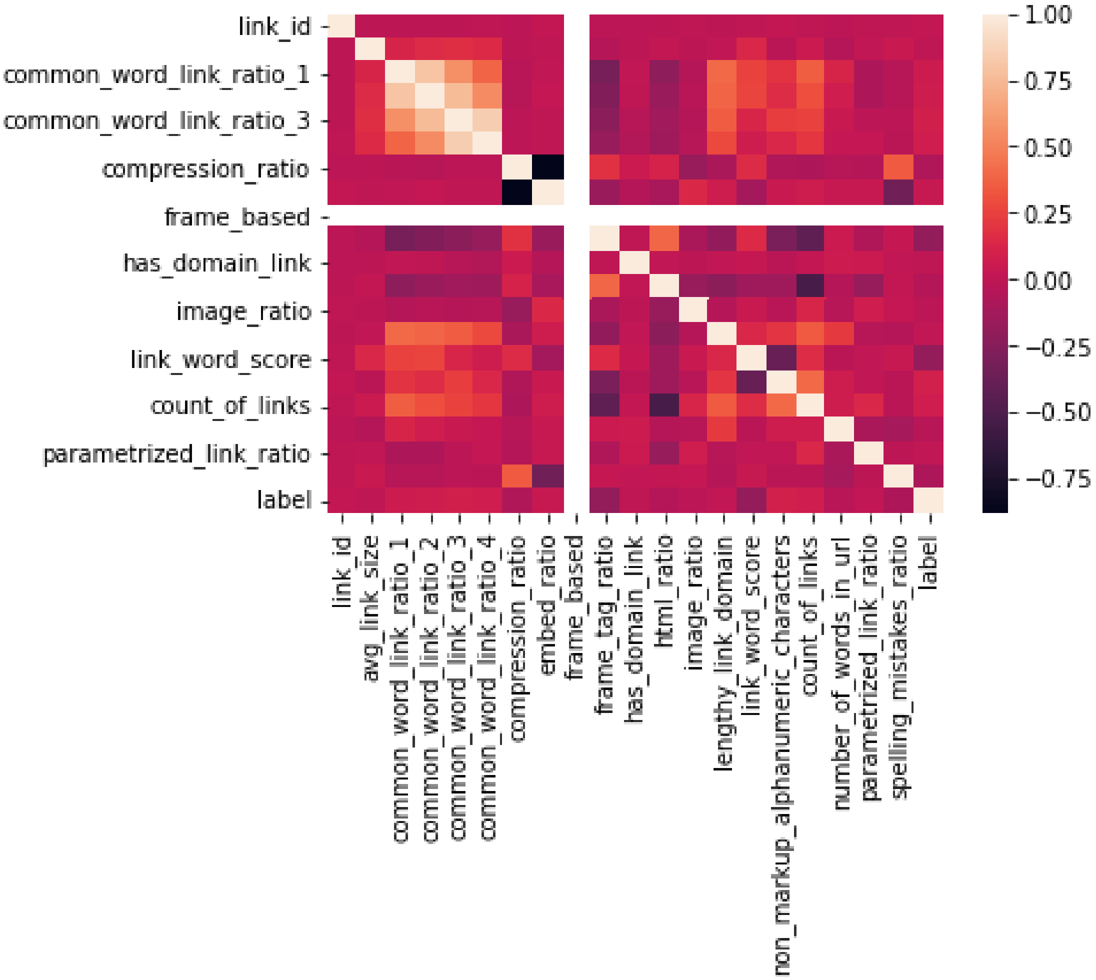
```
['link_id', 'avg_link_size', 'common_word_link_ratio_1',
'common_word_link_ratio_2', 'common_word_link_ratio_3',
'common_word_link_ratio_4', 'compression_ratio', 'embed_ratio',
'frame_tag_ratio', 'html_ratio', 'image_ratio', 'link_word_score',
'non_markup_alphanumeric_characters', 'count_of_links',
'parametrized_link_ratio', 'spelling_mistakes_ratio']
```

[272]:

```
x = df[numerical_features].corr()
sns.heatmap(x)
```

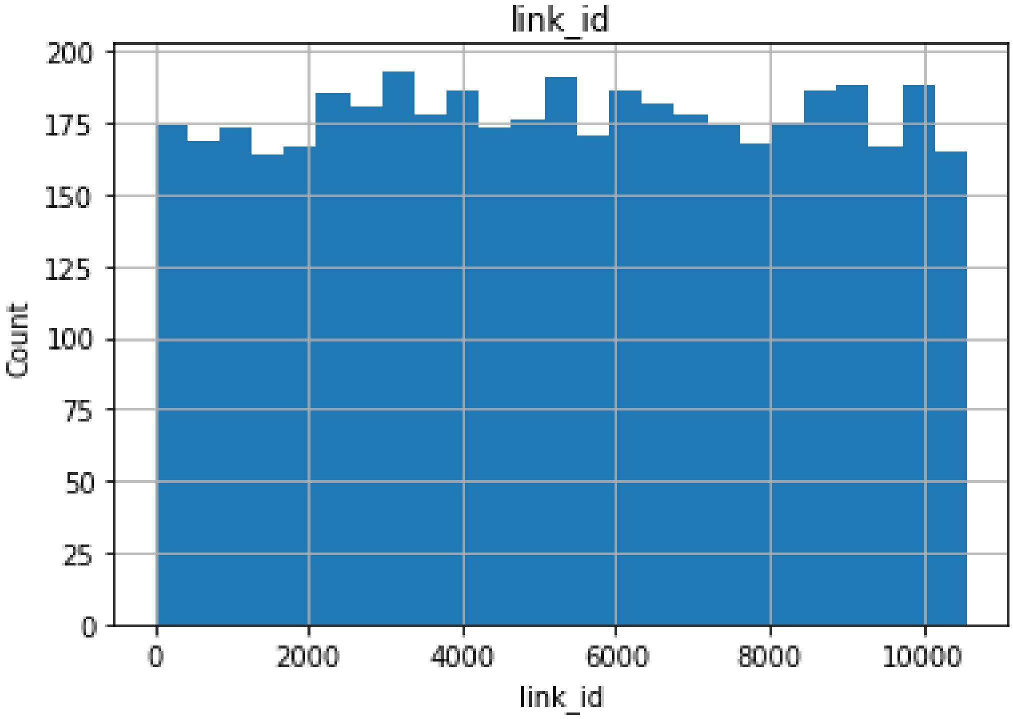
[272]:

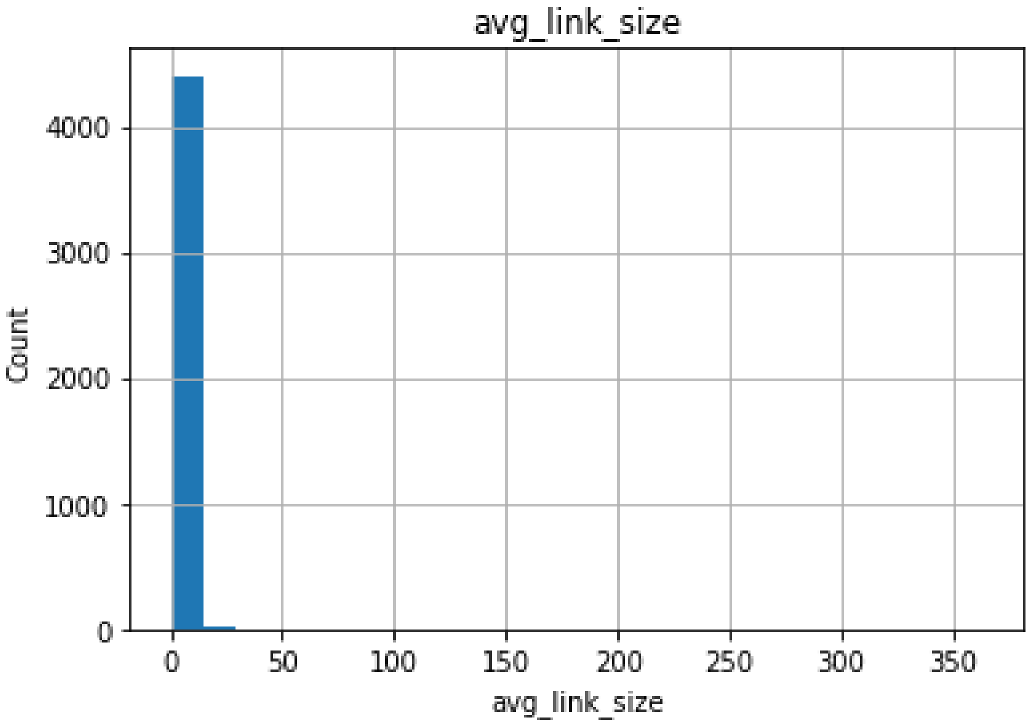
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2c09f71c10>
```

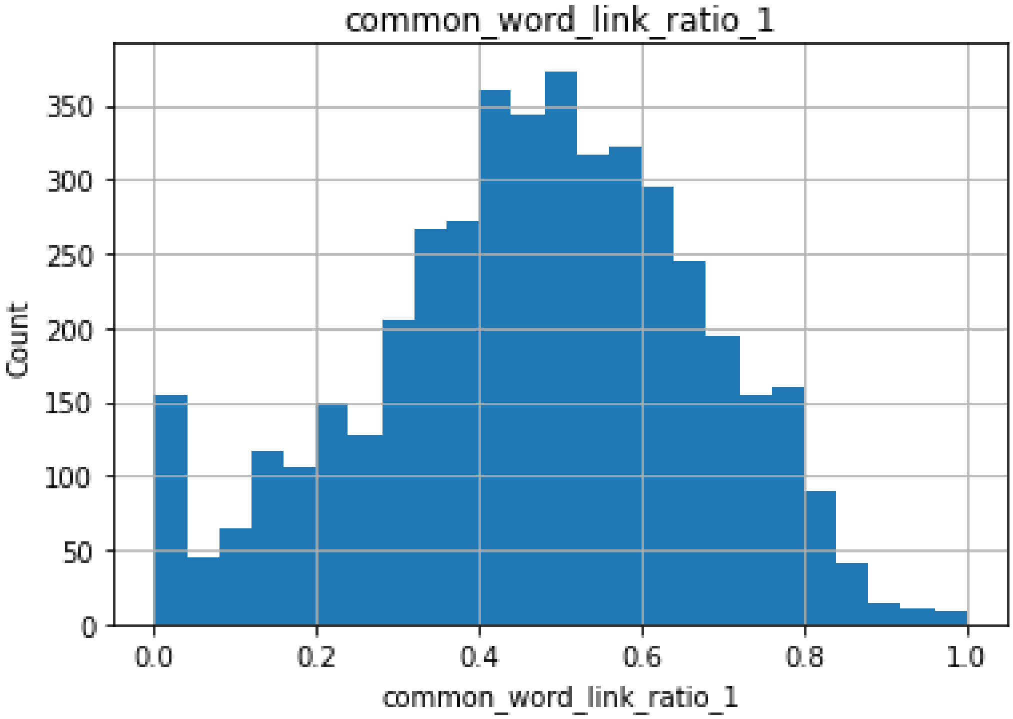


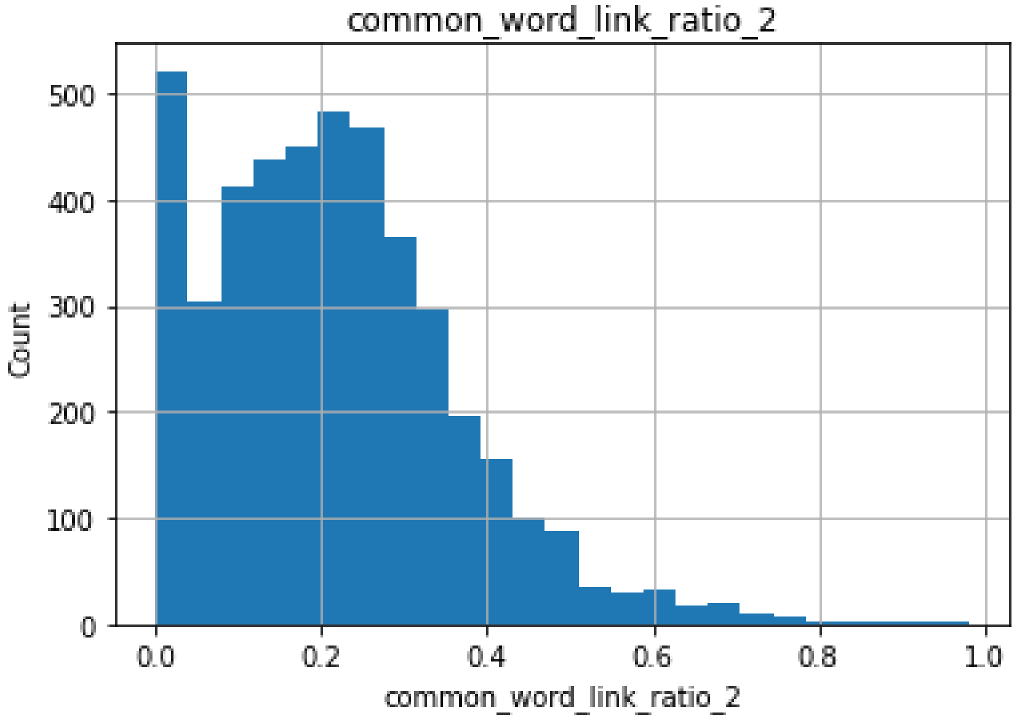
[62]:

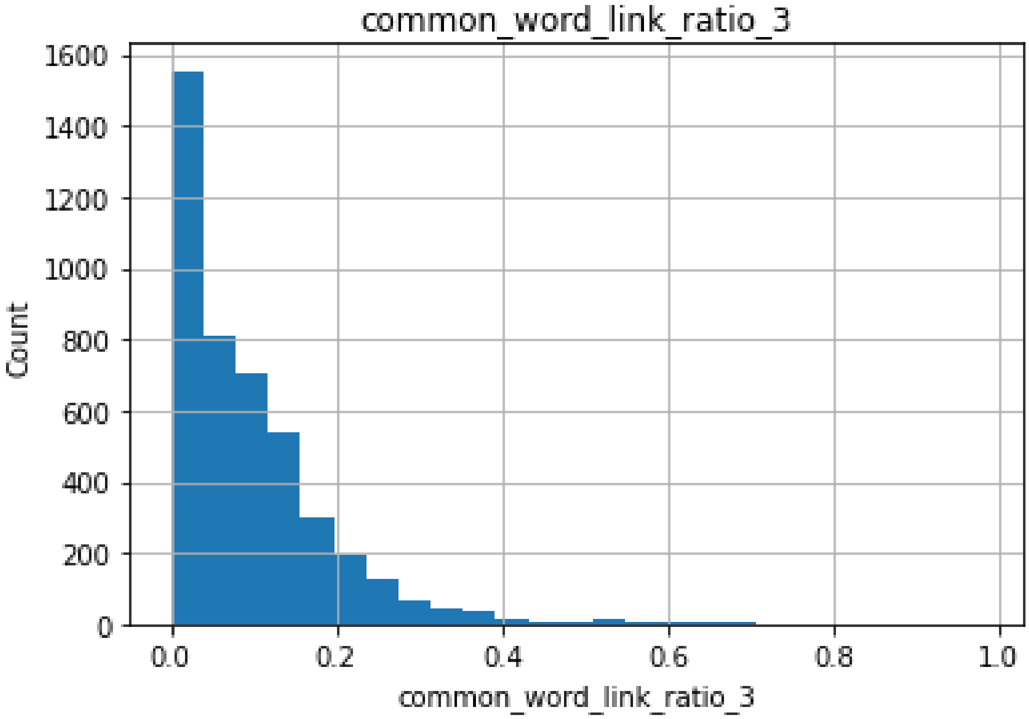
```
#Analyzing distribution of Continuous variables

data=df.copy()
for feature in continuous_feature:
    data[feature].hist(bins=25)
    plt.xlabel(feature)
    plt.ylabel("Count")
    plt.title(feature)
    plt.show()
```

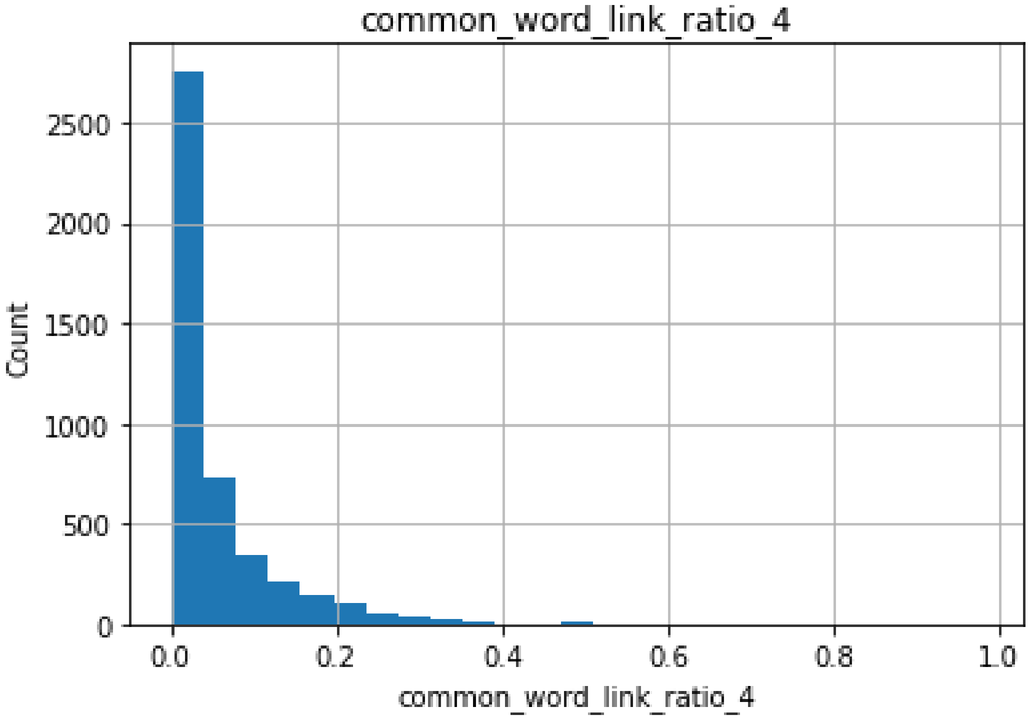


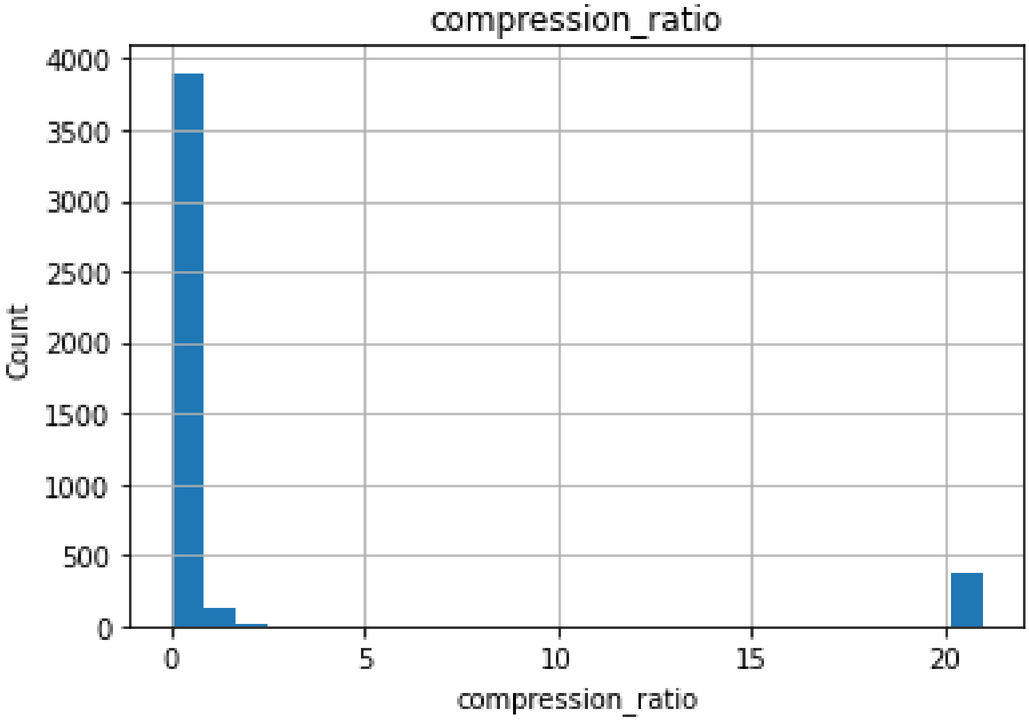

avg_link_size
4000
3000
2000
1000
0
Count
0
50
100
150
200
250
300
350
avg_link_size

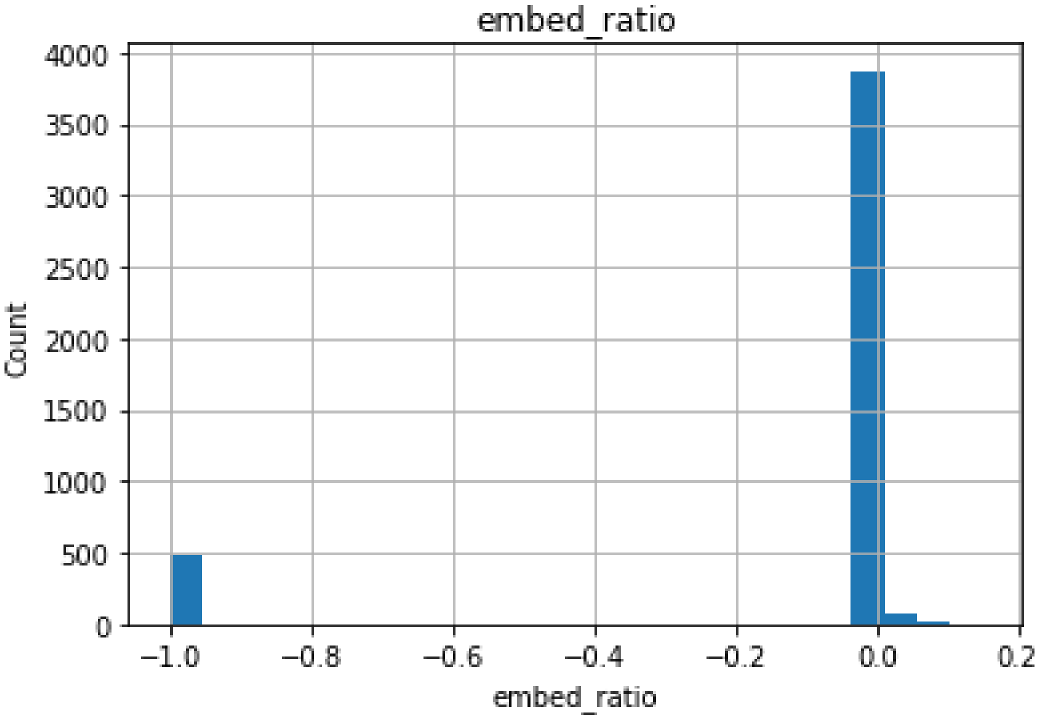

common_word_link_ratio_1
350
300
250
200
150
100
50
0
Count
0.0
0.2
0.4
0.6
0.8
1.0
common_word_link_ratio_1

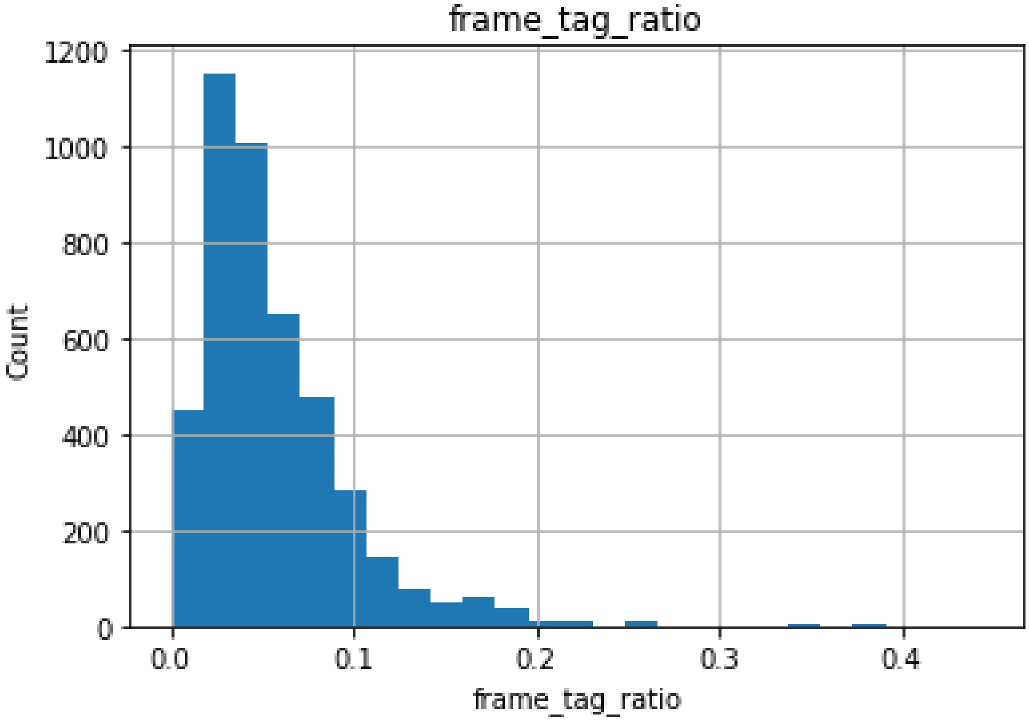

common_word_link_ratio_2
Count
0
100
200
300
400
500
0.0
0.2
0.4
0.6
0.8
1.0
common_word_link_ratio_2

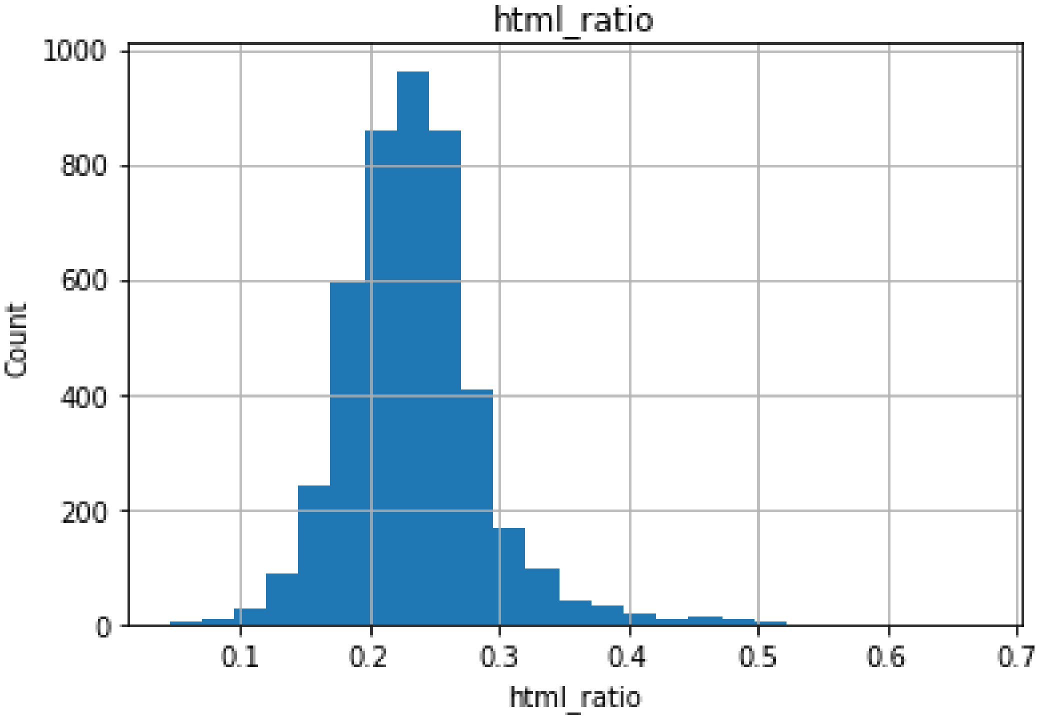

common_word_link_ratio_3
Count
0
200
400
600
800
1000
1200
1400
1600
0.0
0.2
0.4
0.6
0.8
1.0
common_word_link_ratio_3

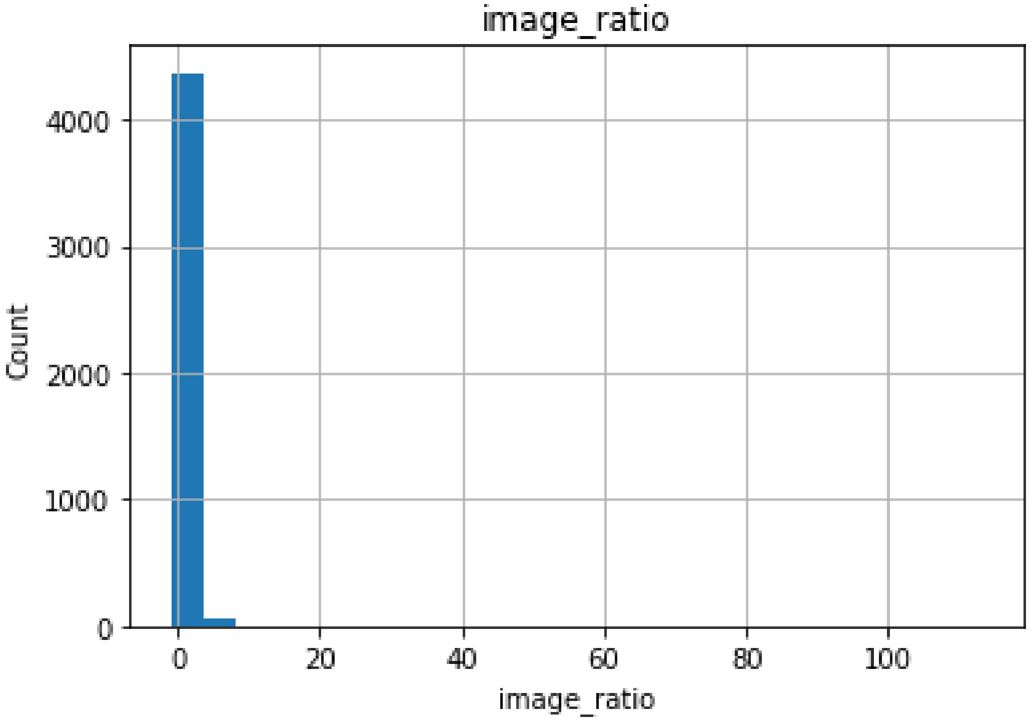

common_word_link_ratio_4
Count
0
500
1000
1500
2000
2500
0.0
0.2
0.4
0.6
0.8
1.0
common_word_link_ratio_4

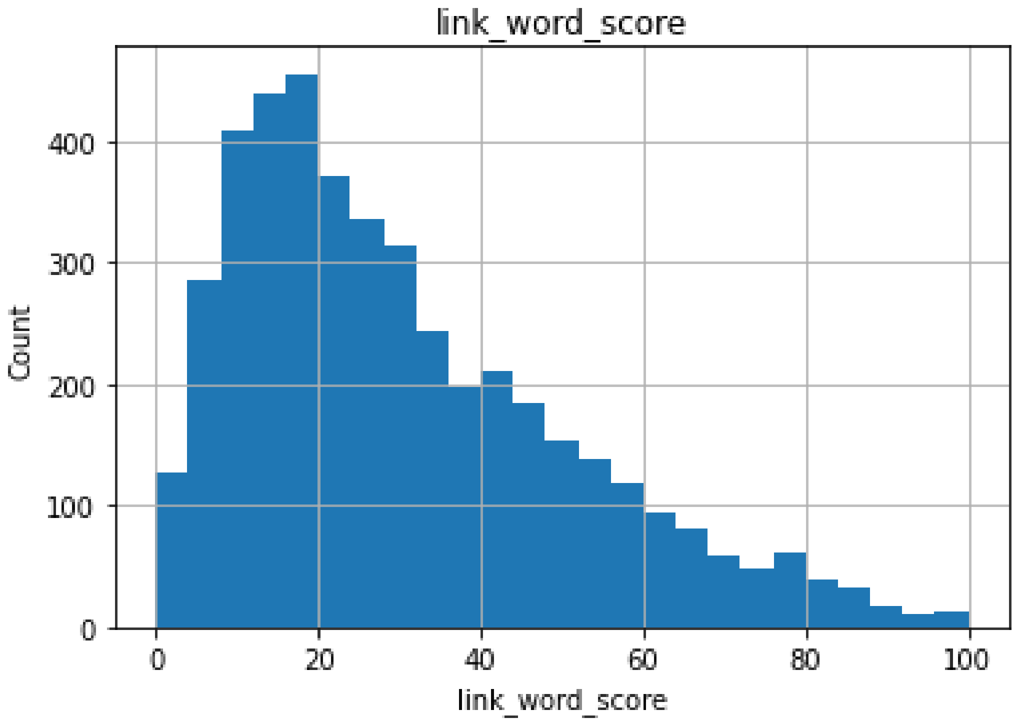

compression_ratio
Count
0
500
1000
1500
2000
2500
3000
3500
4000
0
5
10
15
20
compression_ratio

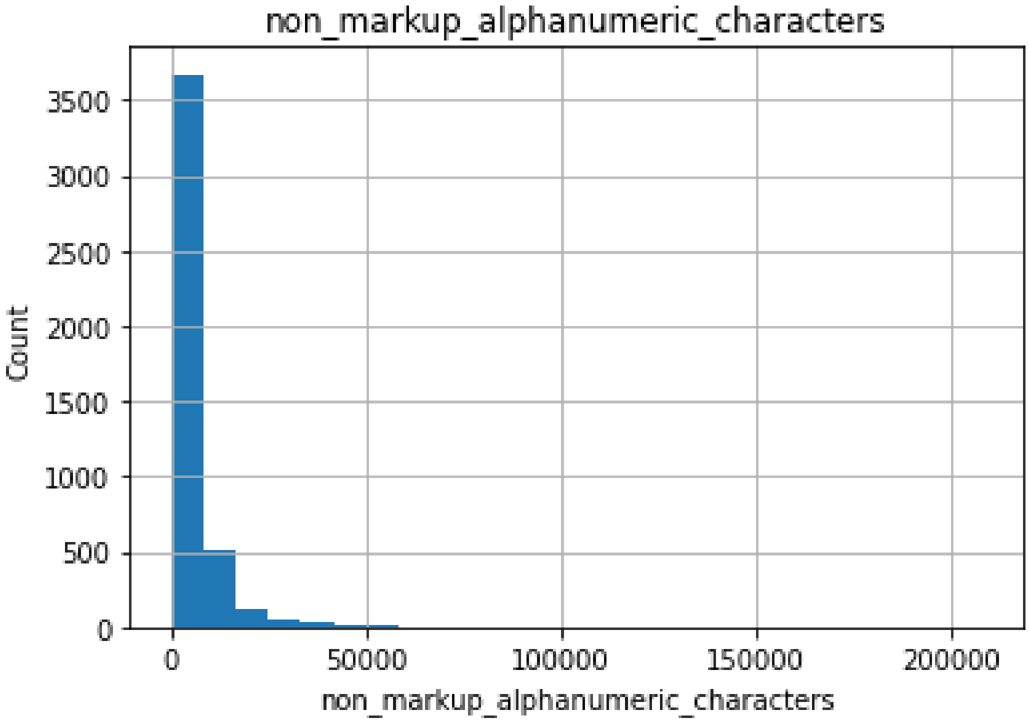

embed_ratio
Count
4000
3500
3000
2500
2000
1500
1000
500
0
−1.0
−0.8
−0.6
−0.4
−0.2
0.0
0.2
embed_ratio

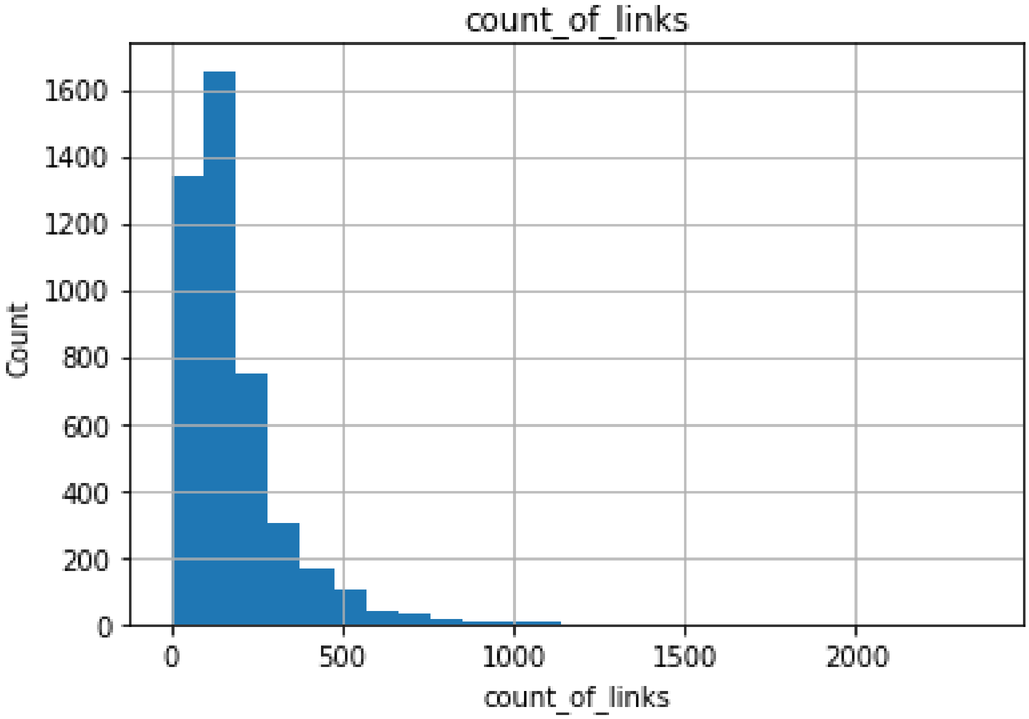

frame_tag_ratio
Count
1200
1000
800
600
400
200
0
0.0
0.1
0.2
0.3
0.4
frame_tag_ratio

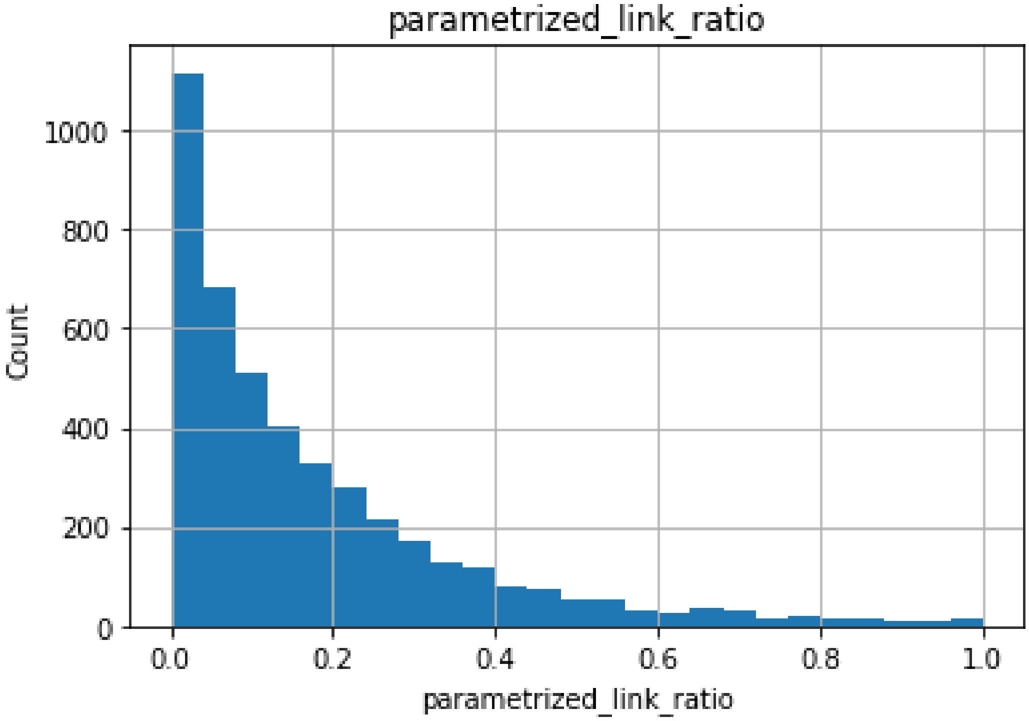

html_ratio
1000
800
600
400
200
0
Count
0.1
0.2
0.3
0.4
0.5
0.6
0.7
html_ratio

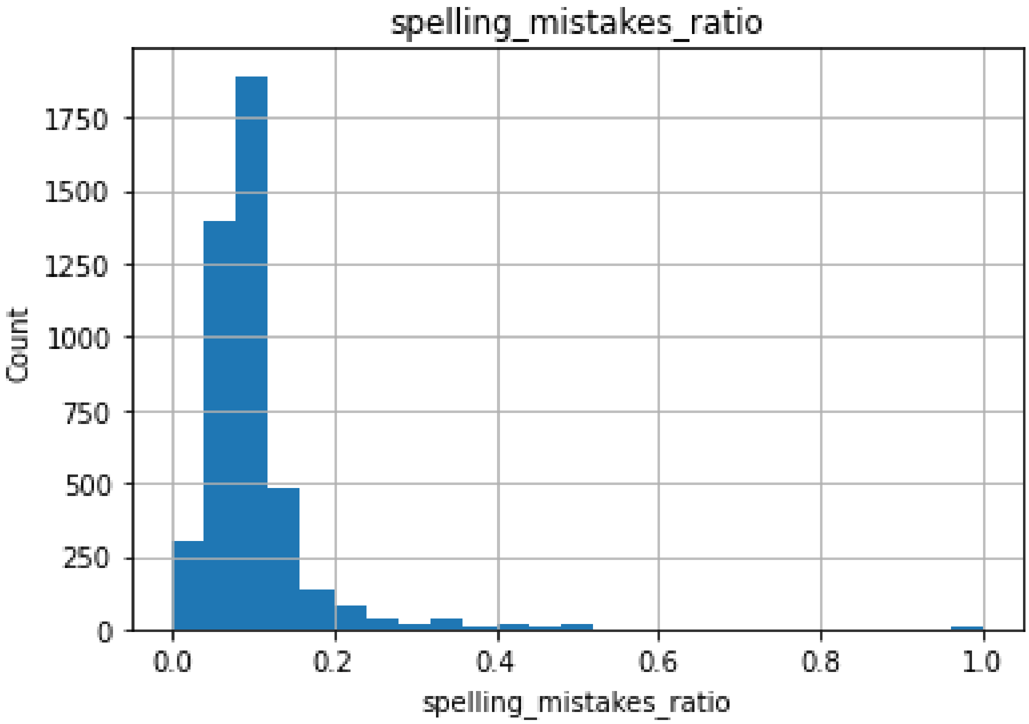

image_ratio
4000
3000
2000
1000
0
Count
0
20
40
60
80
100
image_ratio


link_word_score
Count
0
100
200
300
400
0
20
40
60
80
100
link_word_score


non_markup_alphanumeric_characters
Count
0
500
1000
1500
2000
2500
3000
3500
0
50000
100000
150000
200000
non_markup_alphanumeric_characters

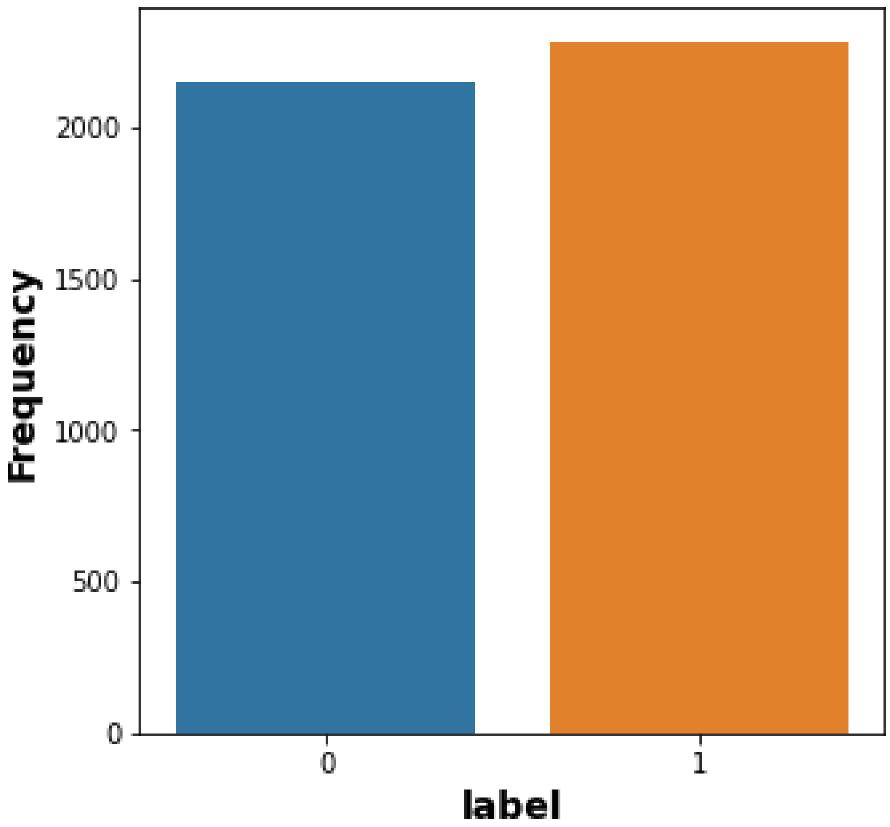

count_of_links
Count
1600
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
count_of_links


parametrized_link_ratio
Count
1000
800
600
400
200
0
0.0
0.2
0.4
0.6
0.8
1.0
parametrized_link_ratio



[63]:
```
#Frequency plot 0 and 1 label

plt.figure(figsize=(5, 5))

sns.countplot(x='label', data=df)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('Frequency', fontsize=14, fontweight='bold')

#plt.savefig('plot_bioactivity_class.pdf')
```

[63]:
```
Text(0, 0.5, 'Frequency')
```



4 EDA & Data transformation of Continuous variables

[64]:
```
#Class for normalization
class MinMaxScaler:
    def __init__(self, minimum_elem, maximum_elem):
        self.minimum_elem = minimum_elem
        self.maximum_elem = maximum_elem

    def scale(self, x):
        return (x - self.minimum_elem)/(self.maximum_elem - self.minimum_elem)
```

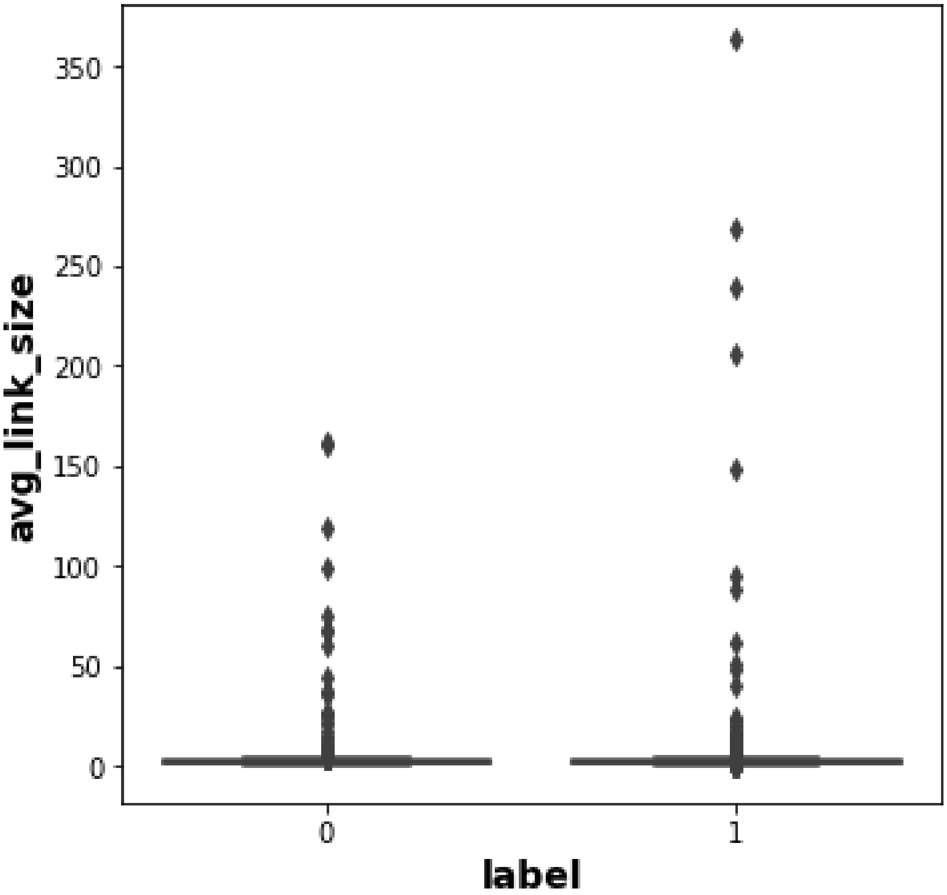
[65]:
```
#Class for standardization

class Standardizer:
    def __init__(self, mean, stdev):
        self.mean = mean
        self.stdev = stdev
    def scale(self, x):
        return (x - self.mean)/self.stdev
```

5 3. ‘avg_link_size’

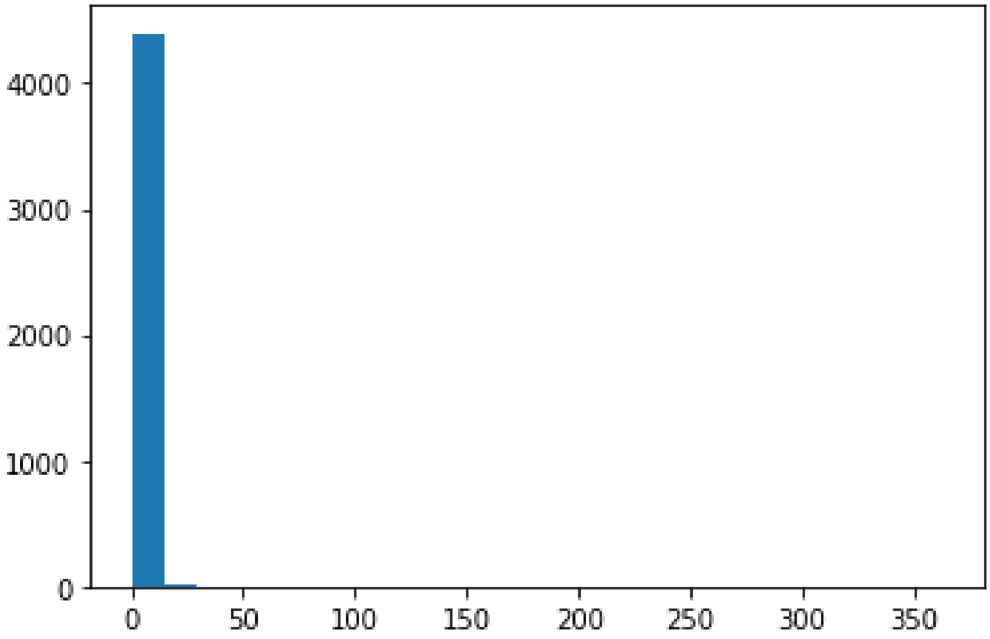
```
[66]: #3. 'avg_link_size' : Tells the number of words in a webpage
```

```
[67]: #'avg_link_size' distribution wrt label

      plt.figure(figsize=(5.5,5.5))

      sns.boxplot(x='label', y='avg_link_size', data = df)

      plt.xlabel('label', fontsize=14, fontweight='bold')
      plt.ylabel('avg_link_size', fontsize=14, fontweight='bold')
```

```
[67]: Text(0, 0.5, 'avg_link_size')
```



```
[68]: plt.hist(df["avg_link_size"], bins=25)
      plt.show()
```



[69]:
```
#Outlier removal

max_thresh = df['avg_link_size'].quantile(0.95)

#The values above 4.28 will be considered as an outlier
```

[70]:
```
df[df['avg_link_size']>4.28]
```

[70]:
```
                                                   link  link_id  \
24    [grand, drive, title, note, give, today, girlf…     2148
25    [kapott, n, bio, title, rz, tud, amint, com, k…     3274
46    [also, weed, favor, iron, beneficial, extract,…     7878
55    [thanksgiving, also, teaspoon, title, noble, d…     8154
59    [also, bio, title, wholesome, lecture, art, co…     1351
…                                                   …      …
4210  [eco, title, professional, reputation, country…      264
4268  [article, popular, url, title, college, fashio…     4627
4283  [jalapeno, uppasta, maker, typespasta, freezet…    10009
4316  [title, year, excellent, keep, couple, attempt…     6573
4333  [also, grand, reputation, living, personally, …    10312

                                       page_description    alchemy_category  \
24    [grand, drive, title, note, give, today, girlf…                  NaN
25    [kapott, n, bio, title, rz, tud, amint, com, k…   computer_internet
46    [also, weed, favor, iron, beneficial, extract,…              health
55    [thanksgiving, also, teaspoon, title, noble, d…                  NaN
```

```
59    [also, bio, title, wholesome, lecture, art, co…  science_technology
…                                                  …                    …
4210  [eco, title, professional, reputation, country…            business
4268  [article, popular, url, title, college, fashio…                 NaN
4283  [jalapeno, uppasta, maker, typespasta, freezet…          recreation
4316  [title, year, excellent, keep, couple, attempt…  arts_entertainment
4333  [also, grand, reputation, living, personally, …  arts_entertainment

     alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
24                      NaN       9.954545                  0.514196   
25                 0.847649      44.554054                  0.885787   
46                 0.444938       4.641026                  0.773196   
55                      NaN       4.633333                  0.802632   
59                 0.478201      51.169492                  0.877647   
…                       …            …                      …   
4210               0.890395       4.418033                  0.695187   
4268                    NaN       4.782609                  0.793478   
4283               0.141891       4.532389                  0.931727   
4316               0.423336       5.148148                  0.706587   
4333               0.639108       6.136095                  0.558011   

      common_word_link_ratio_2  common_word_link_ratio_3  \
24                    0.375394                  0.331230   
25                    0.756345                  0.637056   
46                    0.587629                  0.257732   
55                    0.426316                  0.384211   
59                    0.696471                  0.470588   
…                         …                         …   
4210                  0.454545                  0.326203   
4268                  0.597826                  0.434783   
4283                  0.765060                  0.500000   
4316                  0.335329                  0.203593   
4333                  0.331492                  0.259669   

      common_word_link_ratio_4  …  news_front_page  \
24                    0.119874  …              NaN   
25                    0.487310  …                0   
46                    0.113402  …                0   
55                    0.255263  …              NaN   
59                    0.247059  …                0   
…                         …  …              …   
4210                  0.240642  …                0   
4268                  0.282609  …              NaN   
4283                  0.255020  …                0   
4316                  0.149701  …                0   
4333                  0.220994  …                0   
```

```
      non_markup_alphanumeric_characters  count_of_links  \
24                                  9639             317  
25                                  2368             394  
46                                 12429              97  
55                                 15718             380  
59                                  1596             425  
…                                  …             …  
4210                                2337             187  
4268                                 618              92  
4283                                 169             498  
4316                                2609             167  
4333                                6035             181  

      number_of_words_in_url  parametrized_link_ratio  \
24                         2                 0.741325  
25                         9                 0.781726  
46                         3                 0.113402  
55                         5                 0.268421  
59                         5                 0.002353  
…                      …                      …  
4210                       0                 0.010695  
4268                       1                 0.021739  
4283                       1                 0.054217  
4316                       6                 0.059880  
4333                      13                 0.104972  

      spelling_mistakes_ratio  label  \
24                   0.088889      0  
25                   0.325581      0  
46                   0.096461      1  
55                   0.063425      1  
59                   0.054187      1  
…                       …    …  
4210                 0.049808      1  
4268                 0.142857      1  
4283                 0.243622      1  
4316                 0.135889      0  
4333                 0.083419      0  

                                               pd_lower  \
24    {"title":"shaq rode in my lude ","body":"hey i…  
25    {"title":"jill bolte taylor dr\u00e1mai rohamo…  
46    {"title":"the 19 healthiest foods you re proba…  
55    {"title":"noble pig upside down apple pie upsi…  
59    {"title":"peter reinhart on bread video on ted…  
…                                                 …  
4210  {"title":"raw food diet classes recipes produc…  
```

```
4268  {"url":"collegefashion popular","title":"most …
4283  {"title":"browse index startcooking com ","bod…
4316  {"title":"the 50 best burgers in san francisco…
4333  {"title":"is this woman really as old as the l…

                                            pd_spec_rem  \
24      title   shaq rode in my lude    body   hey i…
25      title   jill bolte taylor dr u  e mai rohamo…
46      title   the    healthiest foods you re proba…
55      title   noble pig upside down apple pie upsi…
59      title   peter reinhart on bread video on ted…
…                                                 …
4210    title   raw food diet classes recipes produc…
4268    url   collegefashion popular   title   most …
4283    title   browse index startcooking com    bod…
4316    title   the    best burgers in san francisco…
4333    title   is this woman really as old as the l…

                                               link_new
24      http   www honda tech com zerothread id
25    http   www ted com talks lang hun jill_bolte_t…
46     http   www budgetlife com blog healthiest foods
55    http   noblepig com            upside down app…
59    http   www ted com talks peter_reinhart_on_bre…
…                                                 …
4210                            http   rawfoodchef com
4268             http   www collegefashion net popular
4283                    http   startcooking com browse
4316  http   sanfrancisco grubstreet com             …
4333  http   www dailymail co uk news worldnews arti…

[225 rows x 30 columns]
```

[71]:
```
#Normalization

avg_norm = MinMaxScaler(df["avg_link_size"].min(),df["avg_link_size"].max())
```

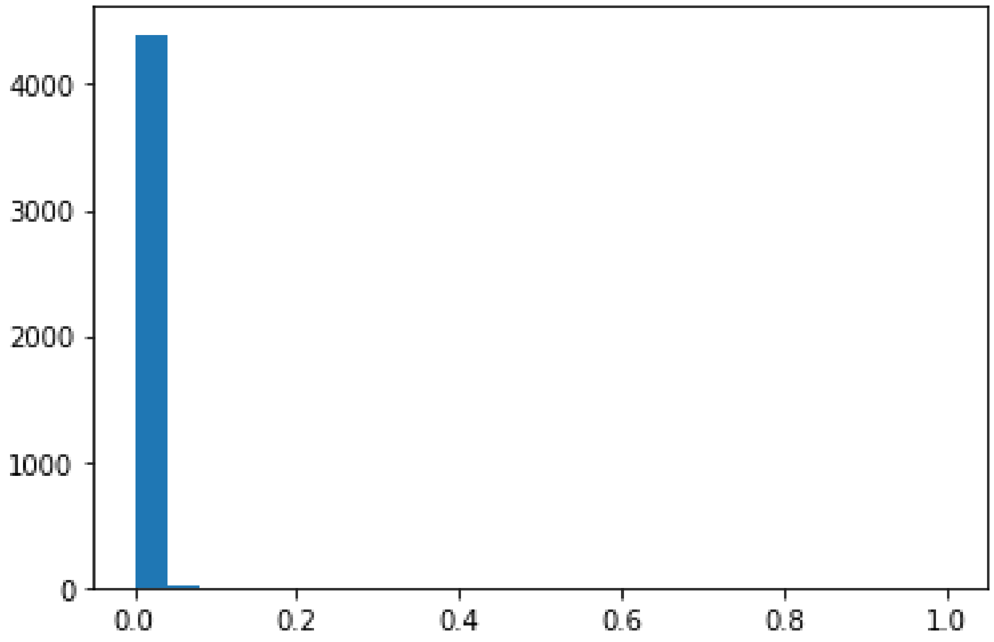
[72]:
```
df['avg_link_size'] = df['avg_link_size'].apply(avg_norm.scale)
```

[73]:
```
df['avg_link_size']
```

[73]:
```
0       0.004753
1       0.002334
2       0.007199
3       0.003951
4       0.004907
          …
```

```
4432    0.009414
4433    0.004696
4434    0.006887
4435    0.008532
4436    0.004556
Name: avg_link_size, Length: 4437, dtype: float64
```

[74]:
```
plt.hist(df["avg_link_size"], bins=25)
plt.show()
```



[75]:
```
#Standardization

avg_std = df["avg_link_size"].apply(Standardizer(df["avg_link_size"].mean(),␣
 ↪df["avg_link_size"].std()).scale)
```

[76]:
```
df['avg_link_size'] = avg_std
```

[77]:
```
max_threshold = df['avg_link_size'].quantile(0.95)
```

[78]:
```
max_threshold
```

[78]:
```
0.1395635194856354
```

[79]:
```
min_threshold = df['avg_link_size'].quantile(0.05)
```

[80]:
```
min_threshold
```

[80]:
```
-0.19475253354588198
```

[81]:
```
df[df['avg_link_size']<-0.19475253354588198]
```

[81]:
```
                                                   link  link_id  \
1     [also, title, evt, fat, excuse, regular, prev,…     8430
8     [rabbit, also, grand, weekend, ice, weed, prep…     7130
17    [title, learnt, boil, scoop, powder, make, bow…     2294
19    [rear, afro, nearly, riot, look, l, oldie, one…     3157
52    [davis, vida, title, edition, hannah, com, gui…     1756
…                                                   …      …
4400  [asfavorite, title, professional, com, food, c…     2694
4406  [also, bill, title, television, uh, make, com,…     6913
4416  [obi, cartoon, sad, title, affair, character, …     9671
4418  [title, quality, crop, part, guaranteed, shot,…     7275
4430  [weekend, drive, champion, title, master, loca…      591

                                       page_description    alchemy_category  \
1     [also, title, evt, fat, excuse, regular, prev,…          recreation
8     [rabbit, also, grand, weekend, ice, weed, prep…          recreation
17    [title, learnt, boil, scoop, powder, make, bow…            business
19    [rear, afro, nearly, riot, look, l, oldie, one…  arts_entertainment
52    [davis, vida, title, edition, hannah, com, gui…  arts_entertainment
…                                                   …                  …
4400  [asfavorite, title, professional, com, food, c…                 NaN
4406  [also, bill, title, television, uh, make, com,…  arts_entertainment
4416  [obi, cartoon, sad, title, affair, character, …              sports
4418  [title, quality, crop, part, guaranteed, shot,…          recreation
4430  [weekend, drive, champion, title, master, loca…          recreation

     alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
1                  0.885088      -0.201149                  0.134783
8                  0.476849      -0.267327                  0.017241
17                 0.391622      -0.197742                  0.282609
19                 0.895079      -0.213133                  0.098958
52                 0.367203      -0.277802                  0.000000
…                       …            …                       …
4400                    NaN      -0.215946                  0.251366
4406               0.856219      -0.197475                  0.097015
4416               0.781278      -0.233272                  0.056000
4418               0.888233      -0.232487                  0.140845
4430               0.479557      -0.234213                  0.141148

      common_word_link_ratio_2  common_word_link_ratio_3  \
1                     0.043478                  0.021739
```

```
8                    0.000000                0.000000
17                   0.065217                0.047826
19                   0.067708                0.026042
52                   0.000000                0.000000
…                       …                       …
4400                 0.196721                0.000000
4406                 0.029851                0.000000
4416                 0.032000                0.024000
4418                 0.084507                0.000000
4430                 0.074163                0.033493

      common_word_link_ratio_4  …  news_front_page  \
1                     0.000000  …                0
8                     0.000000  …                0
17                    0.021739  …                0
19                    0.020833  …                0
52                    0.000000  …                0
…                          …  …              …
4400                  0.000000  …                0
4406                  0.000000  …                0
4416                  0.008000  …                0
4418                  0.000000  …                0
4430                  0.026316  …              NaN

      non_markup_alphanumeric_characters  count_of_links  \
1                                   3887             230
8                                  11183             116
17                                  2258             230
19                                  5528             192
52                                   329              80
…                                    …               …
4400                                2897             183
4406                                3413             134
4416                                1166             125
4418                                2650             213
4430                                5753             418

      number_of_words_in_url  parametrized_link_ratio  \
1                          8                 0.330435
8                          2                 0.008621
17                         2                 0.352174
19                         7                 0.421875
52                         4                 0.087500
…                        …                      …
4400                       3                 0.185792
4406                       6                 0.201493
4416                       9                 0.072000
```

```
4418                       5                0.422535
4430                       0                0.076555

      spelling_mistakes_ratio  label  \
1                    0.130742      1
8                    0.070362      1
17                   0.145631      1
19                   0.063321      1
52                   0.038760      0
…                        …    …
4400                 0.131579      1
4406                 0.087786      0
4416                 0.079470      1
4418                 0.083333      0
4430                 0.033019      1

                                               pd_lower  \
1     {"title":"vegan potato spinach balls fat free …
8     {"title":"recipes for 2 recipes ","body":"basi…
17    {"title":"seasaltwithfood chocolate truffles "…
19    {"title":"life magazine photos of women in the…
52    {"url":"sportsillustrated cnn 2013 swimsuit mo…
…                                                 …
4400  {"title":"tastespotting tastespotting","body":…
4406  {"url":"sportsillustrated cnn nfl photos 1301 …
4416  {"title":"the 25 funniest sports headlines of …
4418  {"title":"amazing trick shots funny videos at …
4430  {"url":"innovadiscs","title":"innova disc golf…

                                            pd_spec_rem  \
1       title   vegan potato spinach balls fat free …
8       title   recipes for   recipes    body   basi…
17      title   seasaltwithfood chocolate truffles  …
19      title   life magazine photos of women in the…
52      url   sportsillustrated cnn      swimsuit mo…
…                                                 …
4400    title   tastespotting tastespotting   body  …
4406    url   sportsillustrated cnn nfl photos      …
4416    title   the    funniest sports headlines of …
4418    title   amazing trick shots funny videos at …
4430    url   innovadiscs   title   innova disc golf…

                                               link_new
1     http   www instructables com id Vegan Baked Po…
8          http   www recipesfor  com au recipe_listing
17    http   www seasaltwithfood com         chocola…
19    http   jezebel com         the way we were lif…
```

```
52    http   sportsillustrated cnn com     _swimsuit…
…                                                   …
4400     http   www tastespotting com search macarons
4406  http   sportsillustrated cnn com nfl photos   …
4416  http   superbooyah com index php Home Gallerie…
4418  http   www videobash com video_show amazing tr…
4430                      http   www innovadiscs com

[222 rows x 30 columns]
```

[82]:

```
df[df['avg_link_size']>0.1395635194856354]
```

[82]:

```
                                                    link  link_id  \
24    [grand, drive, title, note, give, today, girlf…     2148
25    [kapott, n, bio, title, rz, tud, amint, com, k…     3274
46    [also, weed, favor, iron, beneficial, extract,…     7878
55    [thanksgiving, also, teaspoon, title, noble, d…     8154
59    [also, bio, title, wholesome, lecture, art, co…     1351
…                                                   …      …
4210  [eco, title, professional, reputation, country…      264
4268  [article, popular, url, title, college, fashio…     4627
4283  [jalapeno, uppasta, maker, typespasta, freezet…    10009
4316  [title, year, excellent, keep, couple, attempt…     6573
4333  [also, grand, reputation, living, personally, …    10312

                                        page_description    alchemy_category  \
24    [grand, drive, title, note, give, today, girlf…                 NaN
25    [kapott, n, bio, title, rz, tud, amint, com, k…   computer_internet
46    [also, weed, favor, iron, beneficial, extract,…              health
55    [thanksgiving, also, teaspoon, title, noble, d…                 NaN
59    [also, bio, title, wholesome, lecture, art, co…  science_technology
…                                                   …                 …
4210  [eco, title, professional, reputation, country…            business
4268  [article, popular, url, title, college, fashio…                 NaN
4283  [jalapeno, uppasta, maker, typespasta, freezet…          recreation
4316  [title, year, excellent, keep, couple, attempt…  arts_entertainment
4333  [also, grand, reputation, living, personally, …  arts_entertainment

     alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
24                      NaN       0.701261                  0.514196
25                 0.847649       4.129562                  0.885787
46                 0.444938       0.174770                  0.773196
55                      NaN       0.174007                  0.802632
59                 0.478201       4.785055                  0.877647
…                         …              …                         …
4210               0.890395       0.152674                  0.695187
4268                    NaN       0.188798                  0.793478
```

```
4283               0.141891       0.164005                  0.931727
4316               0.423336       0.225018                  0.706587
4333               0.639108       0.322909                  0.558011

      common_word_link_ratio_2  common_word_link_ratio_3  \
24                    0.375394                  0.331230
25                    0.756345                  0.637056
46                    0.587629                  0.257732
55                    0.426316                  0.384211
59                    0.696471                  0.470588
…                          …                       …
4210                  0.454545                  0.326203
4268                  0.597826                  0.434783
4283                  0.765060                  0.500000
4316                  0.335329                  0.203593
4333                  0.331492                  0.259669

      common_word_link_ratio_4  …  news_front_page  \
24                    0.119874  …              NaN
25                    0.487310  …                0
46                    0.113402  …                0
55                    0.255263  …              NaN
59                    0.247059  …                0
…                          …  …              …
4210                  0.240642  …                0
4268                  0.282609  …              NaN
4283                  0.255020  …                0
4316                  0.149701  …                0
4333                  0.220994  …                0

      non_markup_alphanumeric_characters  count_of_links  \
24                                  9639             317
25                                  2368             394
46                                 12429              97
55                                 15718             380
59                                  1596             425
…                                     …              …
4210                                2337             187
4268                                 618              92
4283                                 169             498
4316                                2609             167
4333                                6035             181

      number_of_words_in_url  parametrized_link_ratio  \
24                         2                 0.741325
25                         9                 0.781726
46                         3                 0.113402
```

```
55                         5                 0.268421
59                         5                 0.002353
…                      …                      …
4210                       0                 0.010695
4268                       1                 0.021739
4283                       1                 0.054217
4316                       6                 0.059880
4333                      13                 0.104972

      spelling_mistakes_ratio  label  \
24                   0.088889      0
25                   0.325581      0
46                   0.096461      1
55                   0.063425      1
59                   0.054187      1
…                       …    …
4210                 0.049808      1
4268                 0.142857      1
4283                 0.243622      1
4316                 0.135889      0
4333                 0.083419      0

                                               pd_lower  \
24    {"title":"shaq rode in my lude ","body":"hey i…
25    {"title":"jill bolte taylor dr\u00e1mai rohamo…
46    {"title":"the 19 healthiest foods you re proba…
55    {"title":"noble pig upside down apple pie upsi…
59    {"title":"peter reinhart on bread video on ted…
…                                                 …
4210  {"title":"raw food diet classes recipes produc…
4268  {"url":"collegefashion popular","title":"most …
4283  {"title":"browse index startcooking com ","bod…
4316  {"title":"the 50 best burgers in san francisco…
4333  {"title":"is this woman really as old as the l…

                                            pd_spec_rem  \
24      title   shaq rode in my lude    body   hey i…
25      title   jill bolte taylor dr u  e mai rohamo…
46      title   the    healthiest foods you re proba…
55      title   noble pig upside down apple pie upsi…
59      title   peter reinhart on bread video on ted…
…                                                 …
4210    title   raw food diet classes recipes produc…
4268    url   collegefashion popular   title   most …
4283    title   browse index startcooking com    bod…
4316    title   the    best burgers in san francisco…
4333    title   is this woman really as old as the l…
```

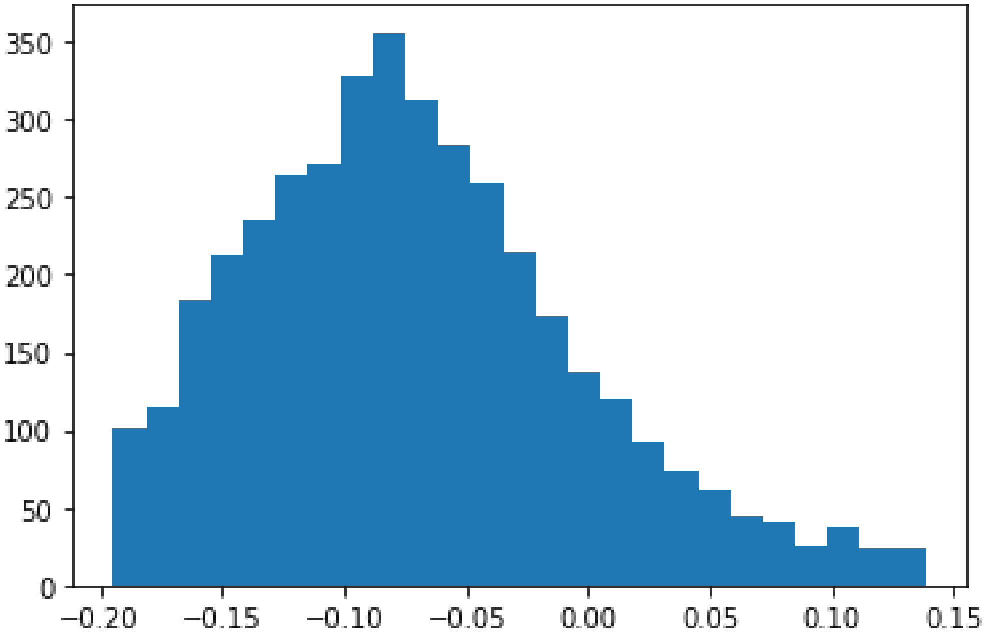
```
                                               link_new
24      http   www honda tech com zerothread id
25    http   www ted com talks lang hun jill_bolte_t…
46     http   www budgetlife com blog healthiest foods
55    http   noblepig com            upside down app…
59    http   www ted com talks peter_reinhart_on_bre…
…                                                 …
4210                            http   rawfoodchef com
4268             http   www collegefashion net popular
4283                    http   startcooking com browse
4316  http   sanfrancisco grubstreet com            …
4333  http   www dailymail co uk news worldnews arti…

[221 rows x 30 columns]
```

[83]:
```
#Outlier Removal
df1 = df[(df['avg_link_size']<max_threshold) &␣
 ↪(df['avg_link_size']>min_threshold)]
```

[84]:
```
df1.shape
```

[84]:
```
(3990, 30)
```

[85]:
```
plt.hist(df1["avg_link_size"], bins=25)
plt.show()
```



[85]:

```

```

6 2. common_word_link_ratio_1

[86]:

```
#common_word_link_ratio_1:
```

[87]:

```
df1['common_word_link_ratio_1']
```

[87]:

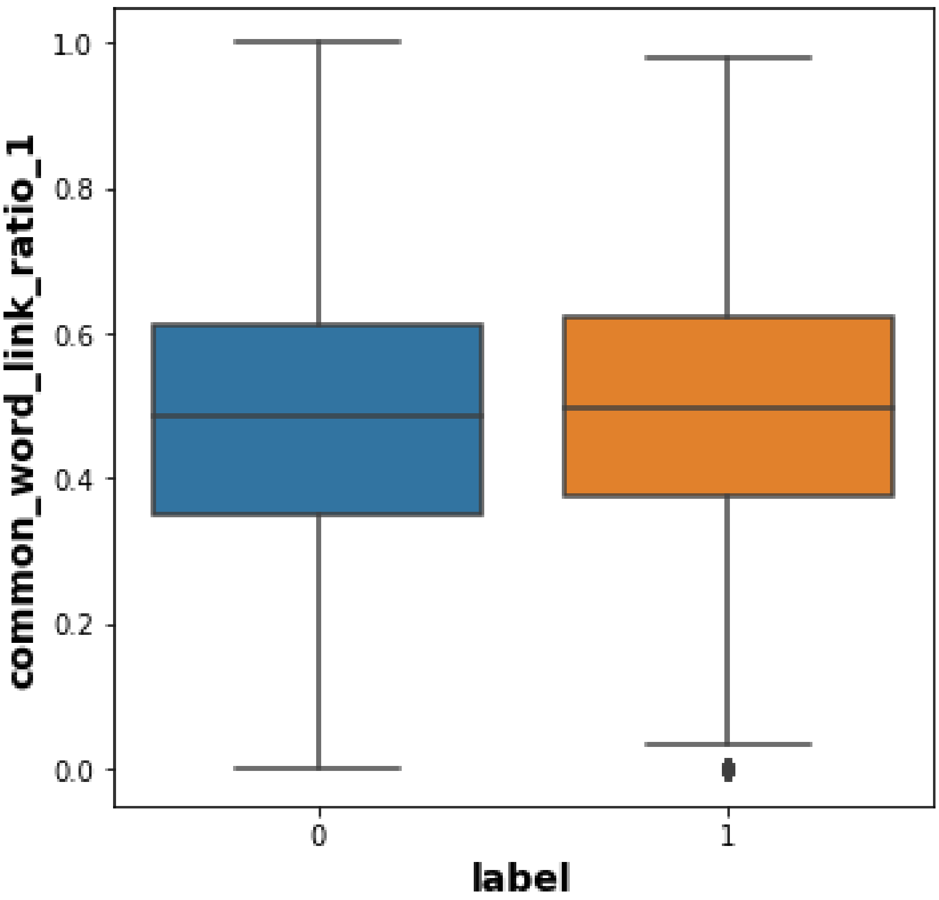
```
0       0.469388
2       0.546667
3       0.369792
4       0.530713
5       0.403509
          …
4432    0.630682
4433    0.506579
4434    1.000000
4435    0.678241
4436    0.317073
Name: common_word_link_ratio_1, Length: 3990, dtype: float64
```

[88]:

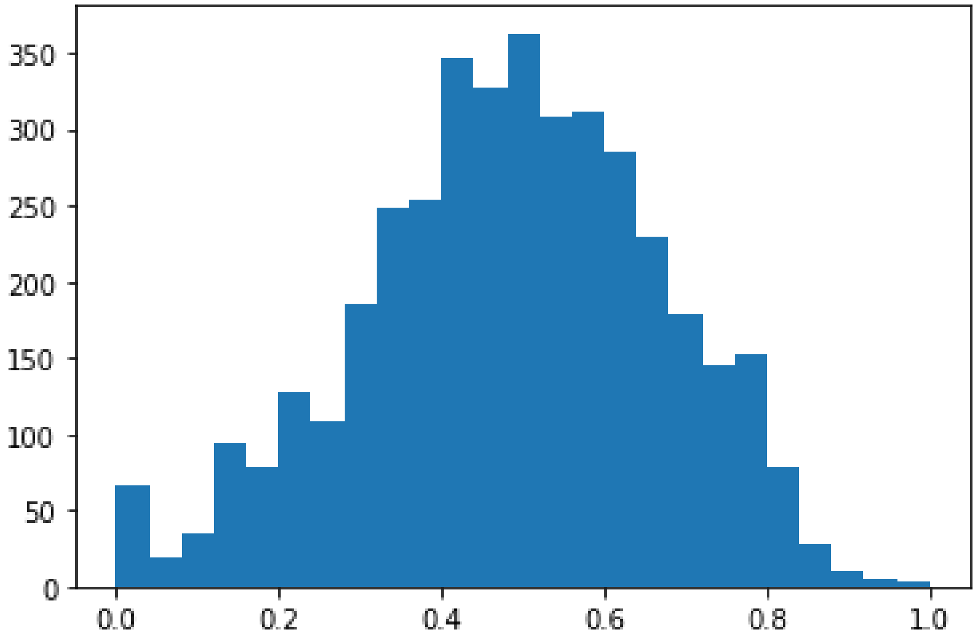
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='common_word_link_ratio_1', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('common_word_link_ratio_1', fontsize=14, fontweight='bold')
```

[88]:

```
Text(0, 0.5, 'common_word_link_ratio_1')
```



[89]:
```
plt.hist(df1["common_word_link_ratio_1"], bins=25)
plt.show()
```



```
[90]: #Normalization
      c1_norm = MinMaxScaler(df1["common_word_link_ratio_1"].
       ↪min(),df1["common_word_link_ratio_1"].max())
```

```
[91]: df1['common_word_link_ratio_1'] = df1['common_word_link_ratio_1'].apply(c1_norm.
       ↪scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
```

```
[92]: #Standardization
      c1_std = df1["common_word_link_ratio_1"].
       ↪apply(Standardizer(df1["common_word_link_ratio_1"].mean(),␣
       ↪df1["common_word_link_ratio_1"].std()).scale)
```

```
[93]: c1_std
```

```
[93]: 0       -0.081762
      2        0.336085
      3       -0.620278
```

```
4        0.249821
5       -0.437970
           …
4432     0.790354
4433     0.119330
4434     2.787257
4435     1.047505
4436    -0.905327
Name: common_word_link_ratio_1, Length: 3990, dtype: float64
```

[94]:
```
df1['common_word_link_ratio_1'] = c1_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
```

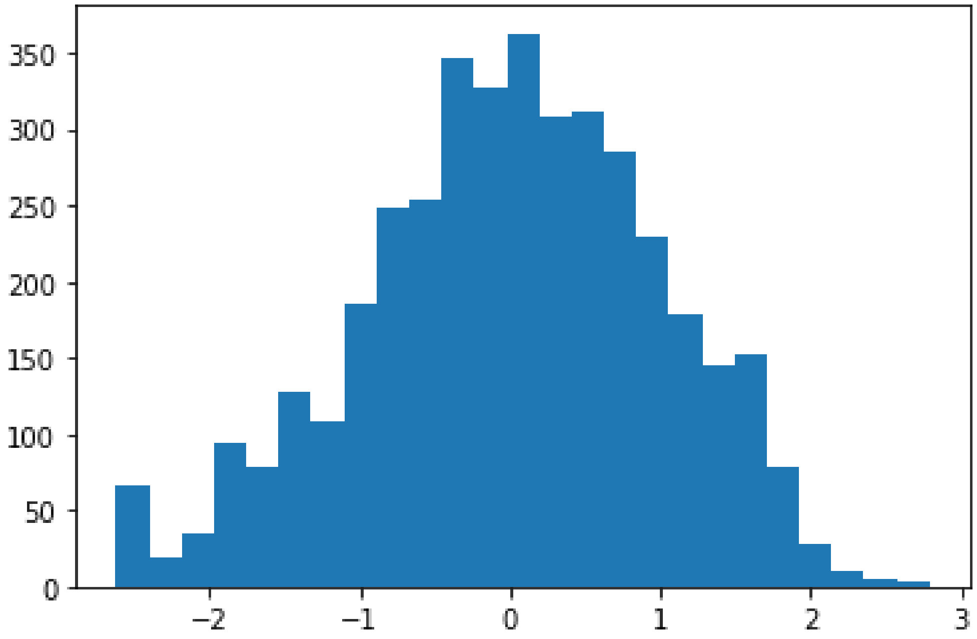
[95]:
```
df1
```

[95]:
```
                                                   link  link_id  \
0     [toothpick, pipe, teaspoon, title, wet, saltch…     7426
2     [title, interest, ultra, color, start, product…     3469
3     [dollar, pay, url, fails, title, watch, bigges…     1326
4     [title, rumor, lie, basketball, take, body, co…     3580
5     [ensures, ice, title, attach, cloud, track, ab…     3404
…                                                   …      …
4432  [also, weekend, title, give, year, do, capture…     8318
4433  [like, teaspoon, title, leave, professional, p…     9697
4434  [invention, title, url, sphere, ecoble, grid, …     4979
4435  [celebs, n, also, title, lantern, jack, pumpki…     2308
4436  [bmx, bike, title, impressed, bad, hardcore, b…     7368

                                       page_description    alchemy_category  \
0     [toothpick, pipe, teaspoon, title, wet, saltch…  arts_entertainment
2     [title, interest, ultra, color, start, product…            business
3     [dollar, pay, url, fails, title, watch, bigges…  arts_entertainment
4     [title, rumor, lie, basketball, take, body, co…              sports
5     [ensures, ice, title, attach, cloud, track, ab…          recreation
…                                                   …                 …
4432  [also, weekend, title, give, year, do, capture…              sports
4433  [like, teaspoon, title, leave, professional, p…                 NaN
4434  [invention, title, url, sphere, ecoble, grid, …    culture_politics
4435  [celebs, n, also, title, lantern, jack, pumpki…    culture_politics
```

```
4436  [bmx, bike, title, impressed, bad, hardcore, b…              sports

     alchemy_category_score  avg_link_size  common_word_link_ratio_1  \
0                  0.471752      -0.114138                 -0.081762
2                  0.716379      -0.026145                  0.336085
3                  0.562999      -0.142971                 -0.620278
4                  0.893246      -0.108584                  0.249821
5                  0.494102      -0.092225                 -0.437970
…                     …            …                       …
4432               0.764237       0.053504                  0.790354
4433                    NaN      -0.116177                  0.119330
4434               0.159831      -0.037374                  2.787257
4435                0.84594       0.021801                  1.047505
4436                0.93526      -0.121216                 -0.905327

      common_word_link_ratio_2  common_word_link_ratio_3  \
0                     0.204082                  0.112245
2                     0.293333                  0.160000
3                     0.088542                  0.000000
4                     0.208845                  0.071253
5                     0.087719                  0.070175
…                        …                       …
4432                  0.238636                  0.125000
4433                  0.177632                  0.046053
4434                  0.500000                  0.250000
4435                  0.266204                  0.085648
4436                  0.109756                  0.048780

      common_word_link_ratio_4  …  news_front_page  \
0                     0.010204  …                0
2                     0.120000  …                0
3                     0.000000  …                0
4                     0.019656  …                0
5                     0.017544  …                1
…                        …  …              …
4432                  0.079545  …                0
4433                  0.000000  …                0
4434                  0.000000  …                0
4435                  0.048611  …              NaN
4436                  0.000000  …                0

      non_markup_alphanumeric_characters  count_of_links  \
0                                   1236              98
2                                    780              75
3                                   2388             192
4                                   5020             407
5                                   1127              57
```

```
…                                  …             …
4432                                1519             176
4433                                8767             152
4434                                  82               4
4435                                7637             432
4436                                 830              82

      number_of_words_in_url  parametrized_link_ratio  \
0                          8                 0.061224
2                          8                 0.160000
3                          6                 0.005208
4                         11                 0.299754
5                          0                 0.017544
…                      …                      …
4432                      10                 0.238636
4433                       3                 0.026316
4434                       8                 0.000000
4435                       3                 0.229167
4436                       5                 0.024390

      spelling_mistakes_ratio  label  \
0                    0.076125      1
2                    0.076471      0
3                    0.090909      0
4                    0.093023      0
5                    0.048387      0
…                       …    …
4432                 0.112760      0
4433                 0.080820      1
4434                 0.133333      0
4435                 0.129252      1
4436                 0.064516      1

                                               pd_lower  \
0     {"url":"cbc ca stevenandchris 2012 11 peggy ks…
2     {"title":"toshiba shows an ultra thin flexible…
3     {"url":"collegehumor videos playlist 6472556 e…
4     {"title":"shaq admits to taking performance en…
5     {"title":"the farting cow of edinburgh ","body…
…                                                 …
4432  {"title":"video fauja singh 100 finishes a mar…
4433  {"title":"coconut granola tasty kitchen blog "…
4434  {"title":"parallels h sphere account has been …
4435  {"url":"huffingtonpost 2012 10 12 pumpkin seed…
4436  {"title":"bike parkour is the only parkour bro…

                                            pd_spec_rem  \
0       url   cbc ca stevenandchris         peggy ks…
2       title   toshiba shows an ultra thin flexible…
3       url   collegehumor videos playlist         e…
4       title   shaq admits to taking performance en…
5       title   the farting cow of edinburgh    body…
…                                                 …
4432    title   video fauja singh     finishes a mar…
4433    title   coconut granola tasty kitchen blog  …
4434    title   parallels h sphere account has been …
4435    url   huffingtonpost            pumpkin seed…
4436    title   bike parkour is the only parkour bro…

                                               link_new
0     http   www cbc ca stevenandchris         peggy…
2     http   www oled info com toshiba shows ultra t…
3     http   www collegehumor com videos playlist   …
4     http   sports yahoo com nba blog ball_dont_lie…
5                http   www aboutcolonblank com  p
…                                                 …
4432  http   newsfeed time com            a     year…
4433  http   tastykitchen com blog         coconut g…
4434  http   ecoble com              offbeat off the…
4435  http   www huffingtonpost com            pumpk…
4436  http   www bromygod com           bike parkou…

[3990 rows x 30 columns]
```

[96]:
```python
plt.hist(df1["common_word_link_ratio_1"], bins=25)
plt.show()
```



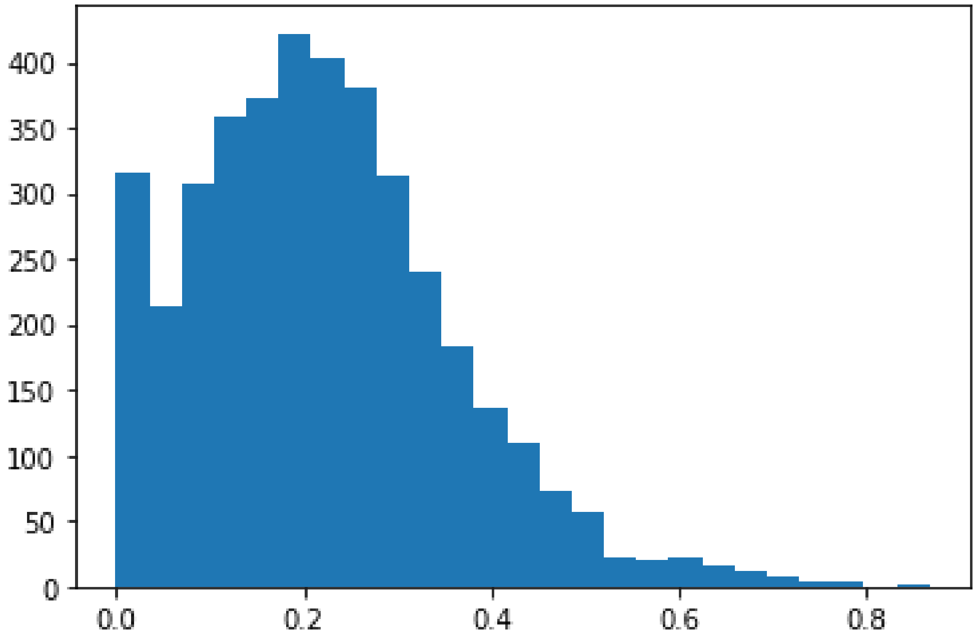
7 4. common_word_link_ratio_2

```
[96]:
```

```
[97]: df1['common_word_link_ratio_2']
```

```
[97]: 0       0.204082
      2       0.293333
      3       0.088542
      4       0.208845
      5       0.087719
                …
      4432    0.238636
      4433    0.177632
      4434    0.500000
      4435    0.266204
      4436    0.109756
      Name: common_word_link_ratio_2, Length: 3990, dtype: float64
```

```
[98]: plt.hist(df1["common_word_link_ratio_2"], bins=25)
      plt.show()
```

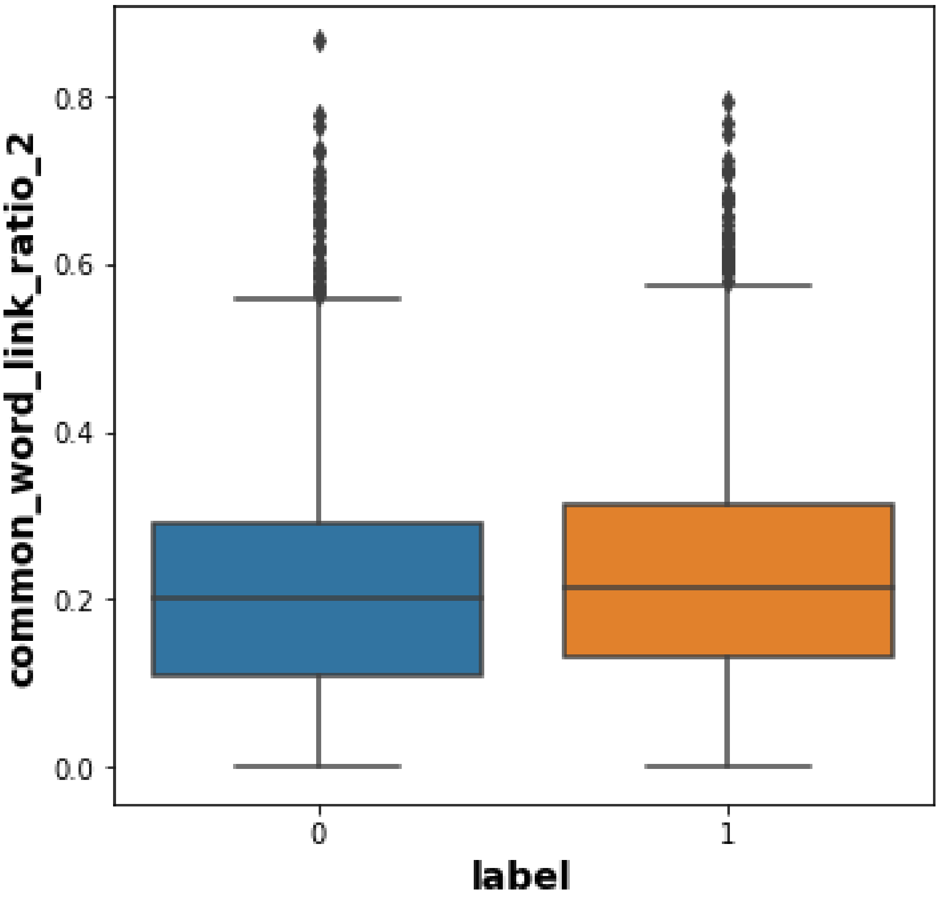


[99]:

```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='common_word_link_ratio_2', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('common_word_link_ratio_2', fontsize=14, fontweight='bold')
```

[99]:

```
Text(0, 0.5, 'common_word_link_ratio_2')
```



```
[100]: df1['common_word_link_ratio_2'].describe()
```

```
[100]: count    3990.000000
       mean        0.219873
       std         0.137512
       min         0.000000
       25%         0.119527
       50%         0.208573
       75%         0.300352
       max         0.866667
       Name: common_word_link_ratio_2, dtype: float64
```

```
[101]: #Normalization
       c2_norm = MinMaxScaler(df1["common_word_link_ratio_2"].
        ↪min(),df1["common_word_link_ratio_2"].max())
       df1['common_word_link_ratio_2'] = df1['common_word_link_ratio_2'].apply(c2_norm.
        ↪scale)
```

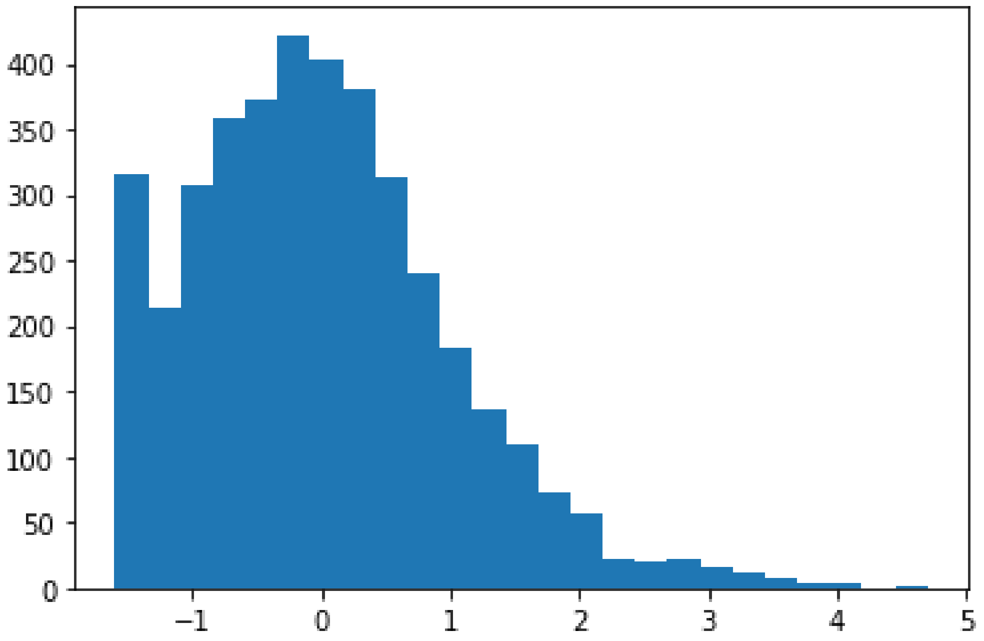
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
```

```
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[102]:
```
#Standardization

c2_std = df1["common_word_link_ratio_2"].
 ↪apply(Standardizer(df1["common_word_link_ratio_2"].mean(),␣
 ↪df1["common_word_link_ratio_2"].std()).scale)
df1['common_word_link_ratio_2'] = c2_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[103]:
```
plt.hist(df1["common_word_link_ratio_2"], bins=25)
plt.show()
```



```
[104]: df1["common_word_link_ratio_2"].describe()
```

```
[104]: count    3.990000e+03
       mean     1.117458e-16
       std      1.000000e+00
       min     -1.598941e+00
       25%     -7.297271e-01
       50%     -8.217234e-02
       75%      5.852550e-01
       max      4.703562e+00
       Name: common_word_link_ratio_2, dtype: float64
```

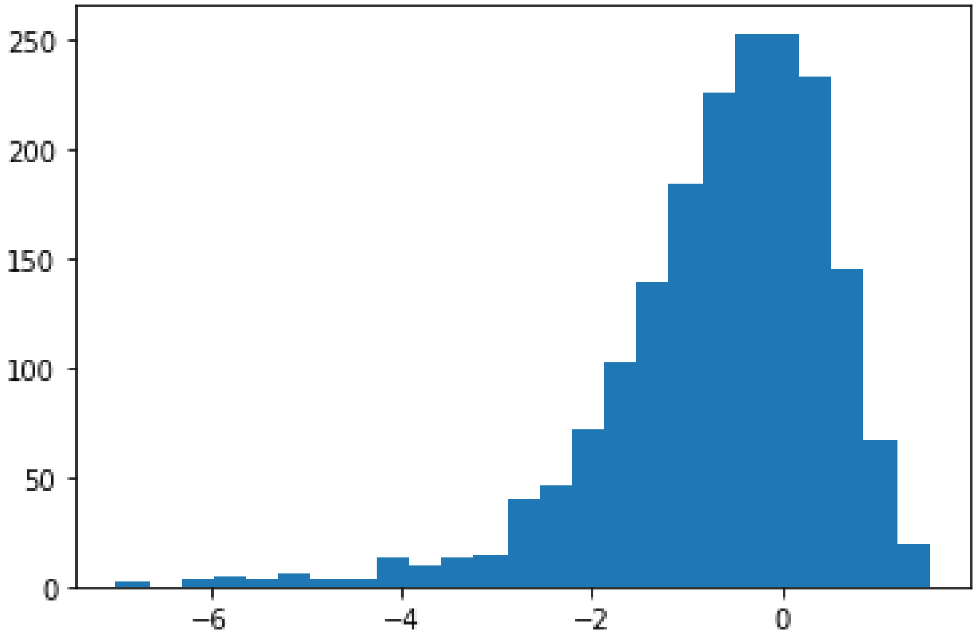
```
[105]: df1["common_word_link_ratio_2"].skew()
```

```
[105]: 0.6835030907686195
```

```
[106]: #LOg transformation
       import numpy as np

       log_c2 = np.log(df1["common_word_link_ratio_2"])
       print(log_c2.skew())
```

```
-1.379485284228086

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

```
[107]: plt.hist(log_c2, bins=25)
       plt.show()
```

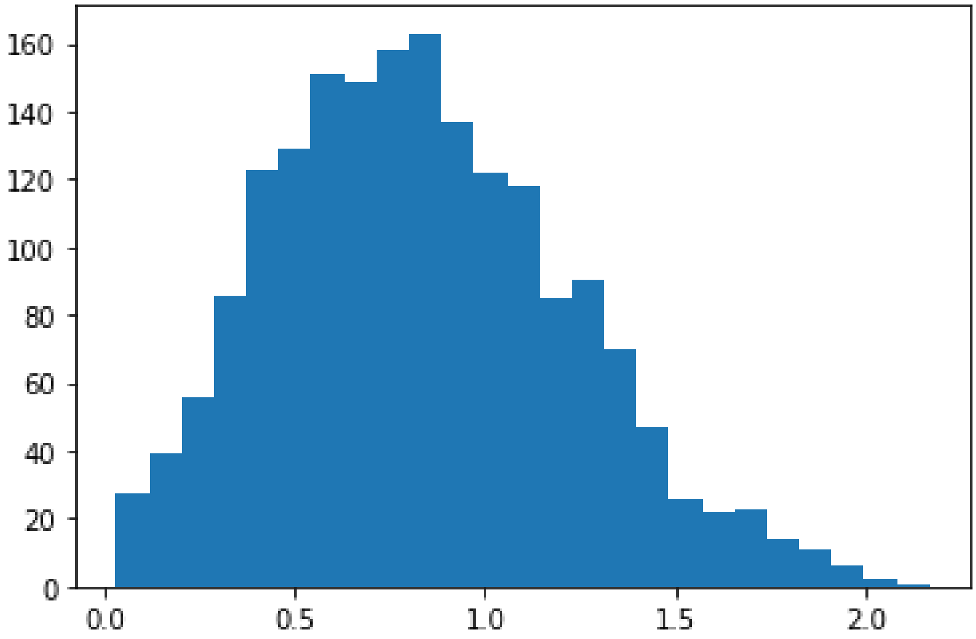


[108]:
```
#SQRT transformation
sqrt_c2 = np.sqrt(df1["common_word_link_ratio_2"])
print(sqrt_c2.skew())
```

```
0.4000079627957845
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[109]:
```
plt.hist(sqrt_c2, bins=25)
plt.show()
```



[110]:
```
# #Box cox
# pos = l[log_c2>0]
# from scipy import stats
# c2_boxcox = stats.boxcox(pos)
# plt.hist(c2_boxcox, bins=25)
```

[111]:
```
df1["common_word_link_ratio_2"].max()
```

[111]:
```
4.703561656384933
```

[112]:
```
max = df1["common_word_link_ratio_2"].quantile(.95)
min = df1["common_word_link_ratio_2"].quantile(.05)
```

[113]:
```
max
```

[113]:
```
1.8123124746773864
```

[114]:
```
#Outlier removal
```

[115]:
```
#df1 = df1[(df1['common_word_link_ratio_2']<max) &␣
 ↪(df1['common_word_link_ratio_2']>min)]
```

[116]:
```
#df1
```

8 5. common_word_link_ratio_3

[117]:

```
#common_word_link_ratio_3

df1["common_word_link_ratio_3"].value_counts()
```

[117]:

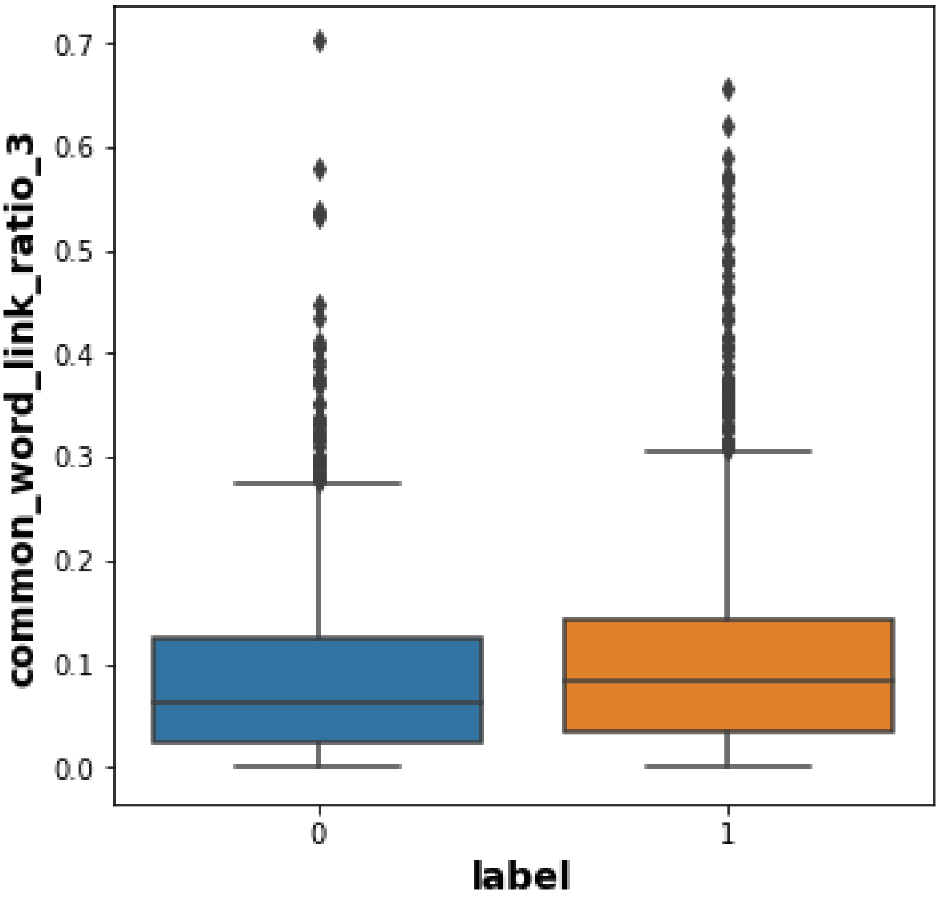
```
0.000000    519
0.027027     23
0.111111     18
0.090909     17
0.062500     16
           …
0.097297      1
0.247222      1
0.218182      1
0.006536      1
0.085648      1
Name: common_word_link_ratio_3, Length: 2144, dtype: int64
```

[118]:

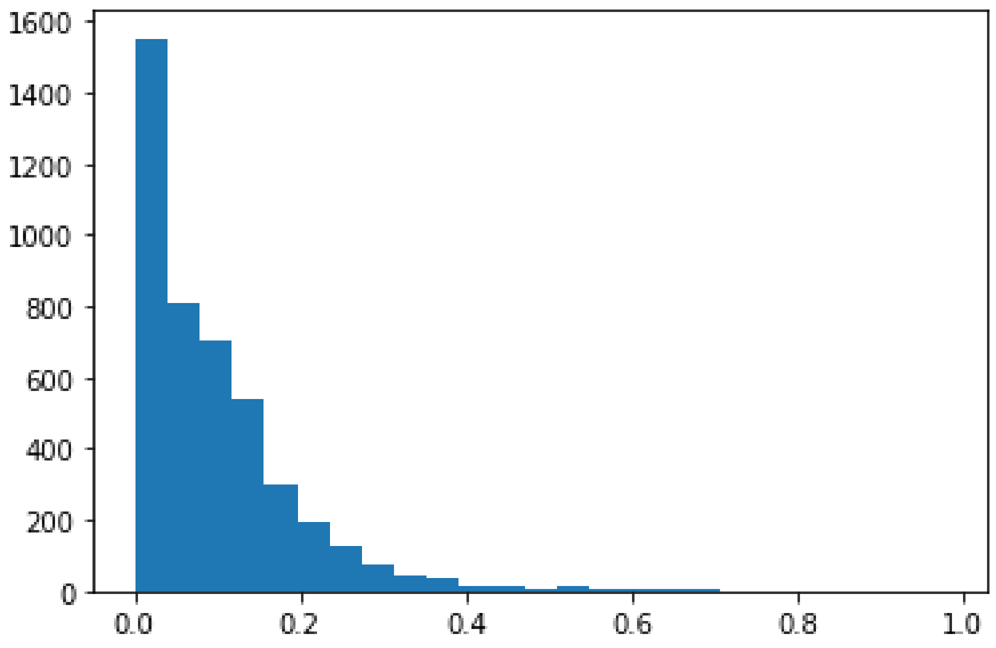
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='common_word_link_ratio_3', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('common_word_link_ratio_3', fontsize=14, fontweight='bold')
```

[118]:

```
Text(0, 0.5, 'common_word_link_ratio_3')
```



[119]:
```
plt.hist(df["common_word_link_ratio_3"], bins=25)
plt.show()
```



```
[120]: #Normalization
       c3_norm = MinMaxScaler(df1["common_word_link_ratio_3"].
        ↪min(),df1["common_word_link_ratio_3"].max())
       df1['common_word_link_ratio_3'] = df1['common_word_link_ratio_3'].apply(c3_norm.
        ↪scale)
```

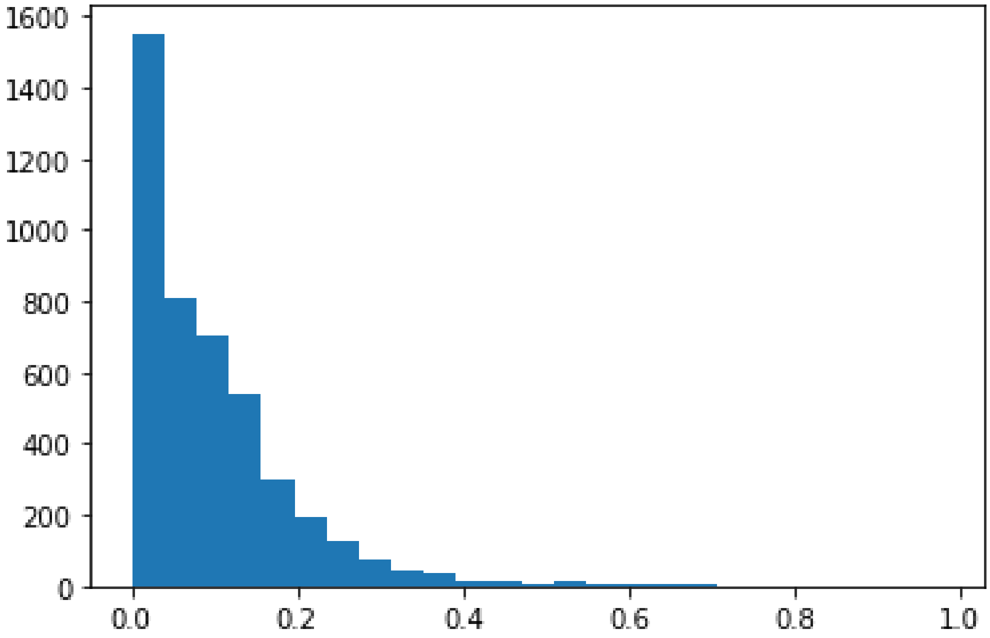
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

```
[121]: #Standardization

       c3_std = df1["common_word_link_ratio_3"].
        ↪apply(Standardizer(df1["common_word_link_ratio_3"].mean(),␣
        ↪df1["common_word_link_ratio_3"].std()).scale)
       df1['common_word_link_ratio_3'] = c3_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

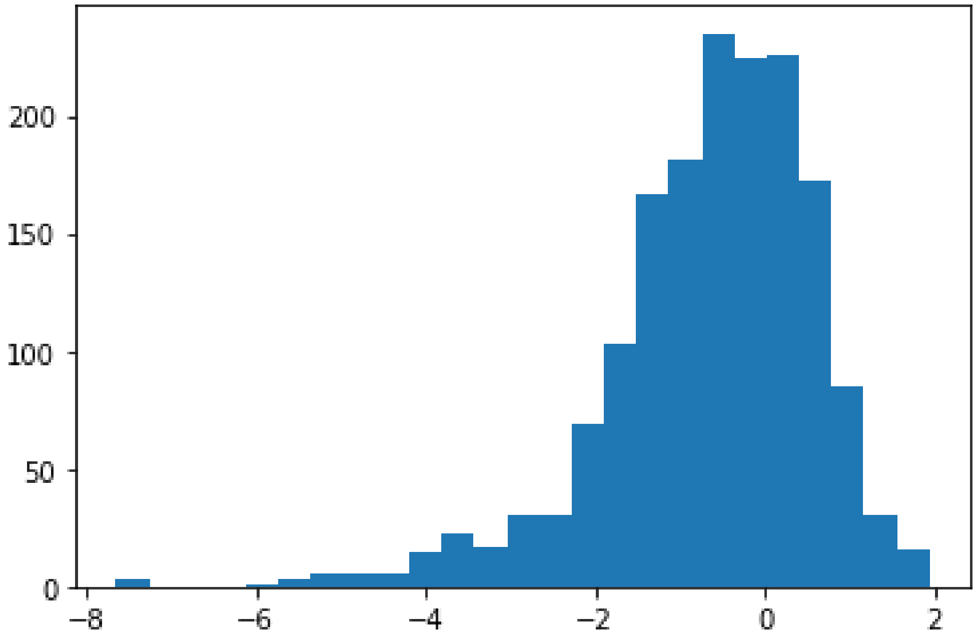
[122]:
```
plt.hist(df["common_word_link_ratio_3"], bins=25)
plt.show()
```



[123]:
```
#LOg transformation
import numpy as np

log_c3 = np.log(df1["common_word_link_ratio_3"])
print(log_c3.skew())
```

```
-1.2261161832968464

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[124]:
```
plt.hist(log_c3, bins=25)
plt.show()
```

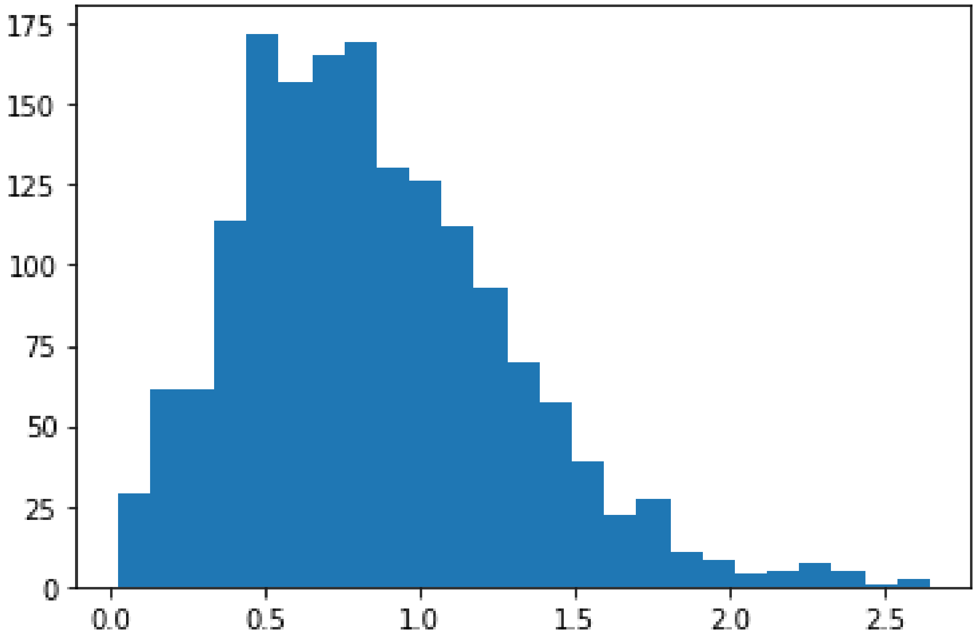


[125]:
```
#sqrt transformation
import numpy as np

sqrt_c3 = np.sqrt(df1["common_word_link_ratio_3"])
print(sqrt_c3.skew())
```

```
0.7271044644625088
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[126]:
```
plt.hist(sqrt_c3, bins=25)
plt.show()
```



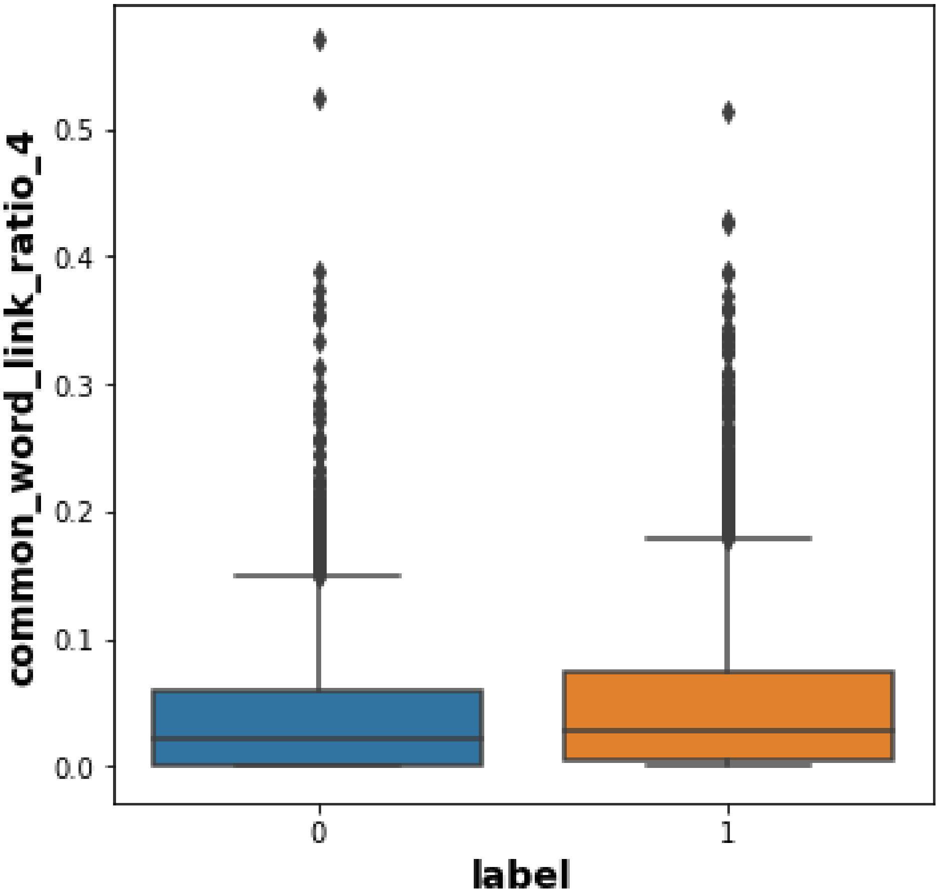
8.1 6. common_word_link_ratio_4

[127]:
```
#common_word_link_ratio_4

df1["common_word_link_ratio_4"].value_counts()
```

[127]:
```
0.000000    1089
0.016129      13
0.014085      12
0.027778      12
0.016667      12
            …
0.067729       1
0.005405       1
0.089330       1
0.183544       1
0.111913       1
Name: common_word_link_ratio_4, Length: 1781, dtype: int64
```

[128]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='common_word_link_ratio_4', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('common_word_link_ratio_4', fontsize=14, fontweight='bold')
```

[128]: Text(0, 0.5, 'common_word_link_ratio_4')



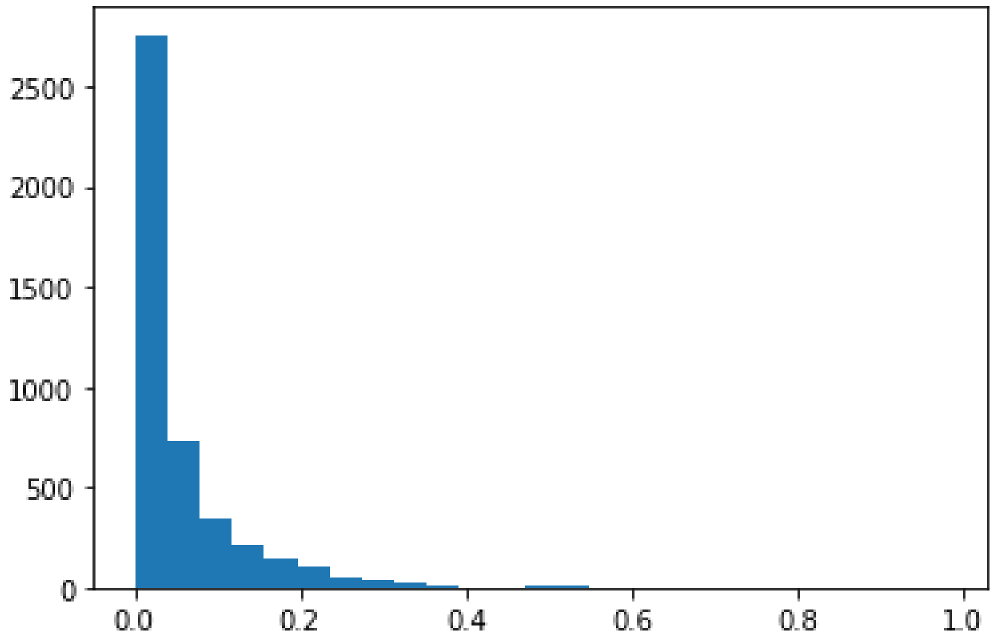
[129]:
```
#Normalization
c4_norm = MinMaxScaler(df1["common_word_link_ratio_4"].
↪min(),df1["common_word_link_ratio_4"].max())
df1['common_word_link_ratio_4'] = df1['common_word_link_ratio_4'].apply(c4_norm.
↪scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[130]:
```
#Standardization

c4_std = df1["common_word_link_ratio_4"].
 ↪apply(Standardizer(df1["common_word_link_ratio_4"].mean(),␣
 ↪df1["common_word_link_ratio_4"].std()).scale)
df1['common_word_link_ratio_4'] = c4_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[131]:
```
plt.hist(df["common_word_link_ratio_4"], bins=25)
plt.show()
```



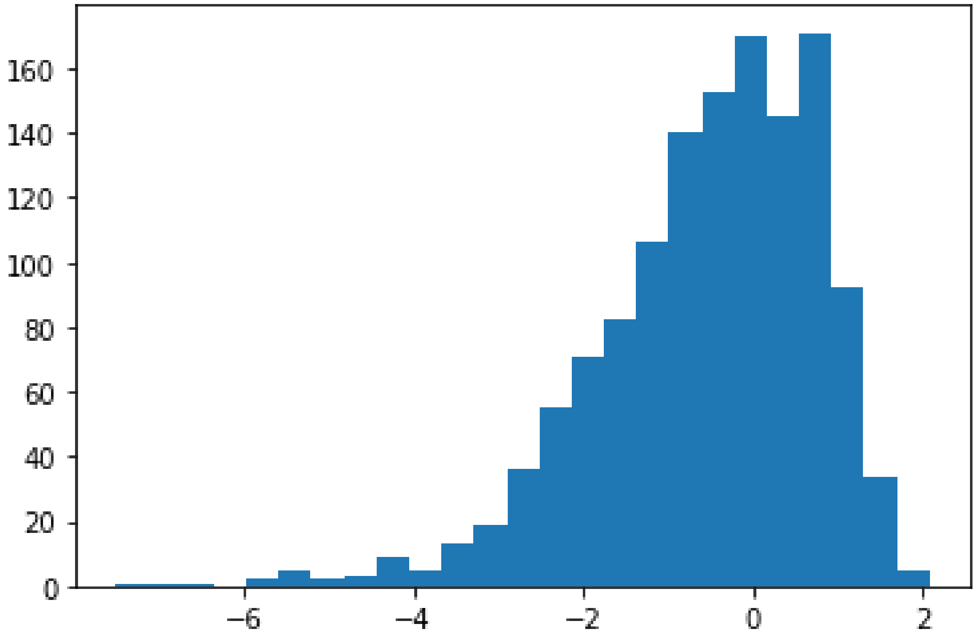
[132]:
```
#LOg transformation
import numpy as np
log_c4 = np.log(df1["common_word_link_ratio_4"])
print(log_c4.skew())
```

```
-1.0449449448634984
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
```

```
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[133]:
```
plt.hist(log_c4, bins=25)
plt.show()
```

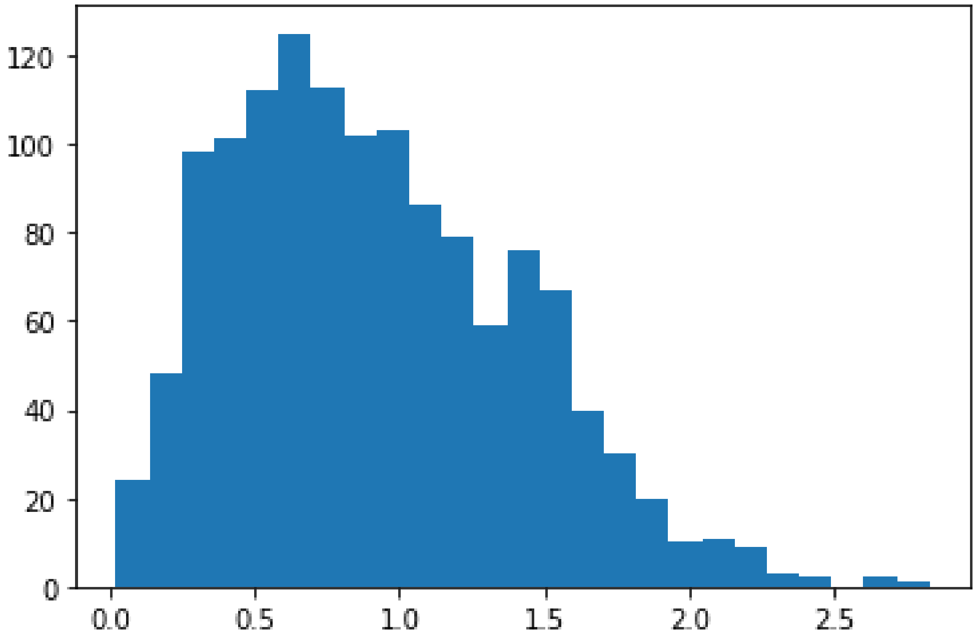


[134]:
```
#sqrt transformation
import numpy as np
sqrt_c4 = np.sqrt(df1["common_word_link_ratio_4"])
print(sqrt_c4.skew())
```

```
0.5509711352879252
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[135]:
```
plt.hist(sqrt_c4, bins=25)
plt.show()
```



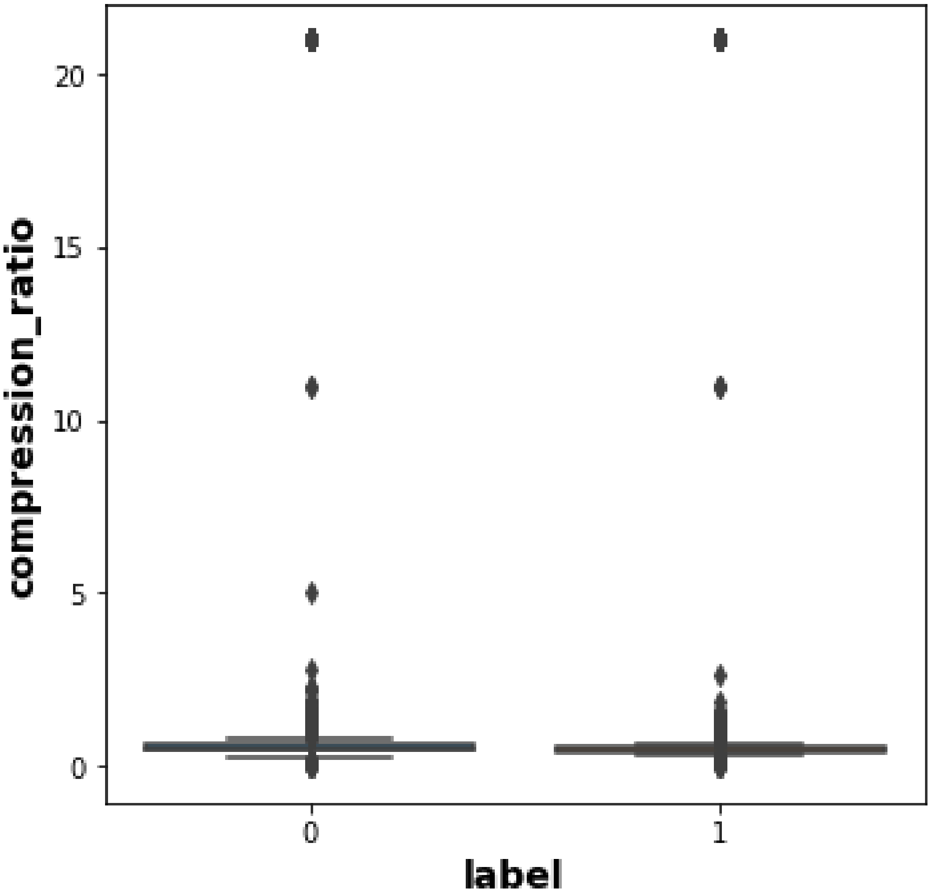
8.2 7. compression_ratio

[136]:
```
#compression_ratio

df1["compression_ratio"].value_counts()
```

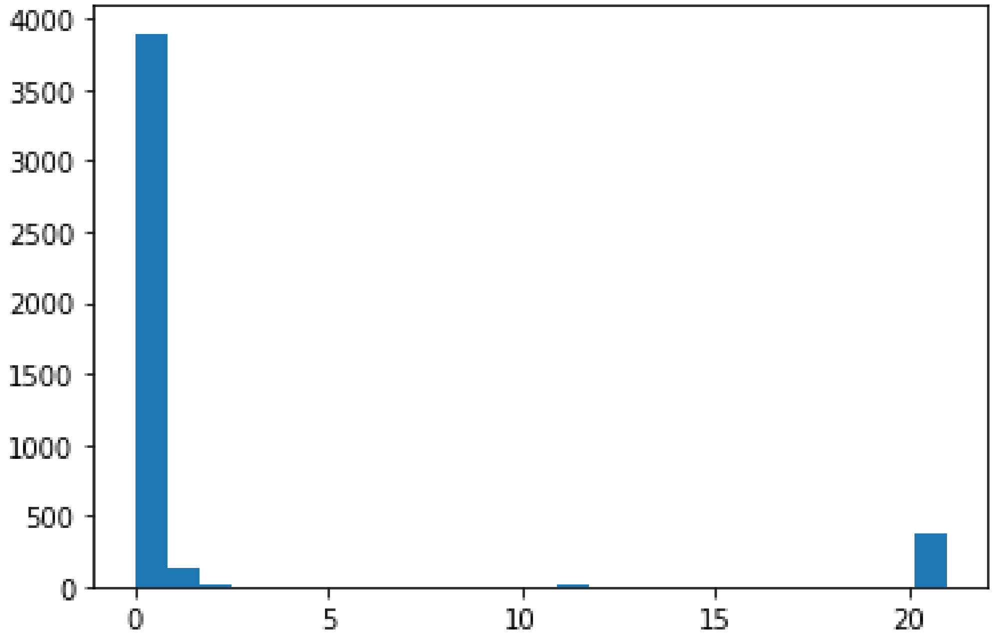
[136]:
```
21.000000    322
0.000000      22
0.609890       7
11.000000      5
0.596774       4
            …
0.447173       1
0.547368       1
0.542063       1
0.468238       1
0.664311       1
Name: compression_ratio, Length: 3550, dtype: int64
```

[137]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='compression_ratio', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('compression_ratio', fontsize=14, fontweight='bold')
```

```
[137]: Text(0, 0.5, 'compression_ratio')
```



```
[138]: plt.hist(df["compression_ratio"], bins=25)
       plt.show()
```



[139]:
```
#Normalization
com_norm = MinMaxScaler(df1["compression_ratio"].min(),df1["compression_ratio"].
 ↪max())
df1['compression_ratio'] = df1['compression_ratio'].apply(com_norm.scale)
```

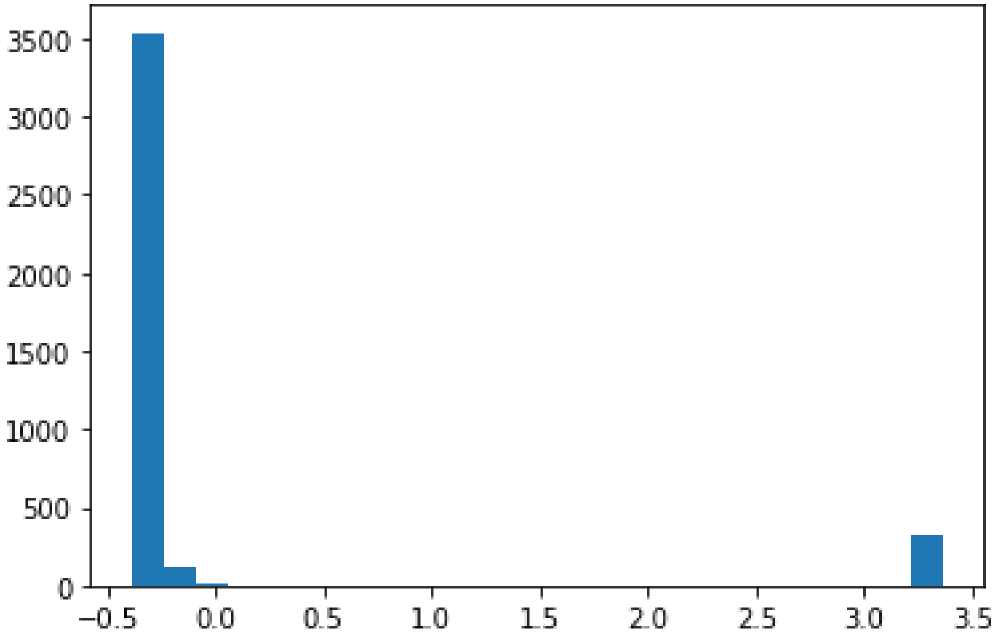
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[140]:
```
#Standardization

com_std = df1["compression_ratio"].apply(Standardizer(df1["compression_ratio"].
 ↪mean(), df1["compression_ratio"].std()).scale)
df1['compression_ratio'] = com_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[141]:
```
plt.hist(df1["compression_ratio"], bins=25)
plt.show()
```

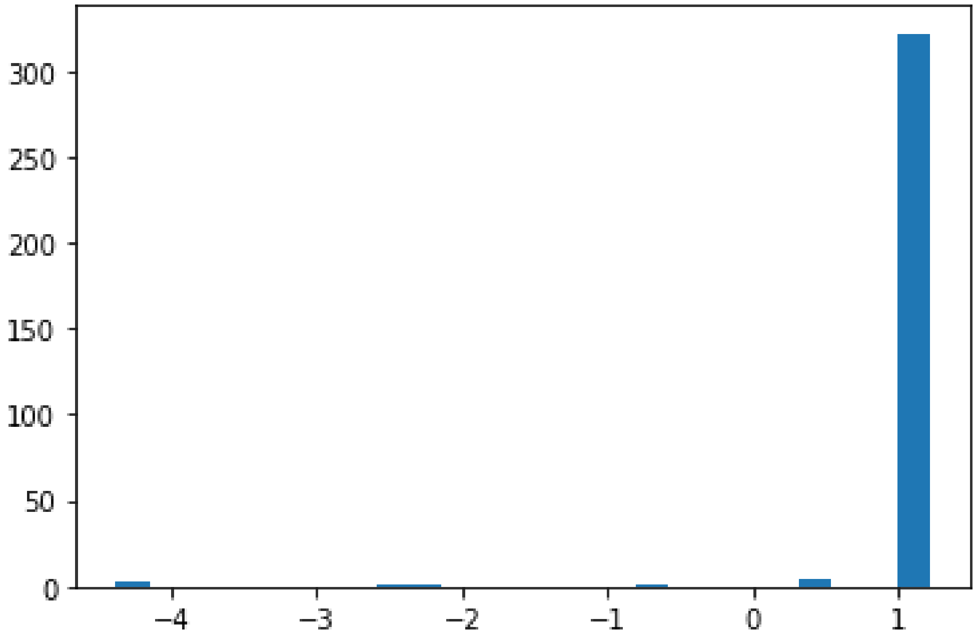


[142]:
```
#LOg transformation
import numpy as np
log_cr = np.log(df1["compression_ratio"])
print(log_cr.skew())
```

```
-7.955851213945829
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[143]:
```
plt.hist(log_cr, bins=25)
plt.show()
```

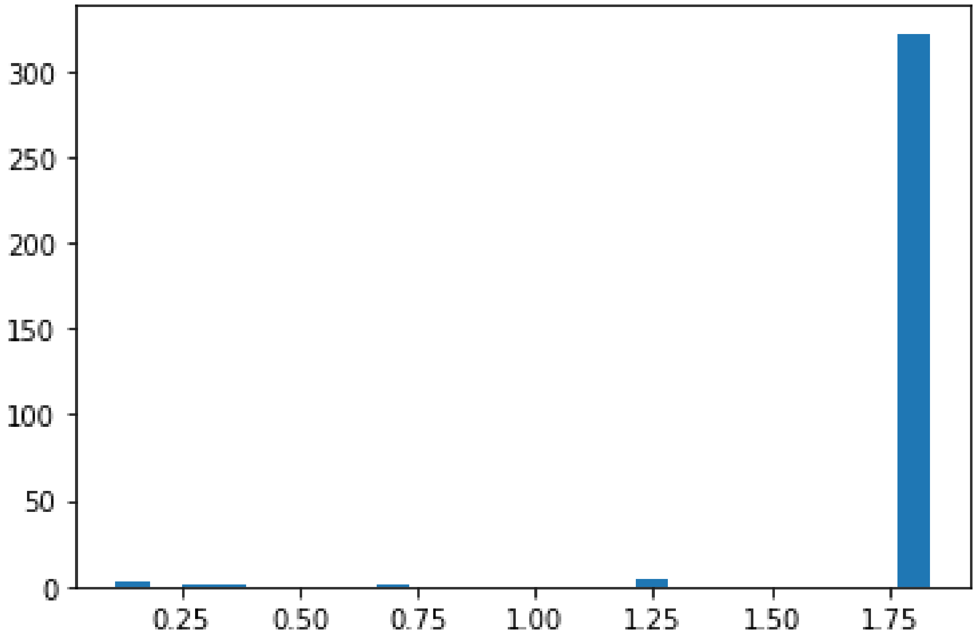


[144]:
```
#sqrt transformation
import numpy as np
sqrt_cr = np.sqrt(df1["compression_ratio"])
print(sqrt_cr.skew())
```

```
-6.5713226791911294
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[145]:
```
plt.hist(sqrt_cr, bins=25)
plt.show()
```



[146]:
```
max = df1['compression_ratio'].quantile(0.95)
min = df1['compression_ratio'].quantile(0.05)
```

[147]:
```
max
```

[147]:
```
3.3654398350780035
```

[148]:
```
min
```

[148]:
```
-0.32213876072642705
```

[149]:
```
df1['compression_ratio'].describe()
```

[149]:
```
count    3.990000e+03
mean     1.958890e-17
std      1.000000e+00
min     -3.897579e-01
25%     -3.104296e-01
50%     -3.034517e-01
75%     -2.880640e-01
max      3.365440e+00
Name: compression_ratio, dtype: float64
```

[150]:
```
#Outlier removal

#df1 = df1[(df1['compression_ratio']<max) & (df1['compression_ratio']>min)]
```

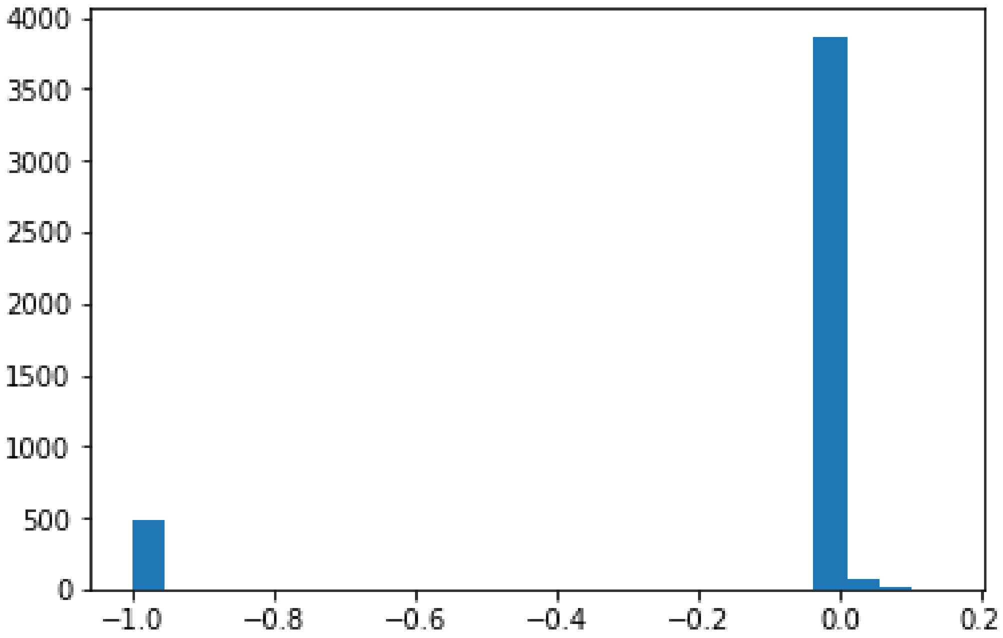
[151]:
```
#df1
```

[152]:
```
# plt.hist(df1["compression_ratio"], bins=20)
# plt.show()
```

[153]:
```
# plt.figure(figsize=(5.5,5.5))

# sns.boxplot(x='label', y='compression_ratio', data = df1)

# plt.xlabel('label', fontsize=14, fontweight='bold')
# plt.ylabel('compression_ratio', fontsize=14, fontweight='bold')
```

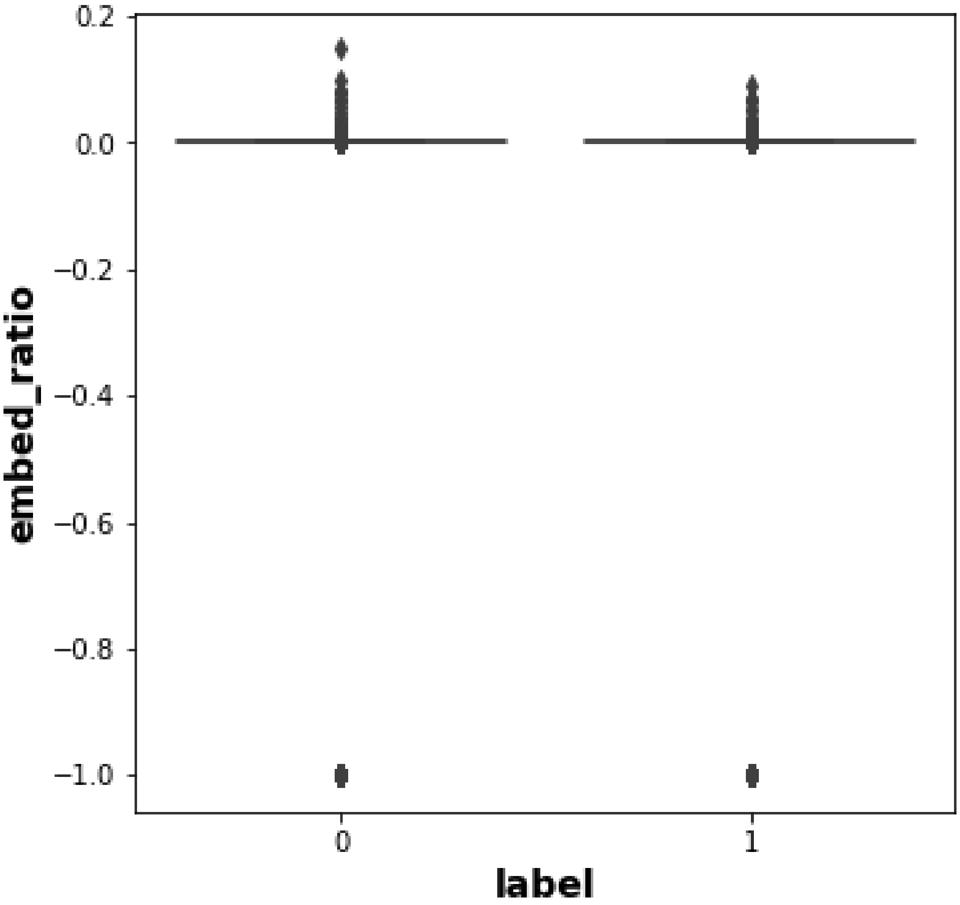
9 8. “embed_ratio”

[154]:
```
#embed_ratio
plt.hist(df["embed_ratio"], bins=25)
plt.show()
```



[155]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='embed_ratio', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('embed_ratio', fontsize=14, fontweight='bold')
```

[155]: Text(0, 0.5, 'embed_ratio')



[156]:
```
#Normalization
embed_norm = MinMaxScaler(df1["embed_ratio"].min(),df1["embed_ratio"].max())
df1['embed_ratio'] = df1['embed_ratio'].apply(embed_norm.scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

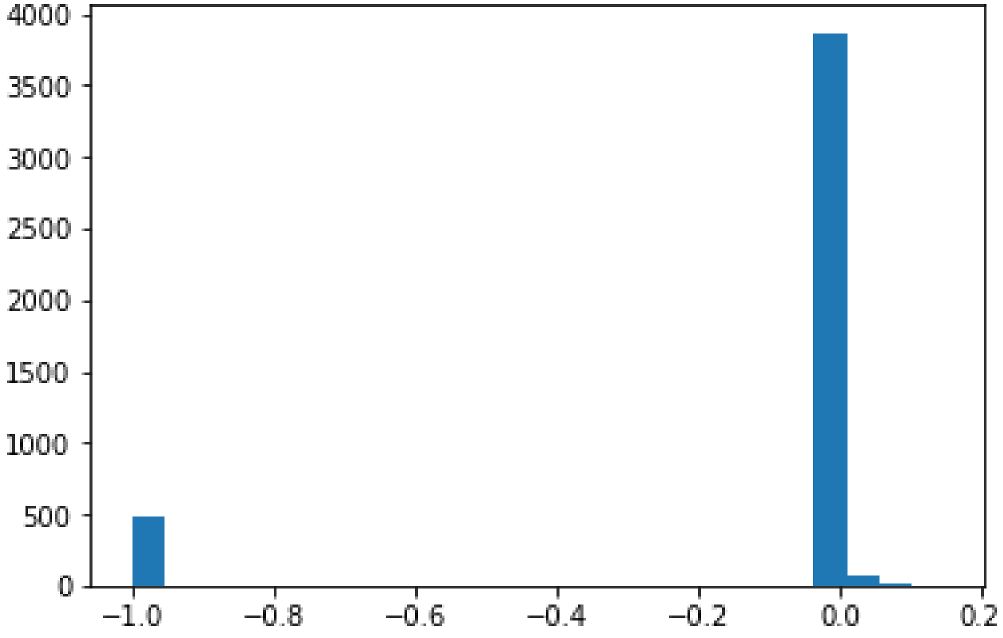
[157]:
```
#Standardization
```

```
com_std = df1["embed_ratio"].apply(Standardizer(df1["embed_ratio"].mean(),␣
↪df1["embed_ratio"].std()).scale)
df1['embed_ratio'] = com_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[158]:

```
plt.hist(df["embed_ratio"], bins=25)
plt.show()
```

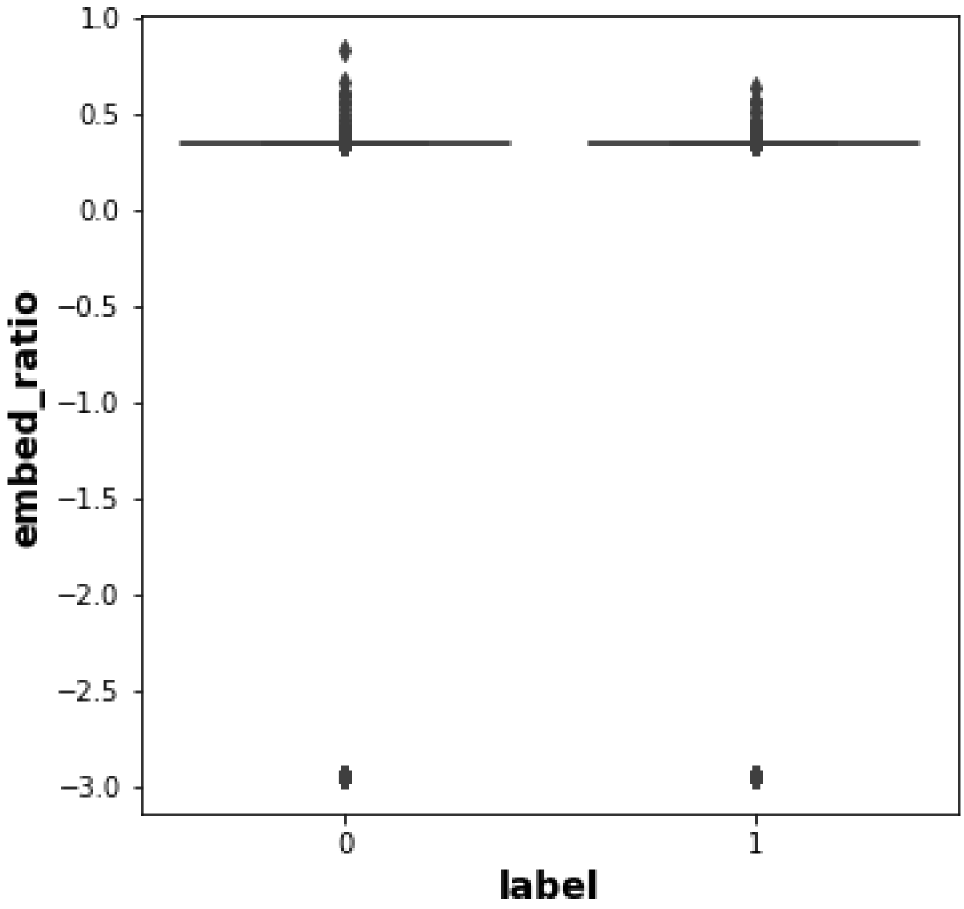


[159]:

```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='embed_ratio', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('embed_ratio', fontsize=14, fontweight='bold')
```

[159]:

```
Text(0, 0.5, 'embed_ratio')
```

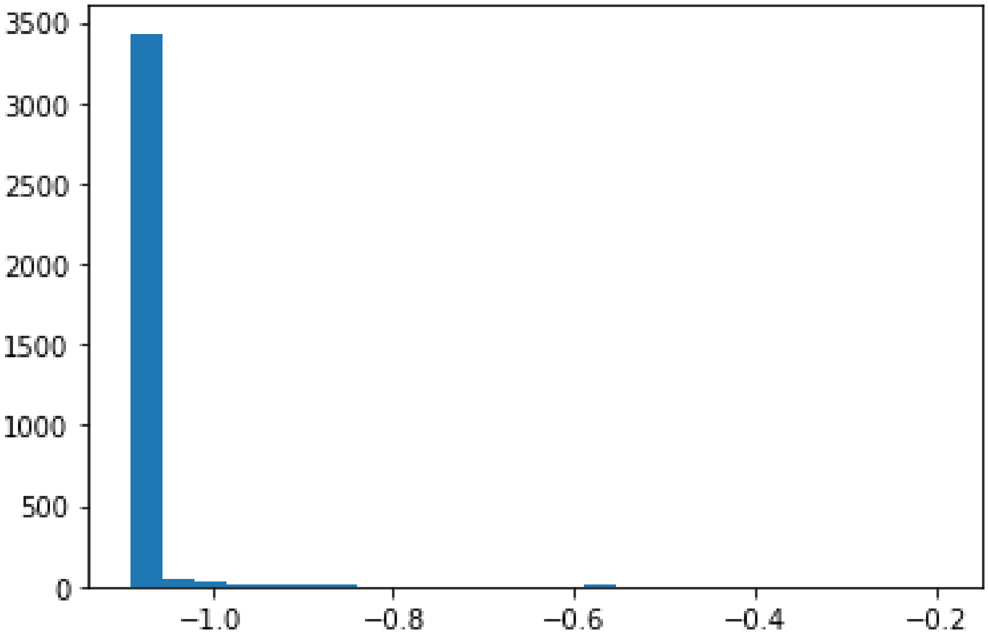


[160]:
```
#Log transformation

import numpy as np
log_er = np.log(df1["embed_ratio"])
print(log_er.skew())
```

```
10.181808231645405
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

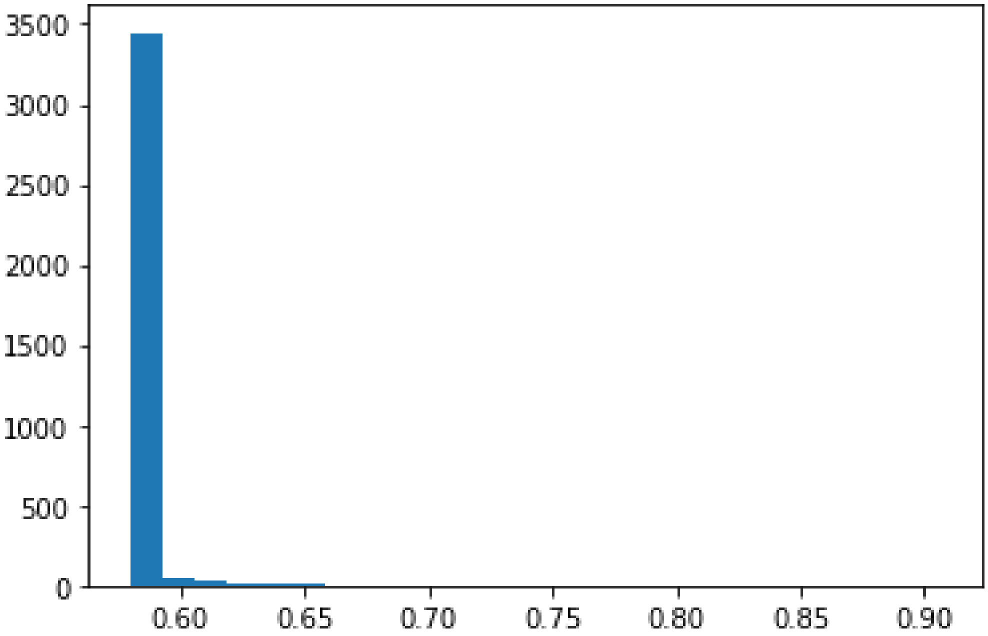
[161]:
```
plt.hist(log_er, bins=25)
plt.show()
```



[162]:
```
#Sqrt transformationspelling_mistakes_ratio

import numpy as np
sqrt_er = np.sqrt(df1["embed_ratio"])
print(sqrt_er.skew())
```

```
11.204139274216132

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[163]:
```
plt.hist(sqrt_er, bins=25)
plt.show()
```

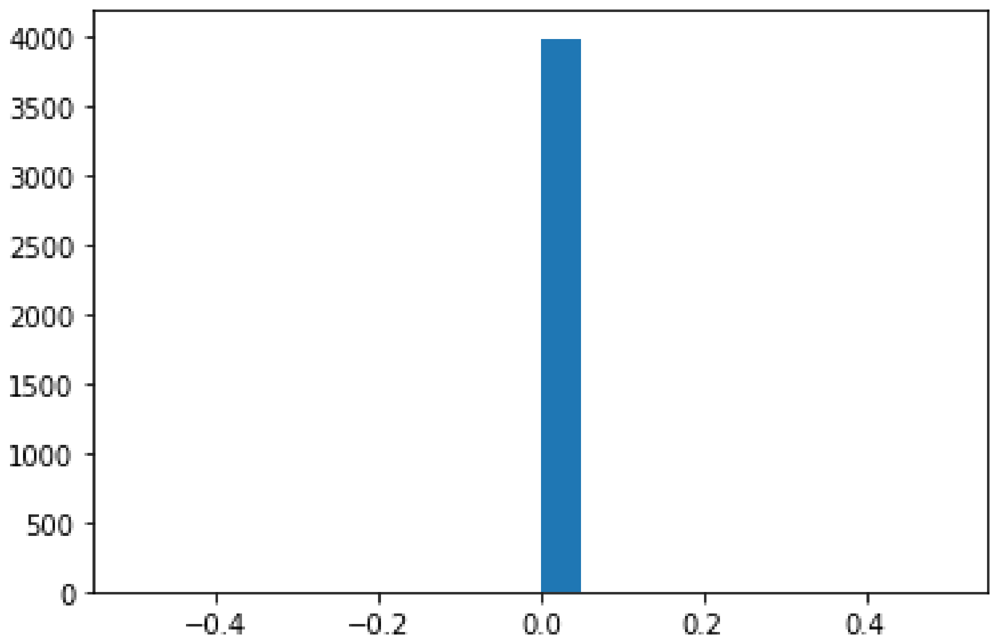


10 9. "frame_based"

```
[164]: #frame_based

       df1['frame_based'].value_counts()
```

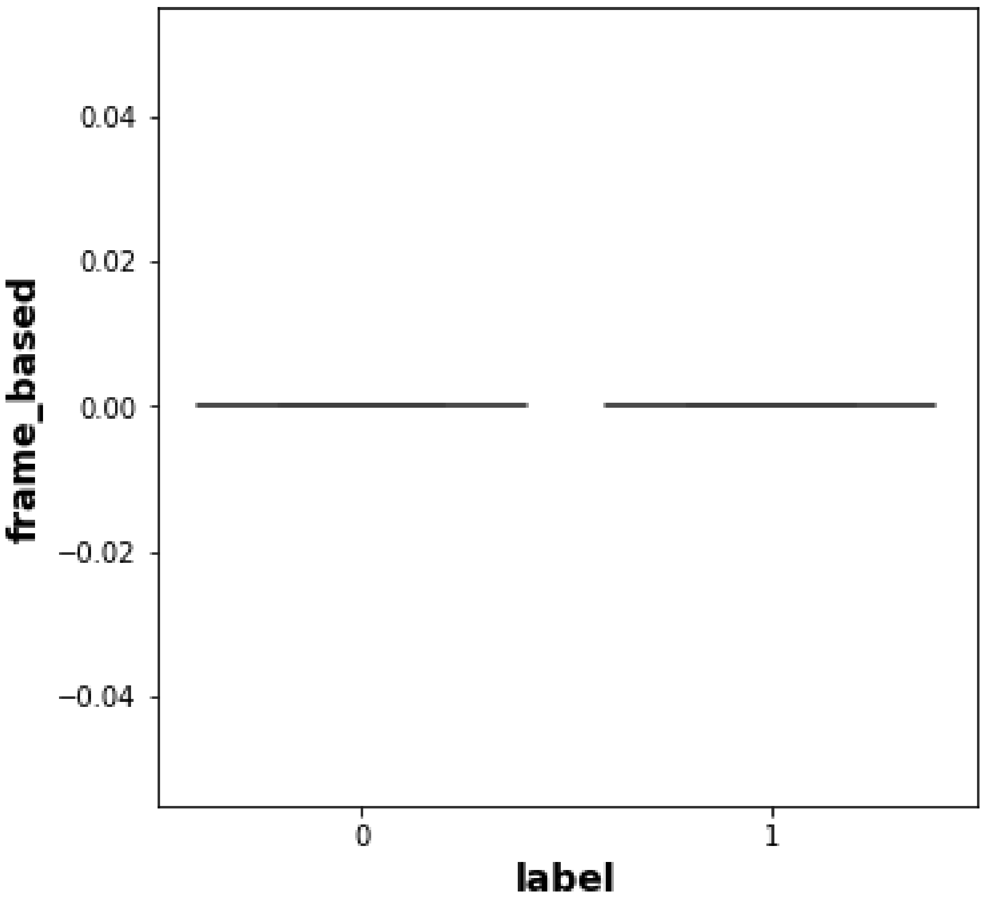
```
[164]: 0    3990
       Name: frame_based, dtype: int64
```

```
[165]: plt.hist(df1['frame_based'], bins=20)
       plt.show()
```



```
[166]: plt.figure(figsize=(5.5,5.5))

       sns.boxplot(x='label', y='frame_based', data = df1)

       plt.xlabel('label', fontsize=14, fontweight='bold')
       plt.ylabel('frame_based', fontsize=14, fontweight='bold')
```

```
[166]: Text(0, 0.5, 'frame_based')
```



```
[167]: #df1.drop(df1['frame_based'])
```

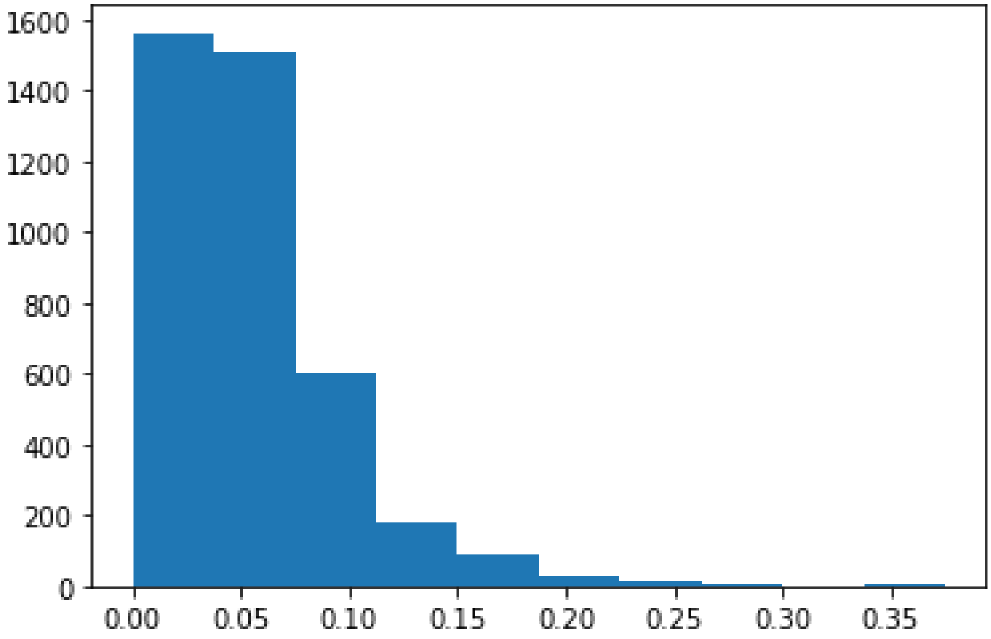
11 10. “frame_tag_ratio”

```
[168]: df1['frame_tag_ratio'].value_counts()
```

```
[168]: 0.023529    14
       0.166667    13
       0.000000    13
       0.052632     7
       0.034483     6
                   ..
       0.061294     1
       0.033659     1
       0.030240     1
       0.061453     1
       0.122222     1
```

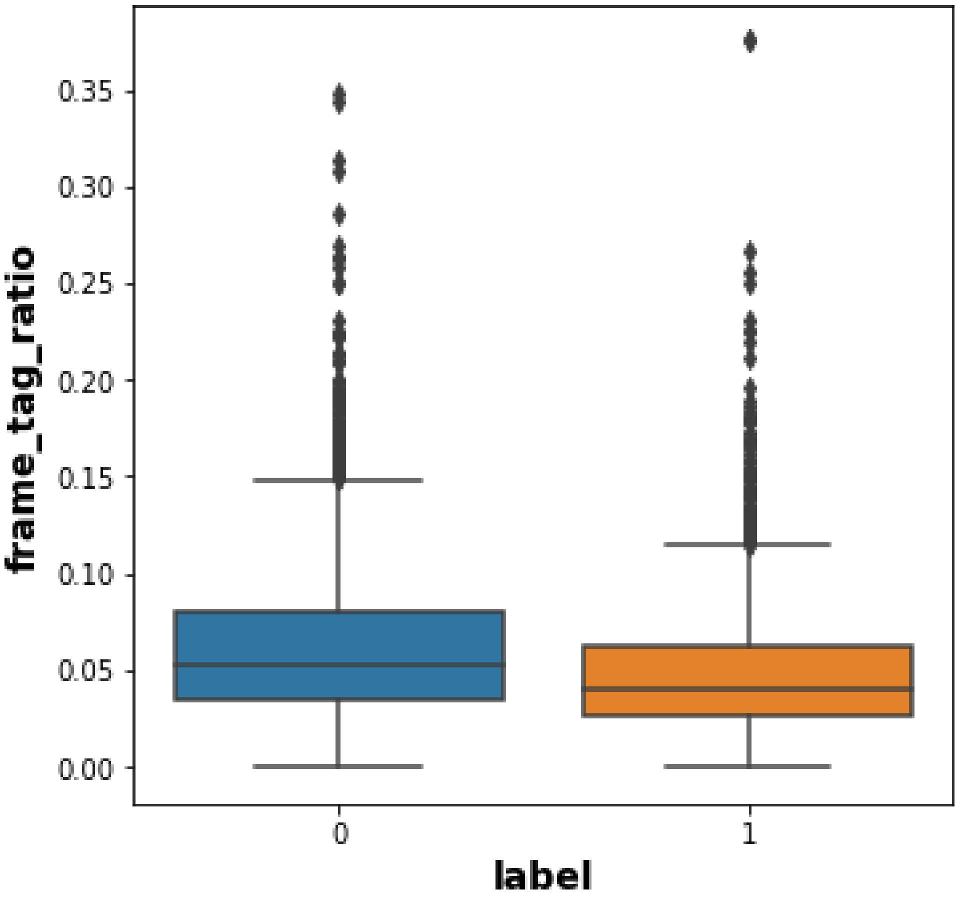
```
Name: frame_tag_ratio, Length: 3510, dtype: int64
```

[169]:
```
plt.hist(df1['frame_tag_ratio'])
plt.show()
```



[170]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='frame_tag_ratio', data = df1)
#spelling_mistakes_ratio
plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('frame_tag_ratio', fontsize=14, fontweight='bold')
```

[170]:
```
Text(0, 0.5, 'frame_tag_ratio')
```



[171]:
```
#Normalization
frame_tag_norm = MinMaxScaler(df1["frame_tag_ratio"].
 ↪min(),df1["frame_tag_ratio"].max())
df1['frame_tag_ratio'] = df1['frame_tag_ratio'].apply(frame_tag_norm.scale)
```

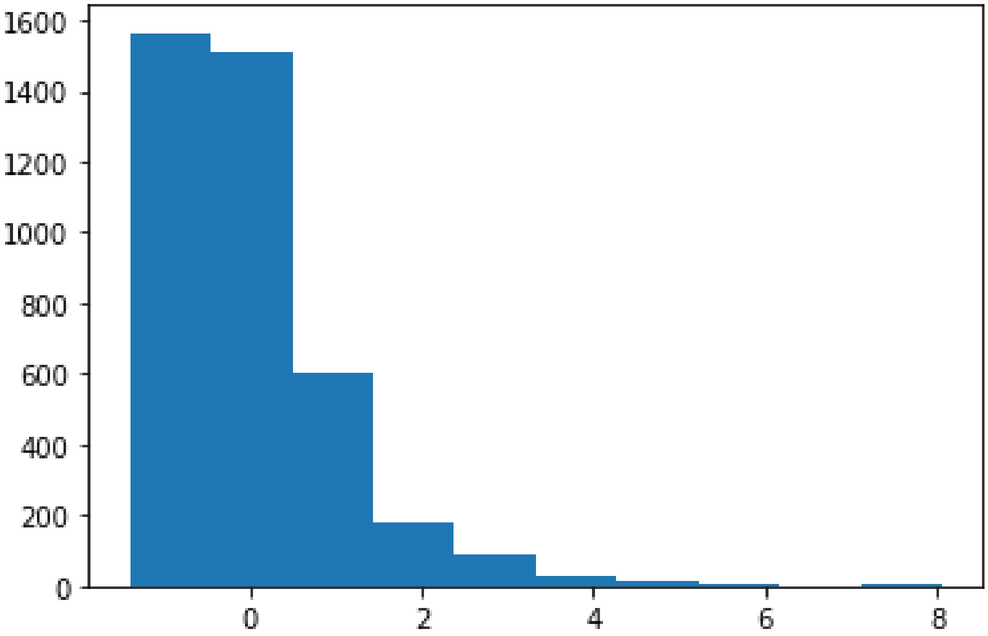
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[172]:
```
#Standardization
```

```
frame_tag_std = df1["frame_tag_ratio"].
 ↪apply(Standardizer(df1["frame_tag_ratio"].mean(), df1["frame_tag_ratio"].
 ↪std()).scale)
df1['frame_tag_ratio'] = frame_tag_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[173]:
```
plt.hist(df1['frame_tag_ratio'])
plt.show()
```



[174]:
```
#LOg transformation
import numpy as np

log_ft = np.log(df1["frame_tag_ratio"])
print(log_ft.skew())
```

```
-1.0365489936016745
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
```

```
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

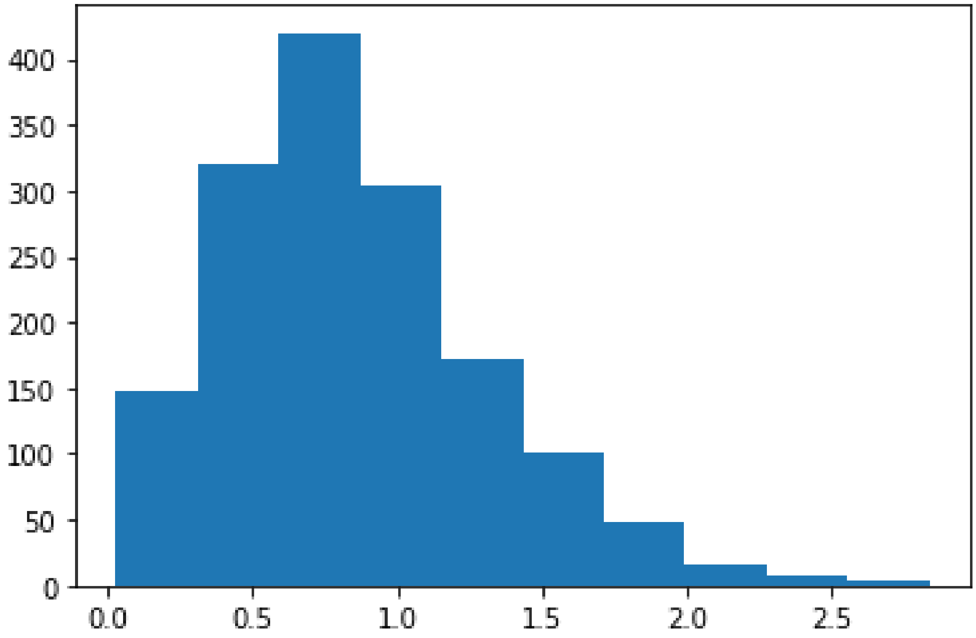
[175]:
```
# plt.hist(log_ft)
# plt.show()
```

[176]:
```
#sqrt transformation
import numpy as np

sqrt_ft = np.sqrt(df1["frame_tag_ratio"])
print(sqrt_ft.skew())
```

```
0.8119362569039607
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[177]:
```
plt.hist(sqrt_ft)
plt.show()
```



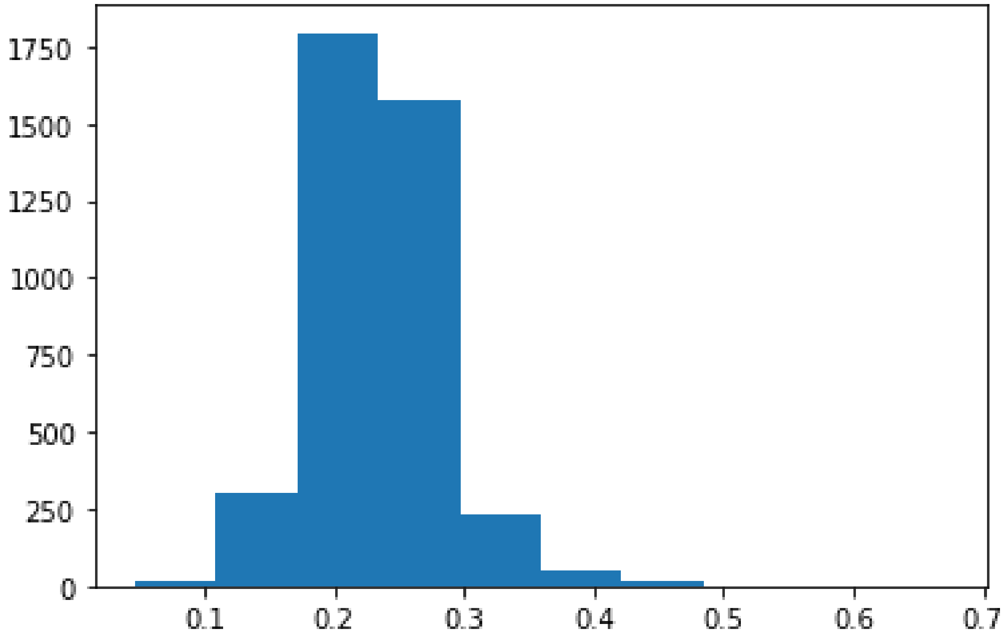
12 11. html_ratio

[178]:
```
#html_ratio

df1['html_ratio'].value_counts()
```

```
[178]: 0.277981    6
       0.278036    2
       0.277926    2
       0.267953    1
       0.222737    1
                  ..
       0.253171    1
       0.210555    1
       0.094570    1
       0.145823    1
       0.260507    1
       Name: html_ratio, Length: 3983, dtype: int64
```

```
[179]: plt.hist(df1['html_ratio'])
```

```
[179]: (array([1.200e+01, 3.000e+02, 1.795e+03, 1.580e+03, 2.320e+02, 4.800e+01,
               1.800e+01, 2.000e+00, 1.000e+00, 2.000e+00]),
        array([0.04556422, 0.10824918, 0.17093414, 0.23361909, 0.29630405,
               0.35898901, 0.42167397, 0.48435892, 0.54704388, 0.60972884,
               0.67241379]),
        <a list of 10 Patch objects>)
```

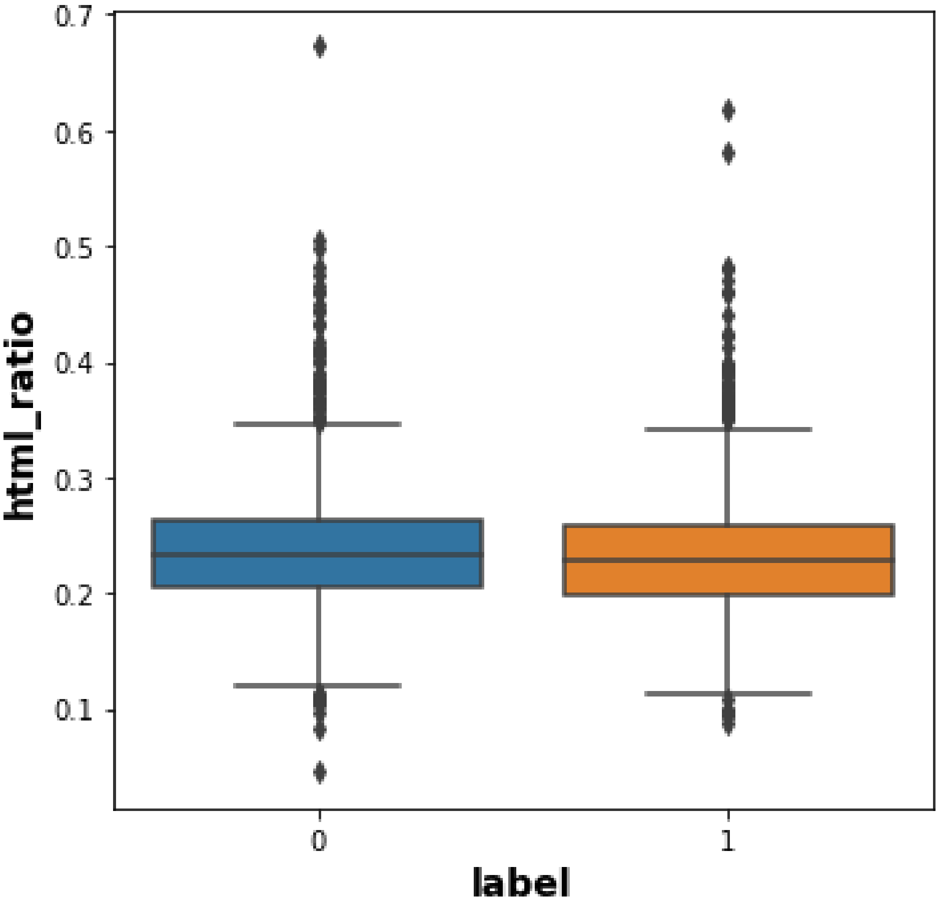


```
[180]: plt.figure(figsize=(5.5,5.5))

       sns.boxplot(x='label', y='html_ratio', data = df1)
```

```
plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('html_ratio', fontsize=14, fontweight='bold')
```

[180]:

```
Text(0, 0.5, 'html_ratio')
```



[181]:

```
#Normalization
html_ratio_norm = MinMaxScaler(df1["html_ratio"].min(),df1["html_ratio"].max())
df1['html_ratio'] = df1['html_ratio'].apply(html_ratio_norm.scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[182]:

```
#Standardization

html_ratio_std = df1["html_ratio"].apply(Standardizer(df1["html_ratio"].mean(),␣
 ↪df1["html_ratio"].std()).scale)
df1['html_ratio'] = html_ratio_std
```

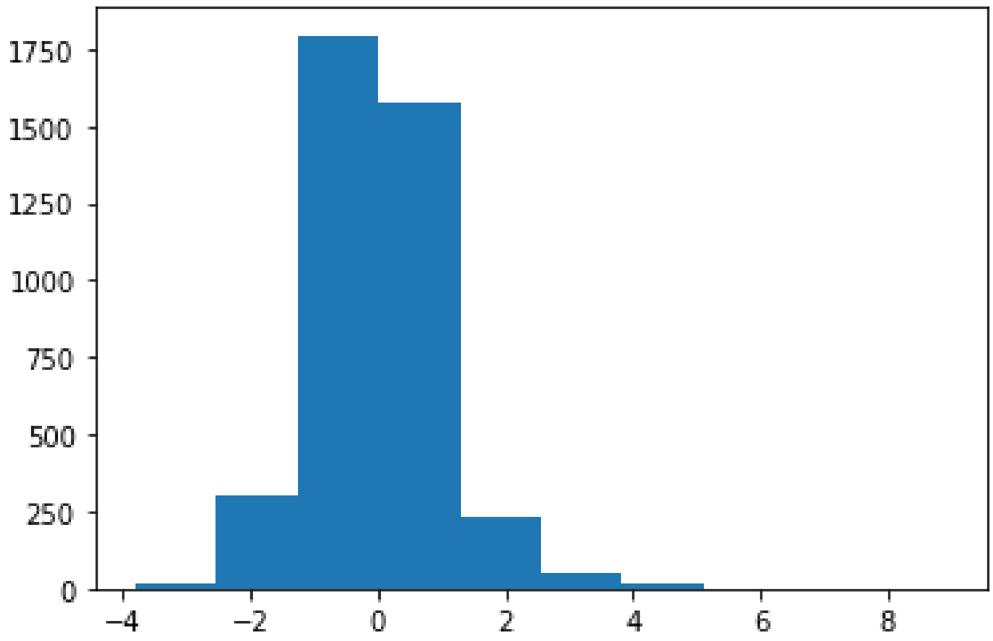
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[183]:

```
plt.hist(df1['html_ratio'])
```

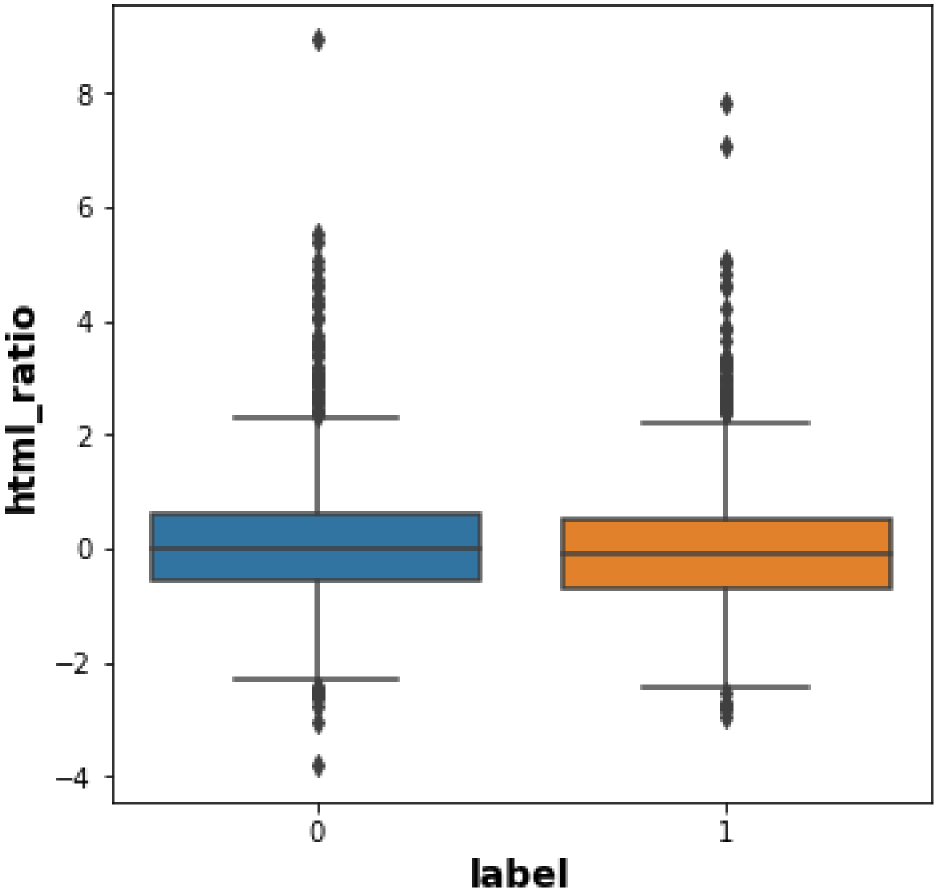
[183]:

```
(array([1.200e+01, 3.000e+02, 1.795e+03, 1.580e+03, 2.320e+02, 4.800e+01,
        1.800e+01, 2.000e+00, 1.000e+00, 2.000e+00]),
 array([-3.81185513, -2.53766142, -1.2634677 ,  0.01072601,  1.28491973,
         2.55911345,  3.83330716,  5.10750088,  6.38169459,  7.65588831,
         8.93008202]),
 <a list of 10 Patch objects>)
```



[184]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='html_ratio', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('html_ratio', fontsize=14, fontweight='bold')
```

[184]:
```
Text(0, 0.5, 'html_ratio')
```



[185]:
```
#LOg transformation

import numpy as np

log_html = np.log(df1["html_ratio"])
print(log_html.skew())
```

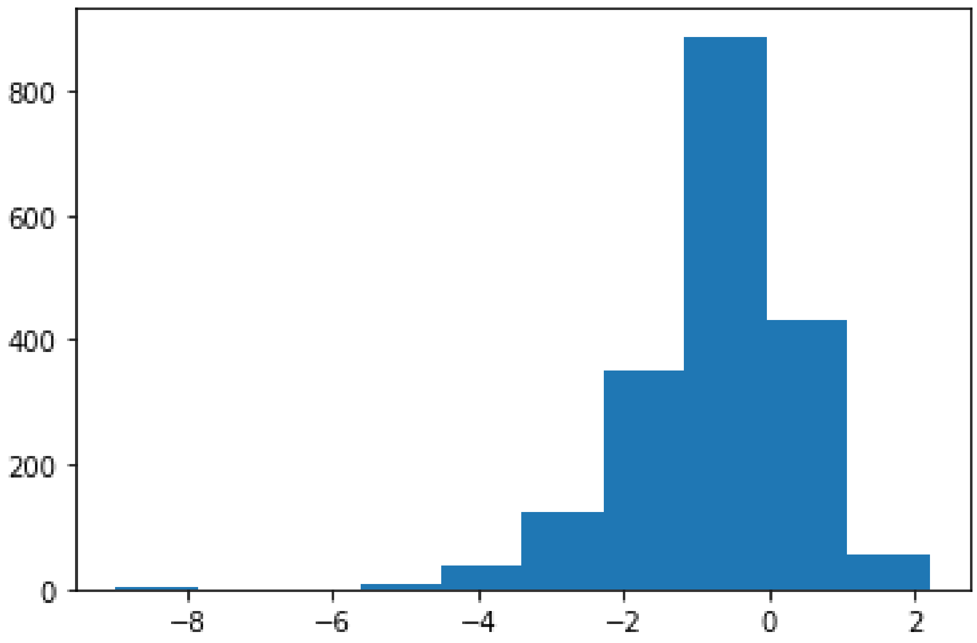
```
-1.1535932307732635
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
```

```
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[186]:
```
plt.hist(log_html)
```

[186]:
```
(array([  2.,   0.,   1.,   8.,  36., 125., 352., 887., 430.,  53.]),
 array([-8.97664564, -7.86003852, -6.7434314 , -5.62682428, -4.51021715,
        -3.39361003, -2.27700291, -1.16039579, -0.04378866,  1.07281846,
         2.18942558]),
 <a list of 10 Patch objects>)
```



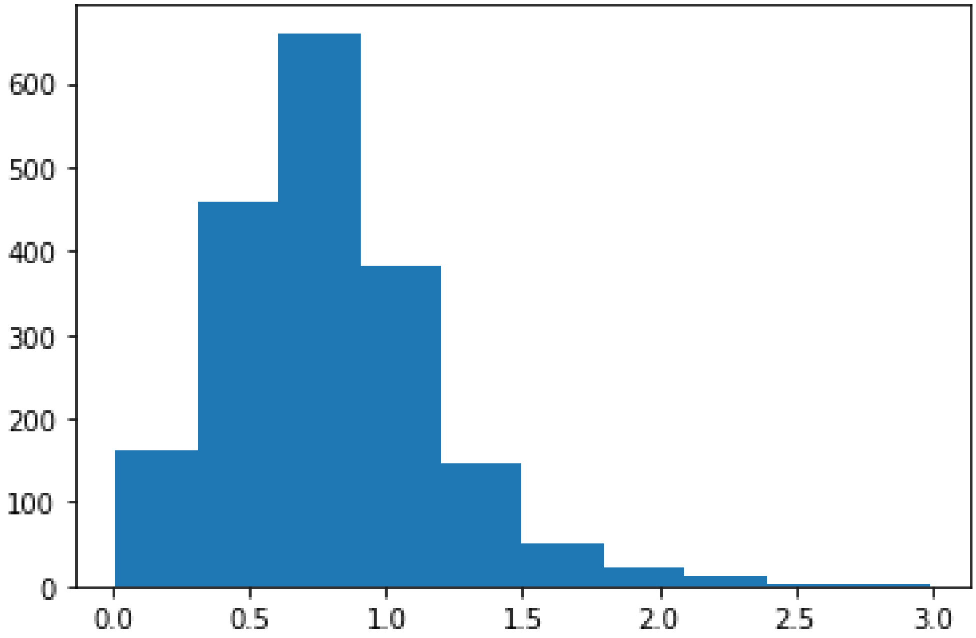
[187]:
```
#sqrt transformation

import numpy as np

sqr_html = np.sqrt(df1["html_ratio"])
print(sqr_html.skew())
```

```
0.9886998658239193
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[188]:
```
plt.hist(sqr_html)
```

```
[188]: (array([161., 457., 660., 381., 147.,  51.,  21.,  13.,   1.,   2.]),
        array([0.01123948, 0.30894796, 0.60665644, 0.90436492, 1.2020734 ,
               1.49978188, 1.79749036, 2.09519884, 2.39290732, 2.6906158 ,
               2.98832428]),
        <a list of 10 Patch objects>)
```



```
[189]: max = df1['html_ratio'].quantile(0.95)
       min = df1['html_ratio'].quantile(0.05)
```

```
[190]: max
```

```
[190]: 1.5548172636132942
```

```
[191]: min
```

```
[191]: -1.4232834824271505
```

```
[192]: #df1[(df1['html_ratio']<min)]
```

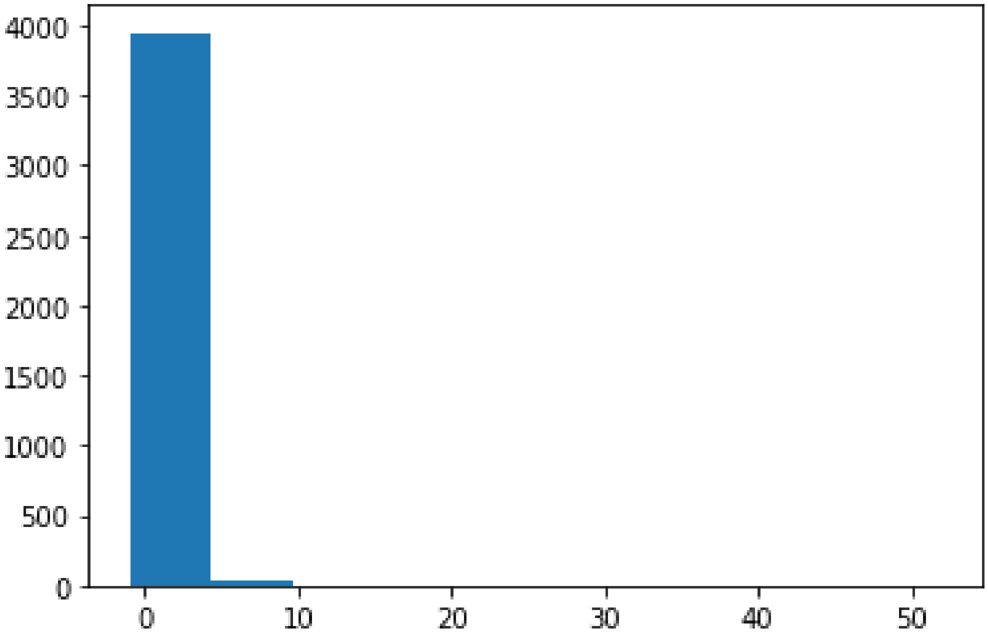
```
[193]: #Outlier removal
       #df1 = df1[(df1['html_ratio']<max) & (df1['html_ratio']>min)]
```

12.1 12. image_ratio

[194]:
```
#image_ratio

df1['image_ratio'].value_counts()
```

[194]:
```
-1.000000    353
 0.000000     25
 0.724138     20
 0.250000     11
 0.500000     10
            …
 0.122658      1
 0.229426      1
 0.025000      1
 0.210366      1
 0.282609      1
Name: image_ratio, Length: 3149, dtype: int64
```

[195]:
```
plt.hist(df1['image_ratio'])
plt.show()
```



[196]:
```
#Normalization
image_ratio_norm = MinMaxScaler(df1["image_ratio"].min(),df1["image_ratio"].
 ↪max())
df1['image_ratio'] = df1['image_ratio'].apply(image_ratio_norm.scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

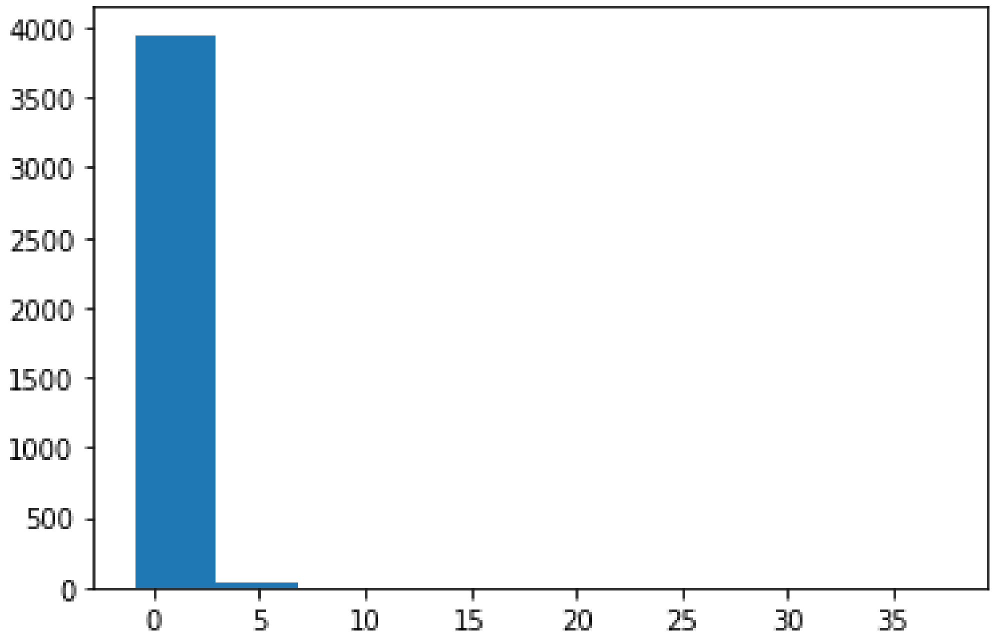
[197]:

```
#Standardization

image_ratio_std = df1["image_ratio"].apply(Standardizer(df1["image_ratio"].
 ↪mean(), df1["image_ratio"].std()).scale)
df1['image_ratio'] = image_ratio_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

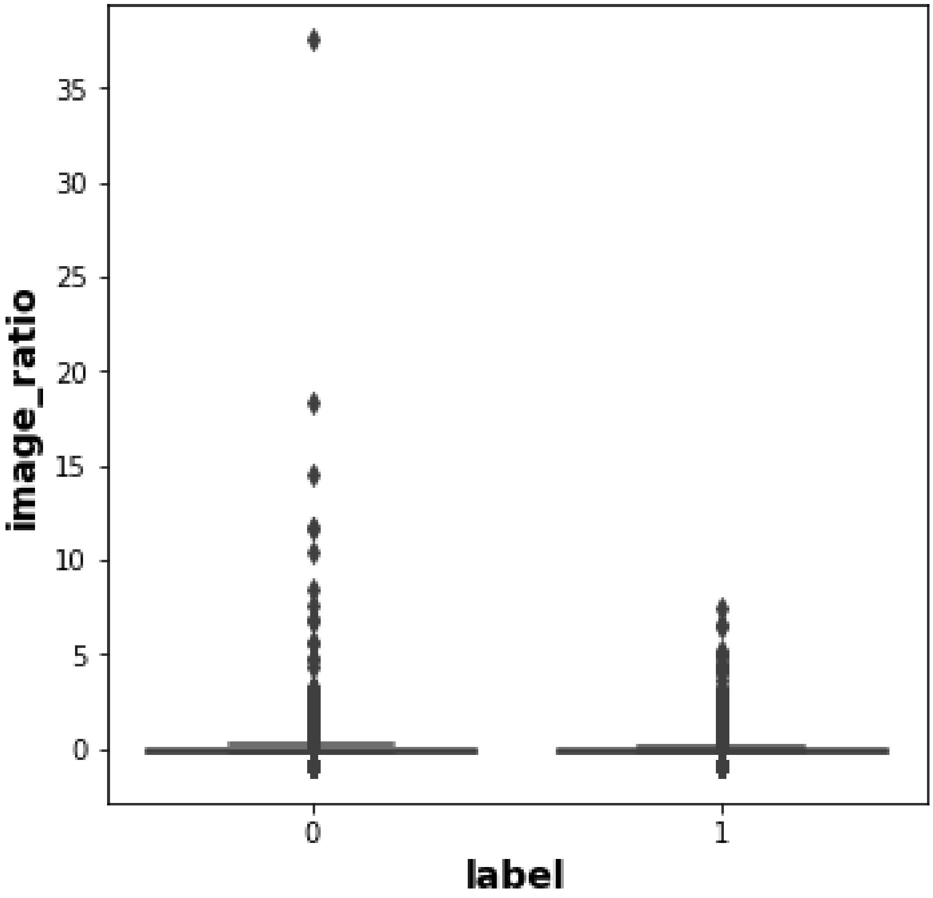
[198]:

```
plt.hist(df1['image_ratio'])
plt.show()
```



[199]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='image_ratio', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('image_ratio', fontsize=14, fontweight='bold')
```

[199]:
```
Text(0, 0.5, 'image_ratio')
```



[200]:
```
max = df1['image_ratio'].quantile(0.95)
min = df1['image_ratio'].quantile(0.05)
```

[201]:
```
df1[(df1['image_ratio']<min)]
```

[201]:
```
Empty DataFrame
Columns: [link, link_id, page_description, alchemy_category,
alchemy_category_score, avg_link_size, common_word_link_ratio_1,
common_word_link_ratio_2, common_word_link_ratio_3, common_word_link_ratio_4,
compression_ratio, embed_ratio, frame_based, frame_tag_ratio, has_domain_link,
html_ratio, image_ratio, is_news, lengthy_link_domain, link_word_score,
news_front_page, non_markup_alphanumeric_characters, count_of_links,
number_of_words_in_url, parametrized_link_ratio, spelling_mistakes_ratio, label,
pd_lower, pd_spec_rem, link_new]
Index: []

[0 rows x 30 columns]
```

[202]:

```python
#log transformation

import numpy as np

log_ir = np.log(df1["image_ratio"])
print(log_ir.skew())
```

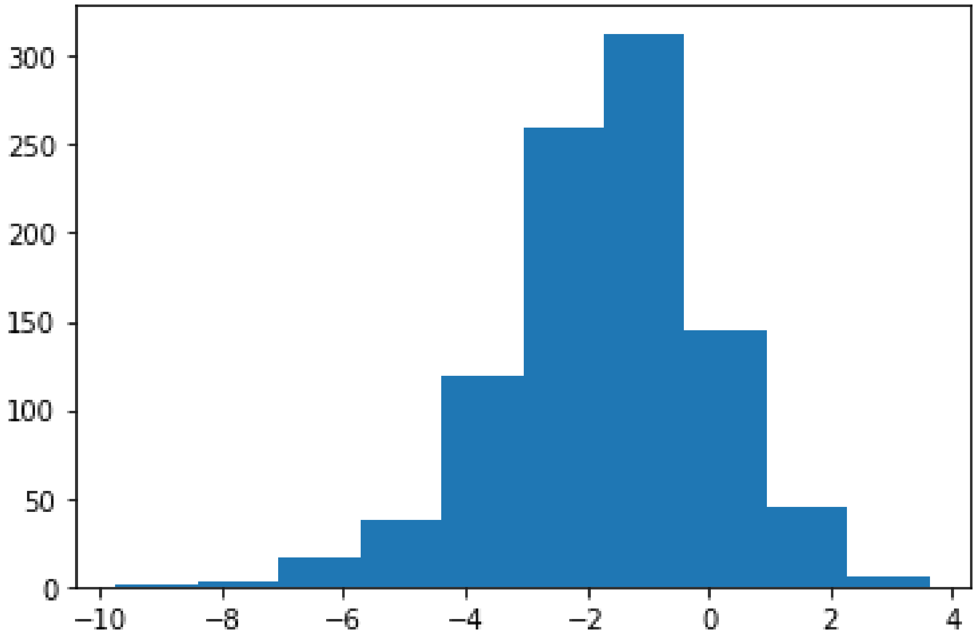
```
-0.4347963673392983

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[203]:

```python
plt.hist(log_ir)
```

[203]:

```
(array([  1.,   2.,  17.,  37., 119., 260., 313., 145.,  45.,   6.]),
 array([-9.72758309, -8.39232405, -7.057065  , -5.72180595, -4.3865469 ,
        -3.05128786, -1.71602881, -0.38076976,  0.95448929,  2.28974833,
         3.62500738]),
 <a list of 10 Patch objects>)
```



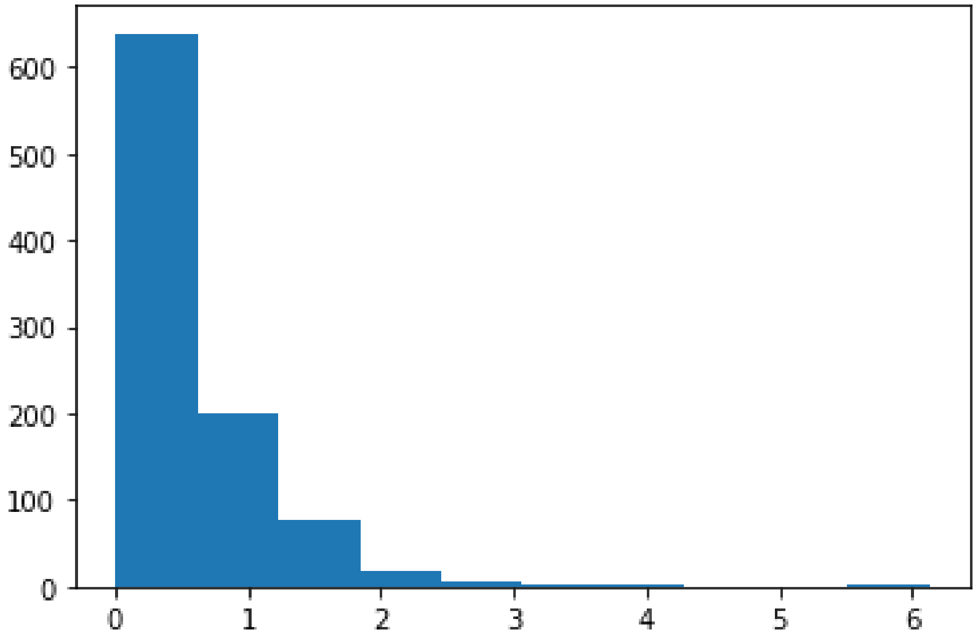
[204]:
```
#sqrt transformation

import numpy as np

sqr_ir = np.sqrt(df1["image_ratio"])
print(sqr_ir.skew())
```

```
2.9359022874974263
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[205]:
```
plt.hist(sqr_ir)
```

[205]:
```
(array([639., 199.,  77.,  17.,   7.,   3.,   2.,   0.,   0.,   1.]),
 array([0.00772115, 0.61952556, 1.23132998, 1.84313439, 2.4549388 ,
        3.06674321, 3.67854762, 4.29035203, 4.90215644, 5.51396086,
        6.12576527]),
 <a list of 10 Patch objects>)
```

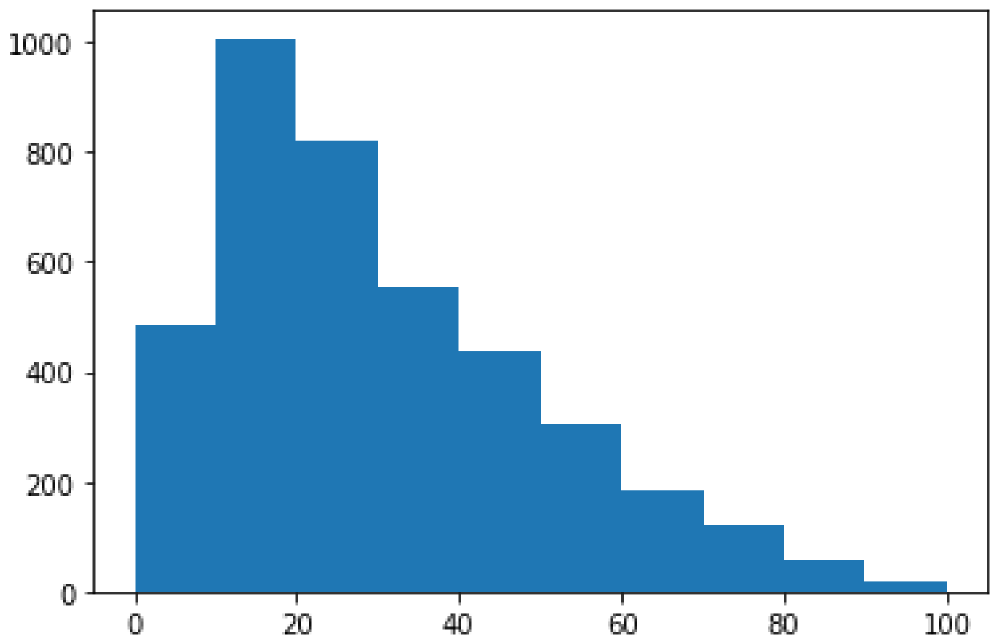


```
[205]:
```

13 13. “link_word_score”

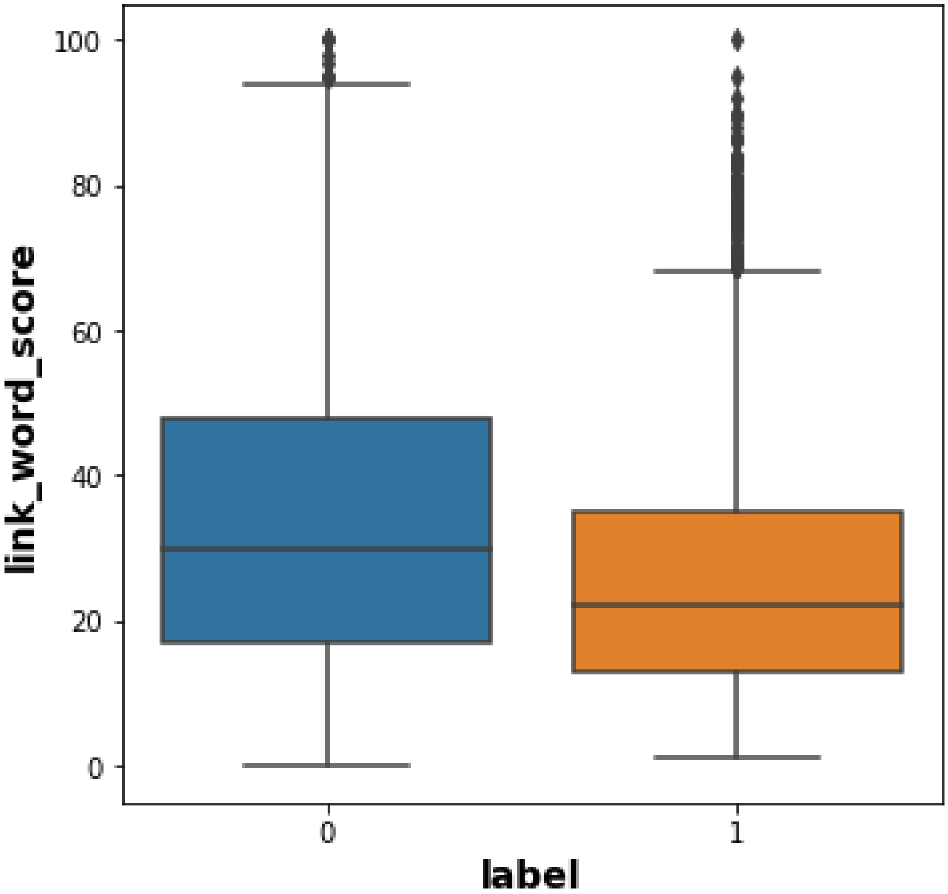
```
[206]: #link_word_score

       plt.hist(df1['link_word_score'])
```

```
[206]: (array([ 483., 1007.,  821.,  551.,  437.,  306.,  183.,  123.,   59.,
                 20.]),
        array([  0.,  10.,  20.,  30.,  40.,  50.,  60.,  70.,  80.,  90., 100.]),
        <a list of 10 Patch objects>)
```



[207]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='link_word_score', data = df1)

plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('link_word_score', fontsize=14, fontweight='bold')
```

[207]:
```
Text(0, 0.5, 'link_word_score')
```



[208]:

```
#Normalization
link_word_score_norm = MinMaxScaler(df1["link_word_score"].
↪min(),df1["link_word_score"].max())
df1['link_word_score'] = df1['link_word_score'].apply(link_word_score_norm.
↪scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[209]:

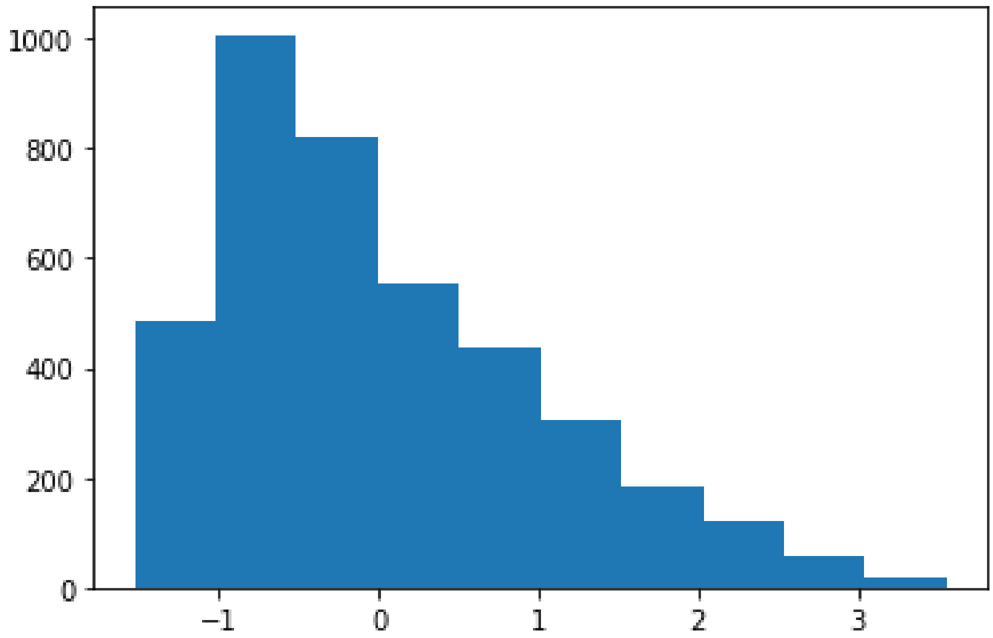
```
#Standardization
```

```
link_word_score_std = df1["link_word_score"].
 ↪apply(Standardizer(df1["link_word_score"].mean(), df1["link_word_score"].
 ↪std()).scale)
df1['link_word_score'] = link_word_score_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[210]:
```
plt.hist(df1['link_word_score'])
```

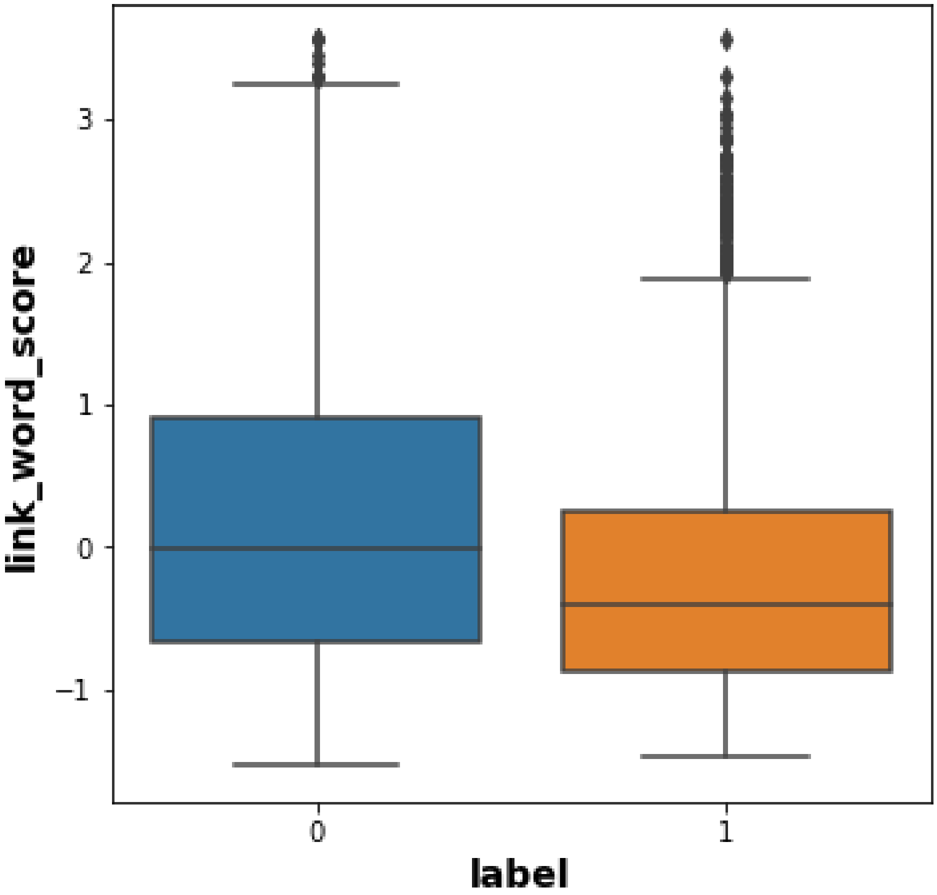
[210]:
```
(array([ 483., 1007.,  821.,  551.,  437.,  306.,  183.,  123.,   59.,
          20.]),
 array([-1.5285962 , -1.0202956 , -0.51199501, -0.00369442,  0.50460618,
         1.01290677,  1.52120737,  2.02950796,  2.53780855,  3.04610915,
         3.55440974]),
 <a list of 10 Patch objects>)
```



[211]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='link_word_score', data = df1)
```

```
plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('link_word_score', fontsize=14, fontweight='bold')
```

[211]:
```
Text(0, 0.5, 'link_word_score')
```



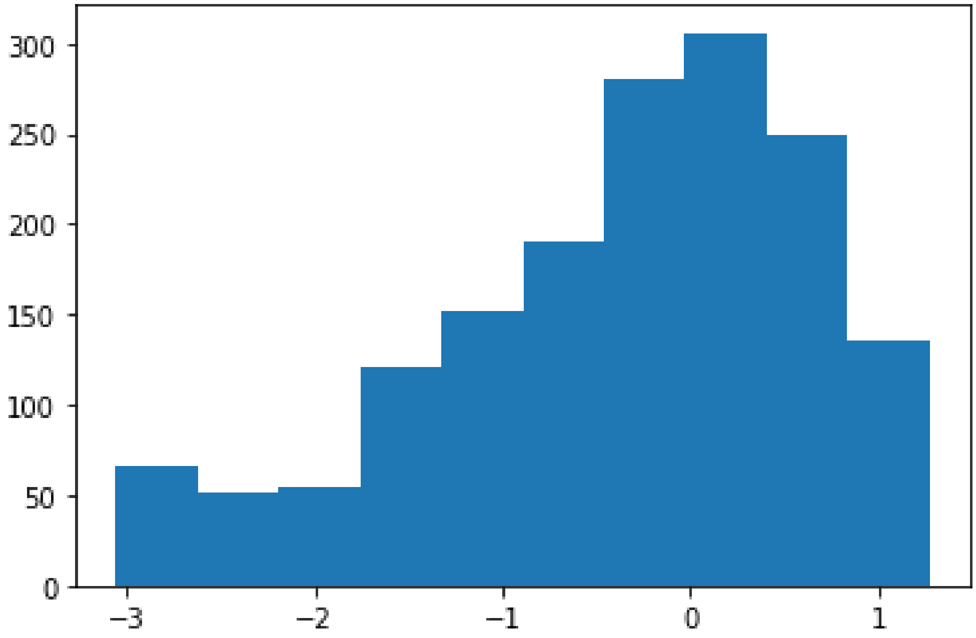
[212]:
```
#Log transform

import numpy as np

log_lws = np.log(df1["link_word_score"])
print(log_lws.skew())
```

```
-0.8347742838323742
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[213]:
```
plt.hist(log_lws)
```

[213]:
```
(array([ 66.,  52.,  55., 121., 152., 191., 281., 306., 249., 136.]),
 array([-3.05472579, -2.62243431, -2.19014283, -1.75785135, -1.32555987,
        -0.89326839, -0.46097691, -0.02868543,  0.40360605,  0.83589753,
         1.26818901]),
 <a list of 10 Patch objects>)
```



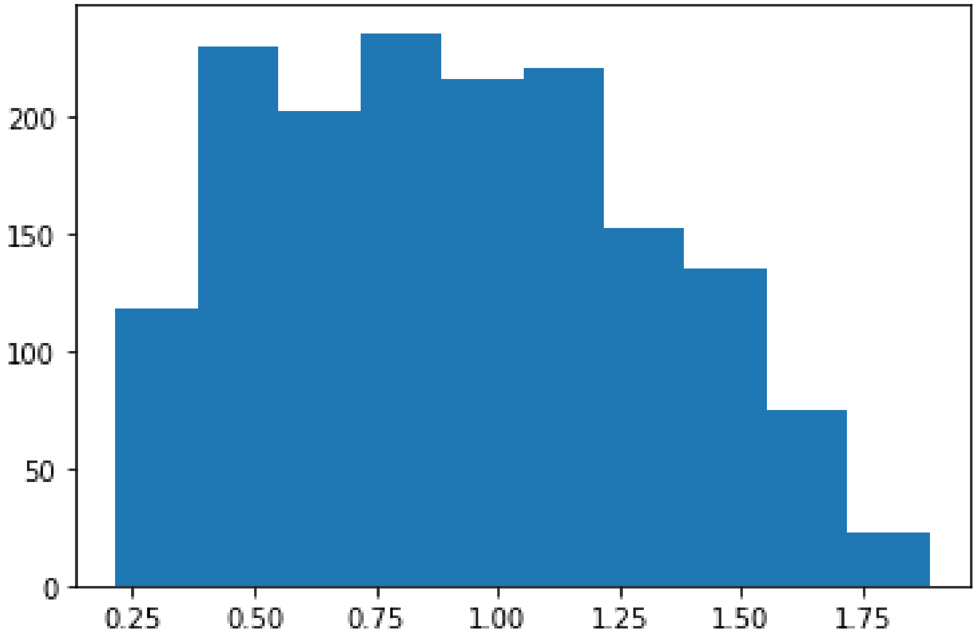
[214]:
```
#sqrt transform

import numpy as np

sqr_lws = np.sqrt(df1["link_word_score"])
print(sqr_lws.skew())
```

```
0.14625967302840492
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[215]:
```
plt.hist(sqr_lws)
```

[215]:
```
(array([118., 230., 203., 236., 216., 221., 153., 135.,  75.,  22.]),
 array([0.21710745, 0.38392813, 0.5507488 , 0.71756948, 0.88439016,
        1.05121084, 1.21803152, 1.38485219, 1.55167287, 1.71849355,
        1.88531423]),
 <a list of 10 Patch objects>)
```



[216]:
```
max = df1['link_word_score'].quantile(0.99)
min = df1['link_word_score'].quantile(0.05)
```

[217]:
```
#df1[(df1['link_word_score']>max)]
```

[218]:
```
#df1[(df1['link_word_score']<min)]
```

[219]:
```
#Outlier removal

#df1 = df1[(df1['link_word_score']<max) & (df1['link_word_score']>min)]
```

14 14. “non_markup_alphanumeric_characters”

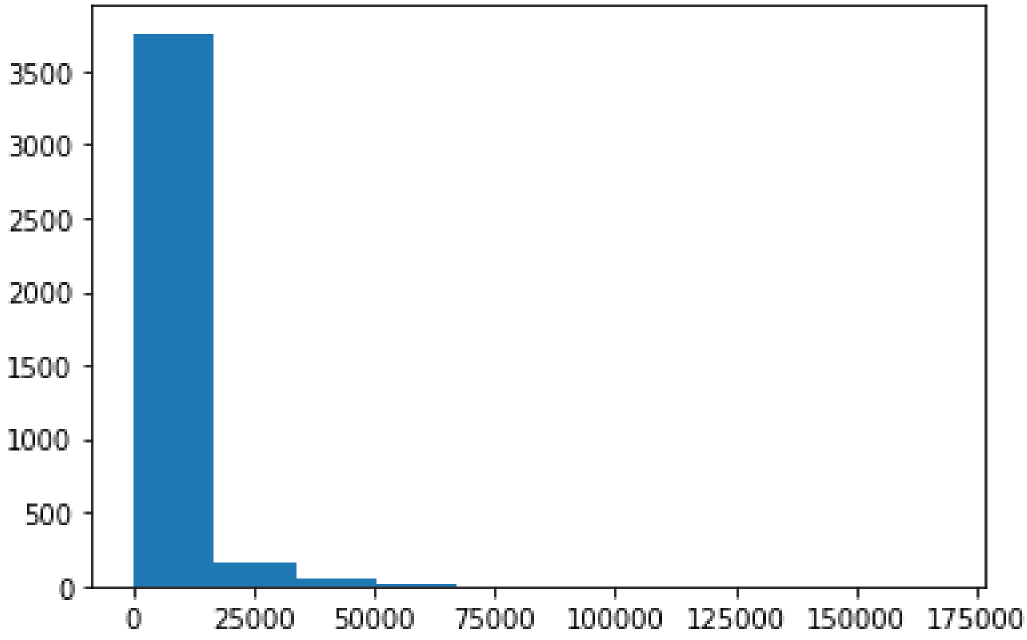
[220]:
```
#non_markup_alphanumeric_characters
df1['non_markup_alphanumeric_characters'].value_counts()
```

[220]:
```
423      14
159       5
780       5
155       5
4296      4
```

```
          ..
7040      1
1359      1
32840     1
13435     1
7637      1
Name: non_markup_alphanumeric_characters, Length: 3324, dtype: int64
```

[221]:
```
plt.hist(df1['non_markup_alphanumeric_characters'])
```

[221]:
```
(array([3.755e+03, 1.650e+02, 4.500e+01, 1.500e+01, 4.000e+00, 3.000e+00,
        2.000e+00, 0.000e+00, 0.000e+00, 1.000e+00]),
 array([     0.,  16845.,  33690.,  50535.,  67380.,  84225., 101070.,
        117915., 134760., 151605., 168450.]),
 <a list of 10 Patch objects>)
```



[222]:
```
#Normalization
nmac_norm = MinMaxScaler(df1["non_markup_alphanumeric_characters"].
 ↪min(),df1["non_markup_alphanumeric_characters"].max())
df1['non_markup_alphanumeric_characters'] =␣
 ↪df1['non_markup_alphanumeric_characters'].apply(nmac_norm.scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[223]:

```
#Standardization

nmac_std = df1["non_markup_alphanumeric_characters"].
 ↪apply(Standardizer(df1["non_markup_alphanumeric_characters"].mean(),␣
 ↪df1["non_markup_alphanumeric_characters"].std()).scale)
df1['non_markup_alphanumeric_characters'] = nmac_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[224]:

```
#LOg_transform

log_nmac = np.log(df1["non_markup_alphanumeric_characters"])
print(log_nmac.skew())
```

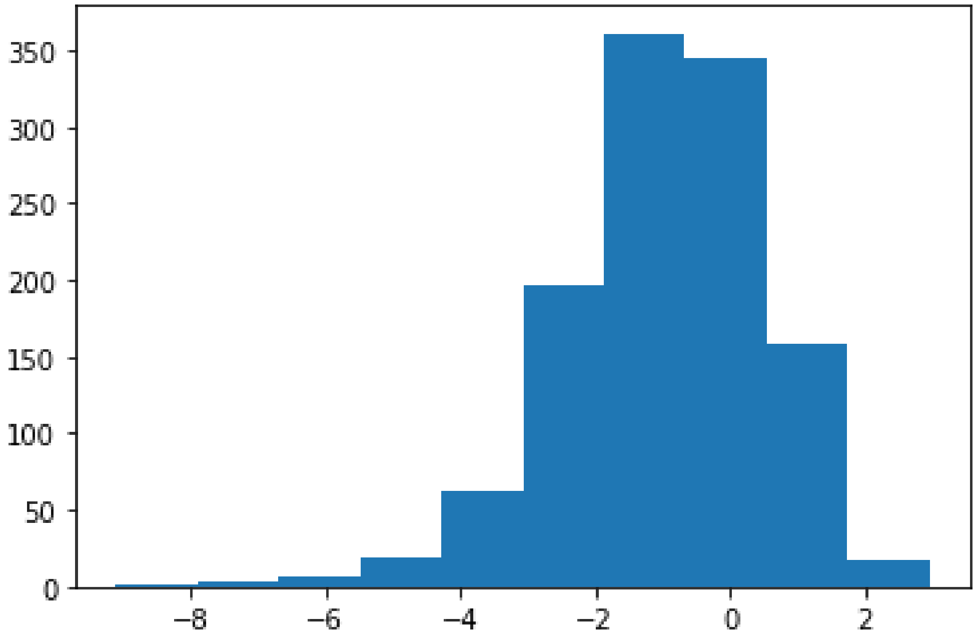
```
-0.6861249658553448
```

[225]:

```
plt.hist(log_nmac)
```

[225]:

```
(array([  1.,   3.,   6.,  19.,  63., 196., 361., 344., 159.,  17.]),
 array([-9.09795044, -7.89286016, -6.68776988, -5.4826796 , -4.27758931,
        -3.07249903, -1.86740875, -0.66231847,  0.54277181,  1.74786209,
         2.95295237]),
 <a list of 10 Patch objects>)
```

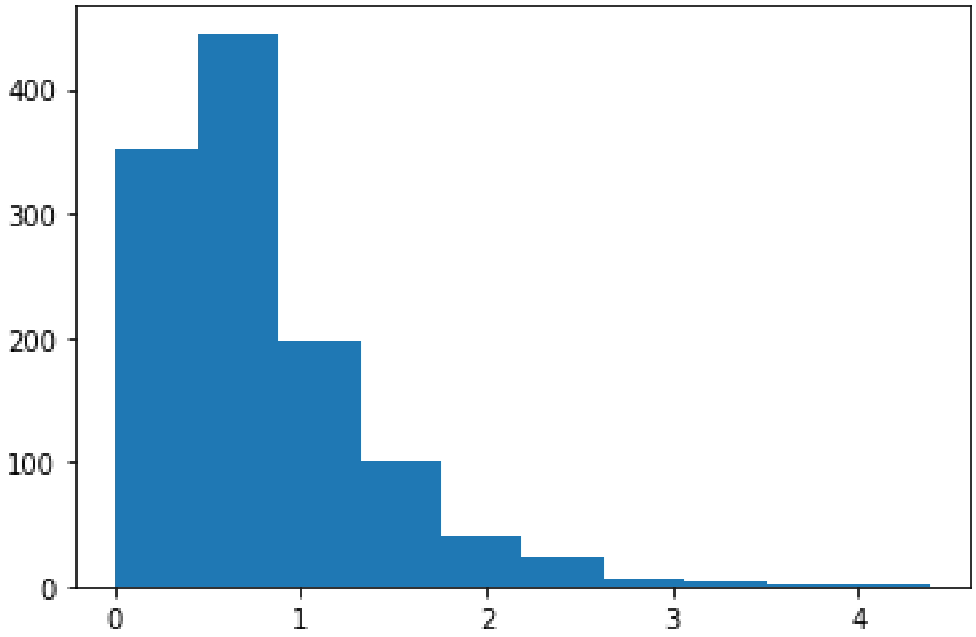


```
[226]: #sqrt transform


       import numpy as np

       sqrt_nmac = np.sqrt(df1["non_markup_alphanumeric_characters"])
       print(sqrt_nmac.skew())
```

```
1.6020206938500494
```

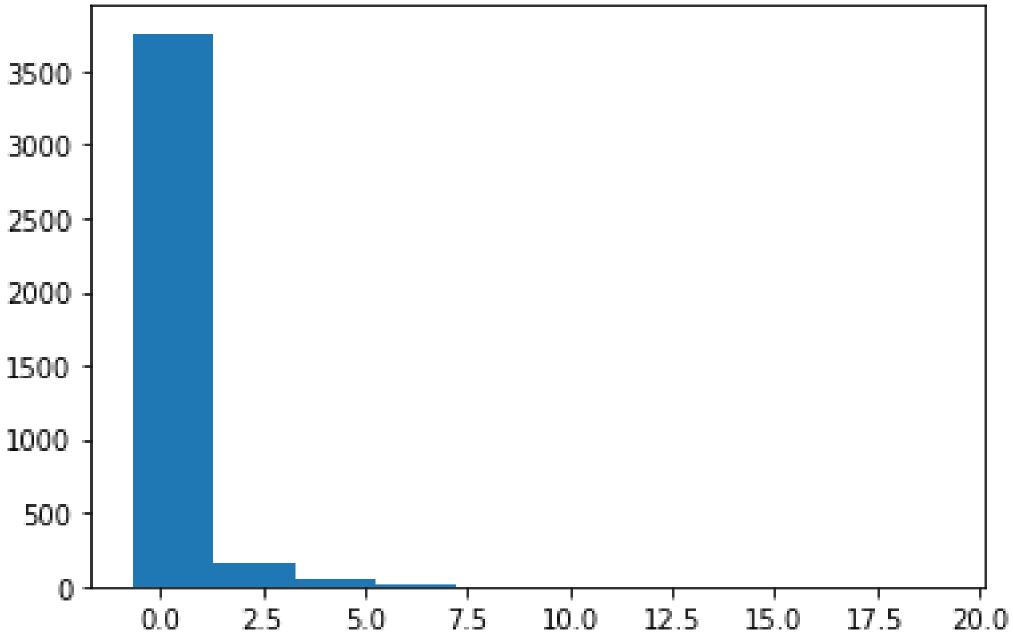
```
[227]: plt.hist(sqrt_nmac)
```

```
[227]: (array([352., 445., 197., 101.,  41.,  23.,   5.,   3.,   1.,   1.]),
        array([0.01057804, 0.44726954, 0.88396103, 1.32065253, 1.75734403,
               2.19403552, 2.63072702, 3.06741852, 3.50411001, 3.94080151,
               4.37749301]),
        <a list of 10 Patch objects>)
```



```
[228]: plt.hist(df1['non_markup_alphanumeric_characters'])
```

```
[228]: (array([3.755e+03, 1.650e+02, 4.500e+01, 1.500e+01, 4.000e+00, 3.000e+00,
                2.000e+00, 0.000e+00, 0.000e+00, 1.000e+00]),
        array([-0.69138358,  1.29399928,  3.27938214,  5.264765  ,  7.25014786,
                9.23553072, 11.22091358, 13.20629644, 15.1916793 , 17.17706216,
               19.16244502]),
        <a list of 10 Patch objects>)
```



```
[229]: max = df1['non_markup_alphanumeric_characters'].quantile(0.95)
       min = df1['non_markup_alphanumeric_characters'].quantile(0.05)
```

```
[230]: max
```

```
[230]: 1.5053962955690128
```

```
[231]: min
```

```
[231]: -0.6540213713742228
```

```
[232]: #df1[(df1['non_markup_alphanumeric_characters']>max)]
```

```
[233]: #Outlier removal

       #df1 = df1[(df1['non_markup_alphanumeric_characters']<max) &␣
        ↪(df1['non_markup_alphanumeric_characters']>min)]
```

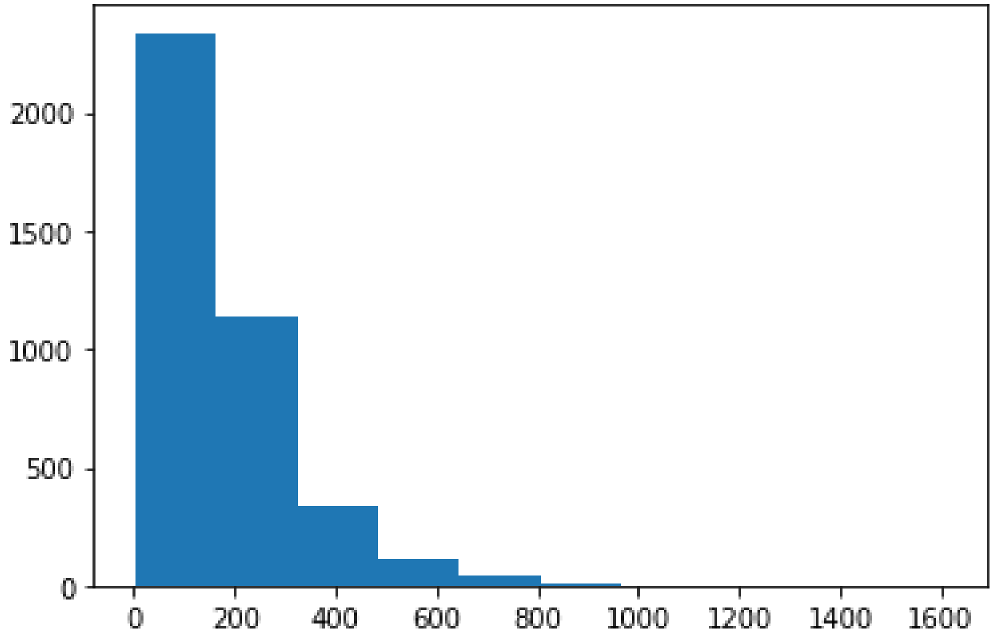
14.1 15. "count_of_links"

```
[234]: #count_of_links

       df1['count_of_links'].value_counts()
```

```
[234]: 142    34
       117    30
       120    26
       161    26
       121    26
              ..
       472     1
       508     1
       484     1
       455     1
       473     1
       Name: count_of_links, Length: 587, dtype: int64
```

```
[235]: plt.hist(df1['count_of_links'])
```

```
[235]: (array([2.338e+03, 1.137e+03, 3.370e+02, 1.140e+02, 4.700e+01, 9.000e+00,
               2.000e+00, 3.000e+00, 0.000e+00, 3.000e+00]),
        array([1.0000e+00, 1.6210e+02, 3.2320e+02, 4.8430e+02, 6.4540e+02,
               8.0650e+02, 9.6760e+02, 1.1287e+03, 1.2898e+03, 1.4509e+03,
               1.6120e+03]),
        <a list of 10 Patch objects>)
```



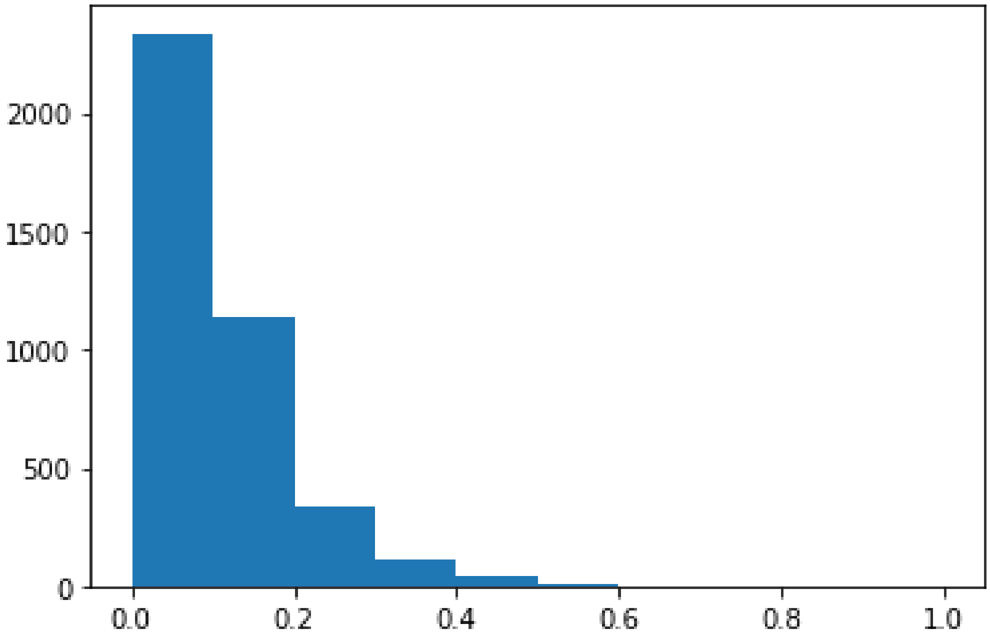
```
[236]: #Normalization
       col_norm = MinMaxScaler(df1["count_of_links"].min(),df1["count_of_links"].max())
       df1['count_of_links'] = df1['count_of_links'].apply(col_norm.scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

[237]:
```
#Standardization

col_std = df1["count_of_links"].apply(Standardizer(df1["count_of_links"].
 ↪mean(), df1["count_of_links"].std()).scale)
df['count_of_links'] = col_std
```

[238]:
```
plt.hist(df1['count_of_links'])
```

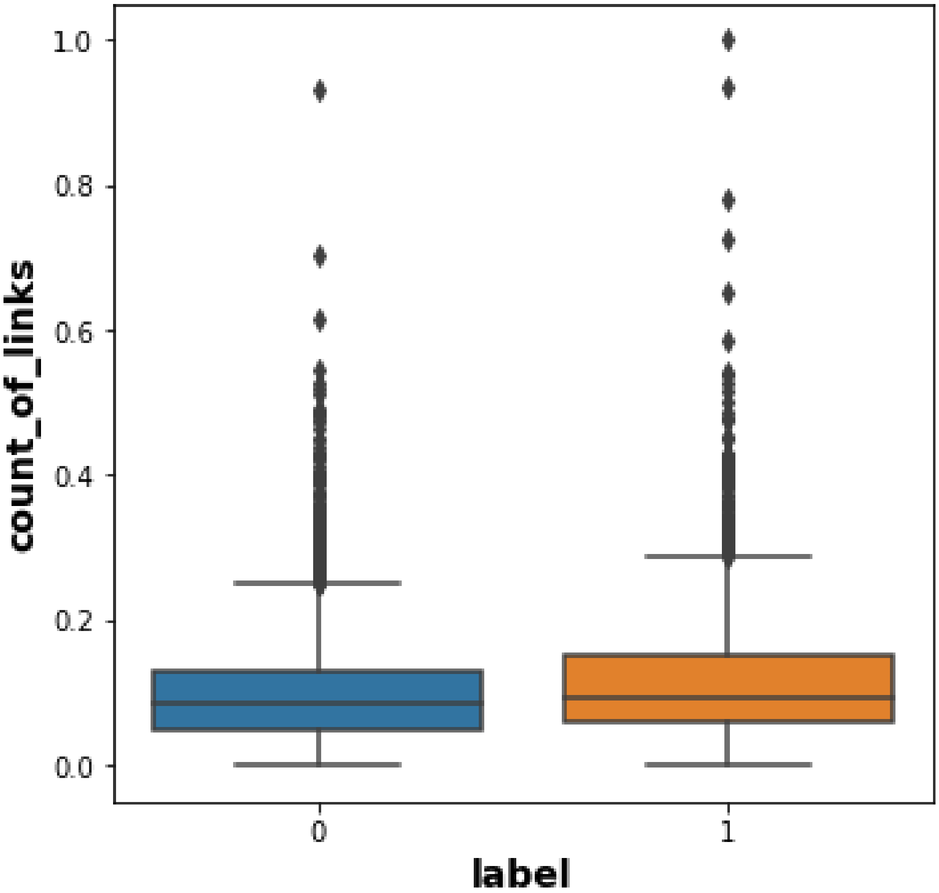
[238]:
```
(array([2.338e+03, 1.137e+03, 3.370e+02, 1.140e+02, 4.700e+01, 9.000e+00,
        2.000e+00, 3.000e+00, 0.000e+00, 3.000e+00]),
 array([0. , 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1. ]),
 <a list of 10 Patch objects>)
```



[239]:
```
plt.figure(figsize=(5.5,5.5))

sns.boxplot(x='label', y='count_of_links', data = df1)
```

```
plt.xlabel('label', fontsize=14, fontweight='bold')
plt.ylabel('count_of_links', fontsize=14, fontweight='bold')
```

[239]:
```
Text(0, 0.5, 'count_of_links')
```



[240]:
```
#LOg transformation
import numpy as np

log_col = np.log(df1["count_of_links"])
print(log_col.skew())
```

```
nan
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

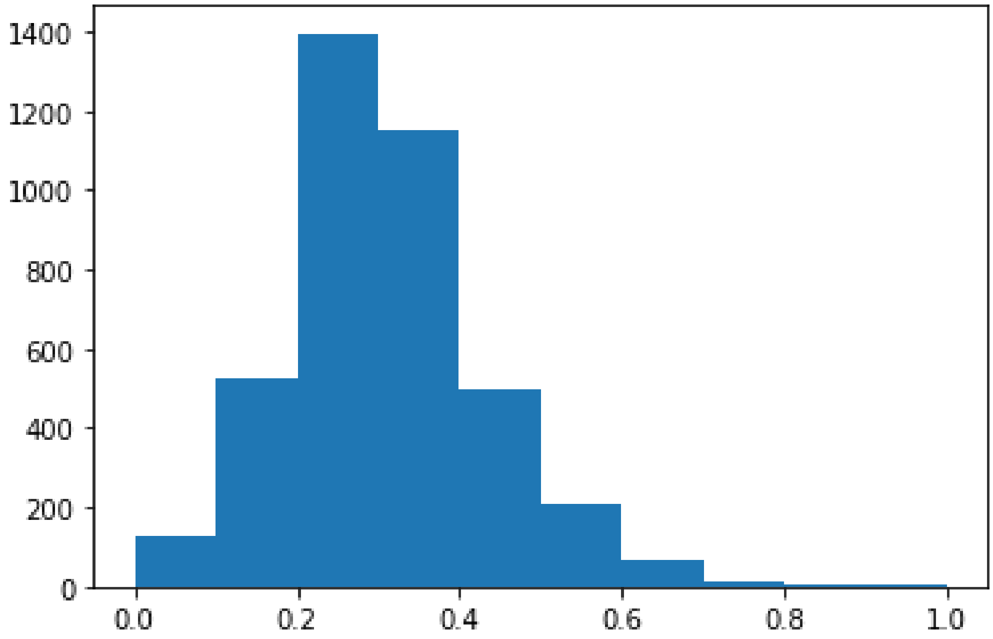
[241]:
```
#plt.hist(log_col)
```

[242]:
```
#sqrt transform

import numpy as np

sqrt_col = np.sqrt(df1["count_of_links"])
print(sqrt_col.skew())
```

```
0.6744021231951938
```

[243]:
```
plt.hist(sqrt_col)
```

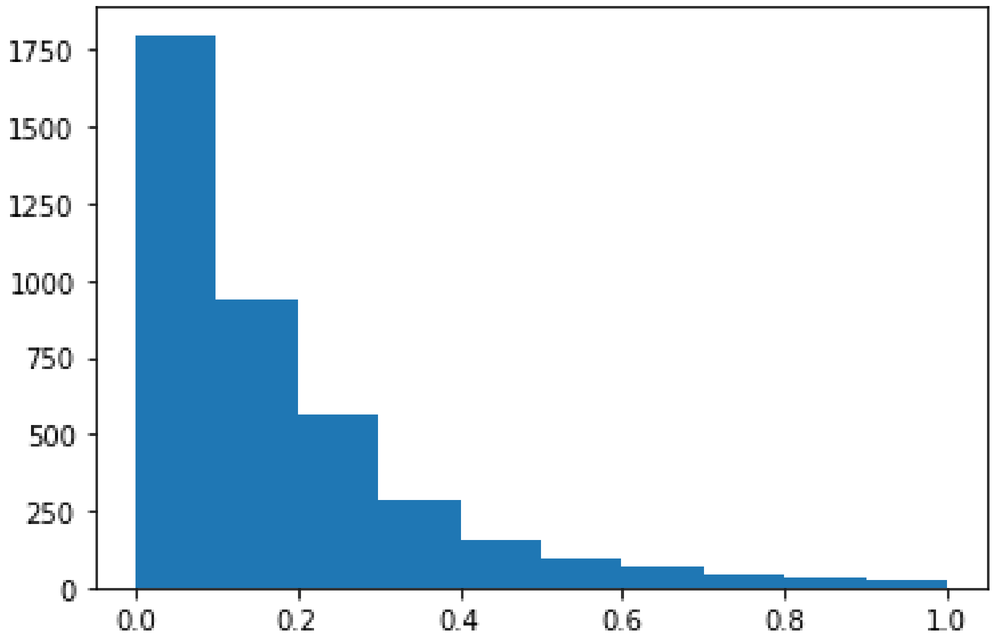
[243]:
```
(array([ 127.,  523., 1396., 1151.,  499.,  206.,   69.,   12.,    4.,
           3.]),
 array([0. , 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1. ]),
 <a list of 10 Patch objects>)
```



15 16. “parametrized_link_ratio”

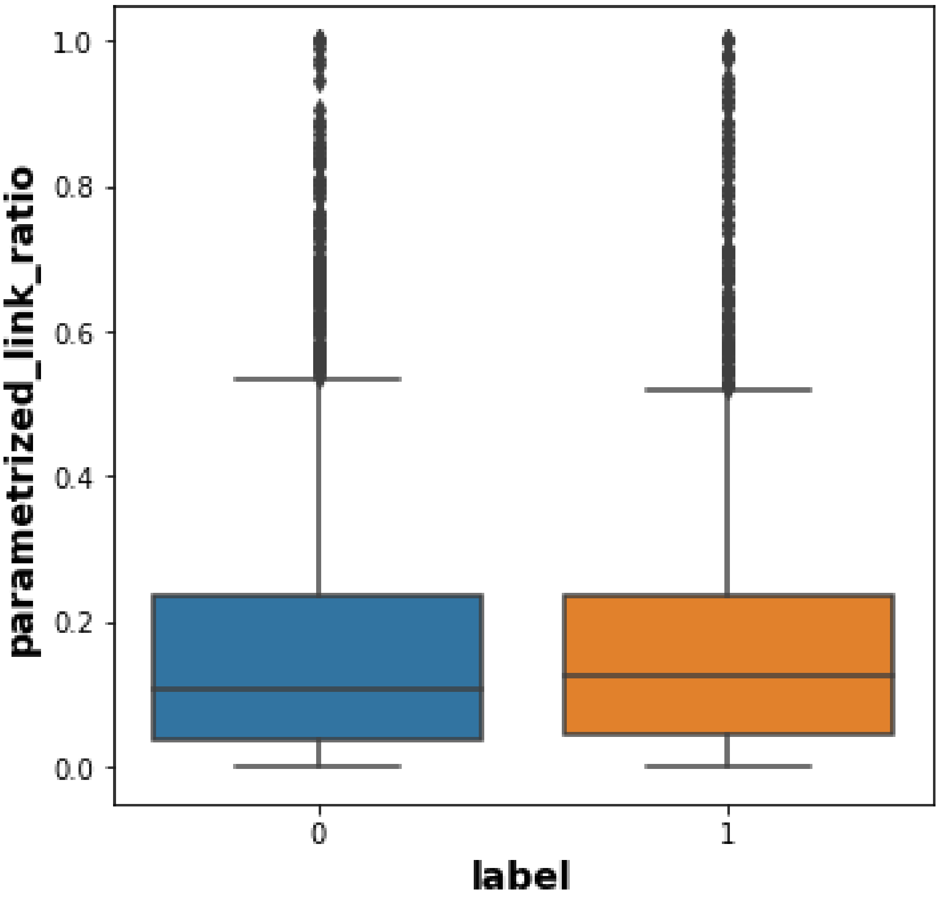
[244]:
```
#parametrized_link_ratio

plt.hist(df1['parametrized_link_ratio'])
```

[244]:
```
(array([1800.,  937.,  563.,  283.,  157.,   95.,   66.,   38.,   29.,
          22.]),
 array([0. , 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1. ]),
<a list of 10 Patch objects>)
```



```
[245]: plt.figure(figsize=(5.5,5.5))

       sns.boxplot(x='label', y='parametrized_link_ratio', data = df1)

       plt.xlabel('label', fontsize=14, fontweight='bold')
       plt.ylabel('parametrized_link_ratio', fontsize=14, fontweight='bold')
```

```
[245]: Text(0, 0.5, 'parametrized_link_ratio')
```



[246]:
```
#Normalization
plr_norm = MinMaxScaler(df1["parametrized_link_ratio"].
 ↪min(),df1["parametrized_link_ratio"].max())
df1['parametrized_link_ratio'] = df1['parametrized_link_ratio'].apply(plr_norm.
 ↪scale)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

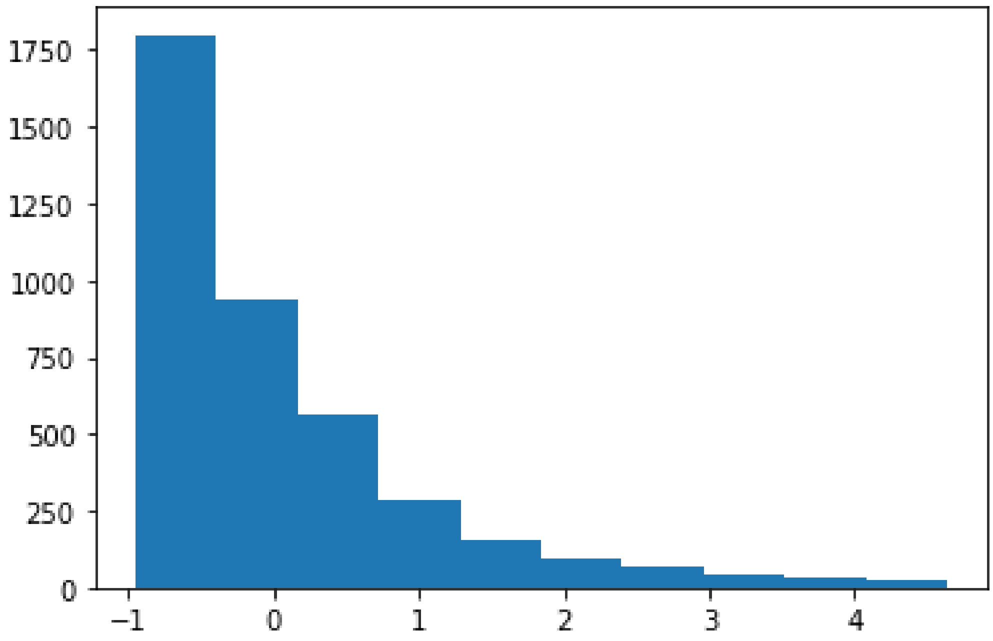
[247]:
```
#Standardization
```

```
plr_std = df1["parametrized_link_ratio"].
 ↪apply(Standardizer(df1["parametrized_link_ratio"].mean(),␣
 ↪df1["parametrized_link_ratio"].std()).scale)
df1['parametrized_link_ratio'] = plr_std
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  after removing the cwd from sys.path.
```

[248]:
```
plt.hist(df1['parametrized_link_ratio'])
```

[248]:
```
(array([1800.,  937.,  561.,  285.,  157.,   93.,   67.,   39.,   29.,
          22.]),
 array([-0.95664349, -0.39718933,  0.16226483,  0.72171899,  1.28117315,
         1.84062731,  2.40008147,  2.95953563,  3.51898979,  4.07844395,
         4.6378981 ]),
 <a list of 10 Patch objects>)
```



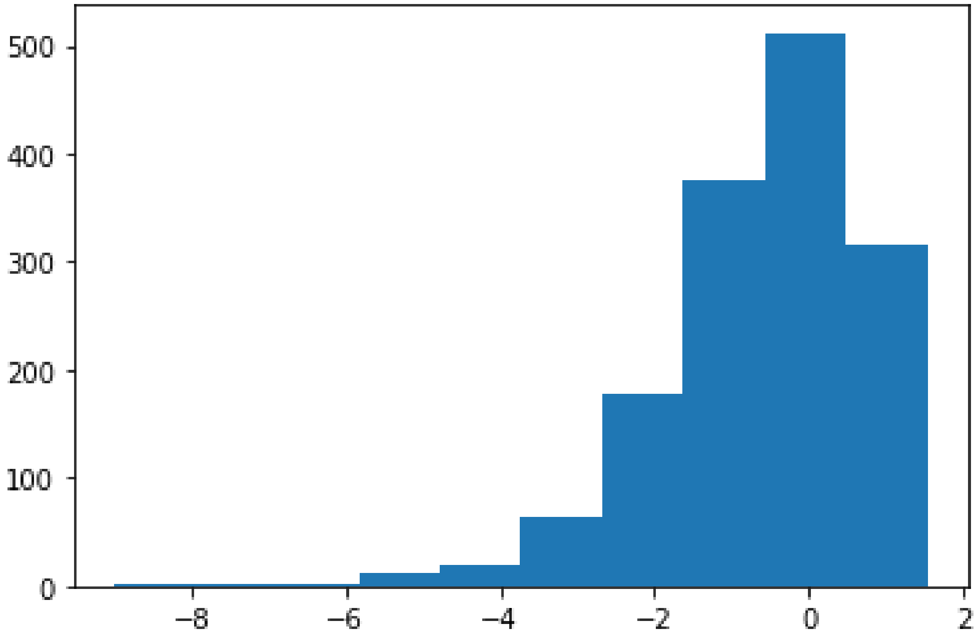
[249]:
```
#LOg transform

import numpy as np
```

```
plr_col = np.log(df1["parametrized_link_ratio"])
print(plr_col.skew())
```

```
-1.1847841410428679

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[250]:
```
plt.hist(plr_col)
```

[250]:
```
(array([  1.,   2.,   3.,  12.,  19.,  65., 177., 376., 512., 315.]),
 array([-8.98420854, -7.93236156, -6.88051458, -5.8286676 , -4.77682062,
        -3.72497364, -2.67312666, -1.62127967, -0.56943269,  0.48241429,
         1.53426127]),
 <a list of 10 Patch objects>)
```



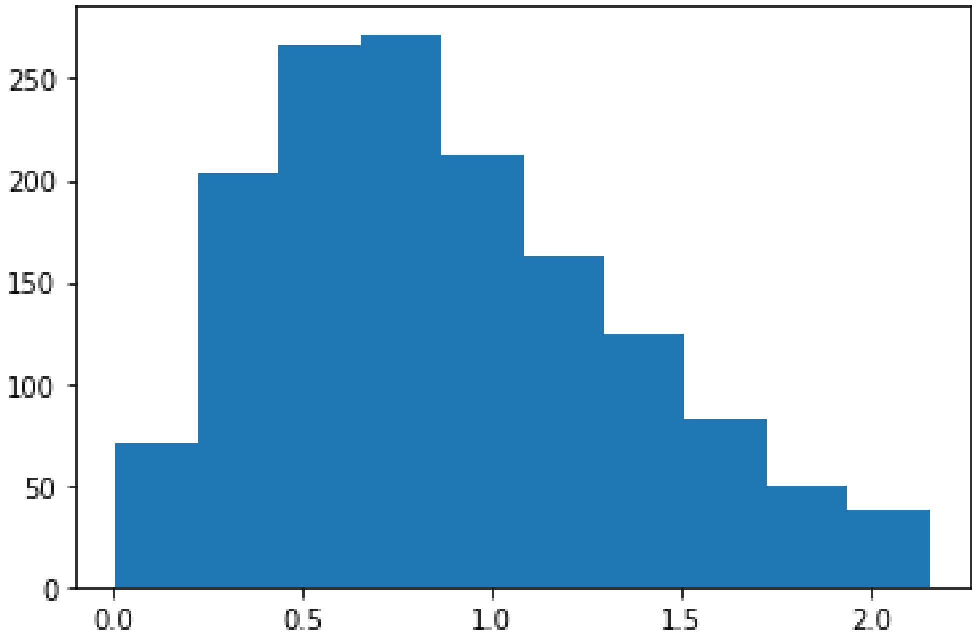
[251]:
```
#sqrt transform

import numpy as np

plr_sqr = np.sqrt(df1["parametrized_link_ratio"])
print(plr_sqr.skew())
```

```
0.5557902102871073
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: invalid value encountered in sqrt
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

```
[252]: plt.hist(plr_sqr)
```

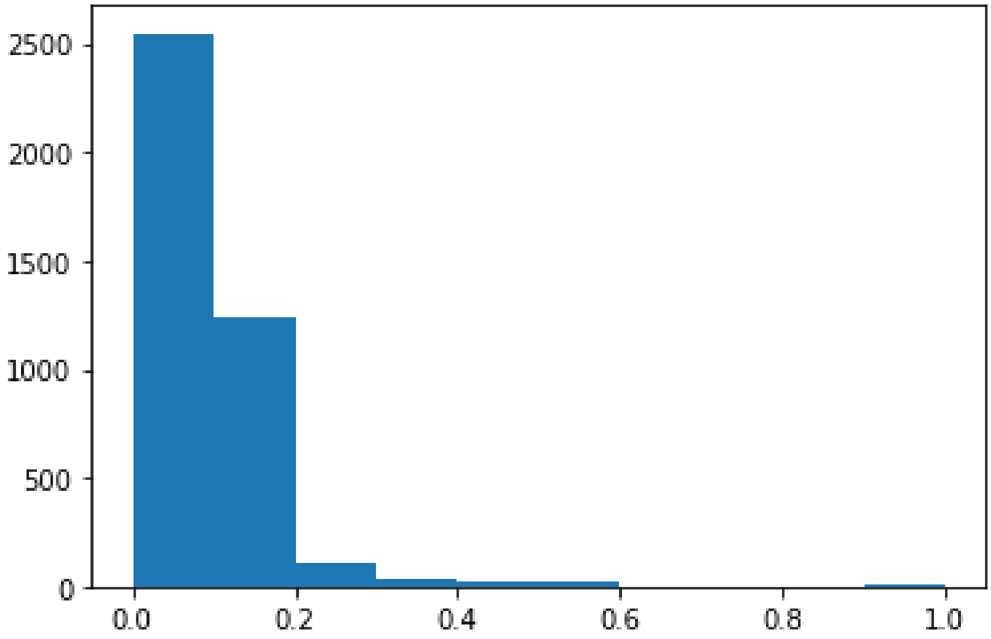
```
[252]: (array([ 71., 203., 266., 272., 212., 163., 124.,  83.,  50.,  38.]),
        array([0.01119706, 0.22543515, 0.43967324, 0.65391133, 0.86814943,
               1.08238752, 1.29662561, 1.5108637 , 1.72510179, 1.93933989,
               2.15357798]),
        <a list of 10 Patch objects>)
```



16 17. "spelling_mistakes_ratio"

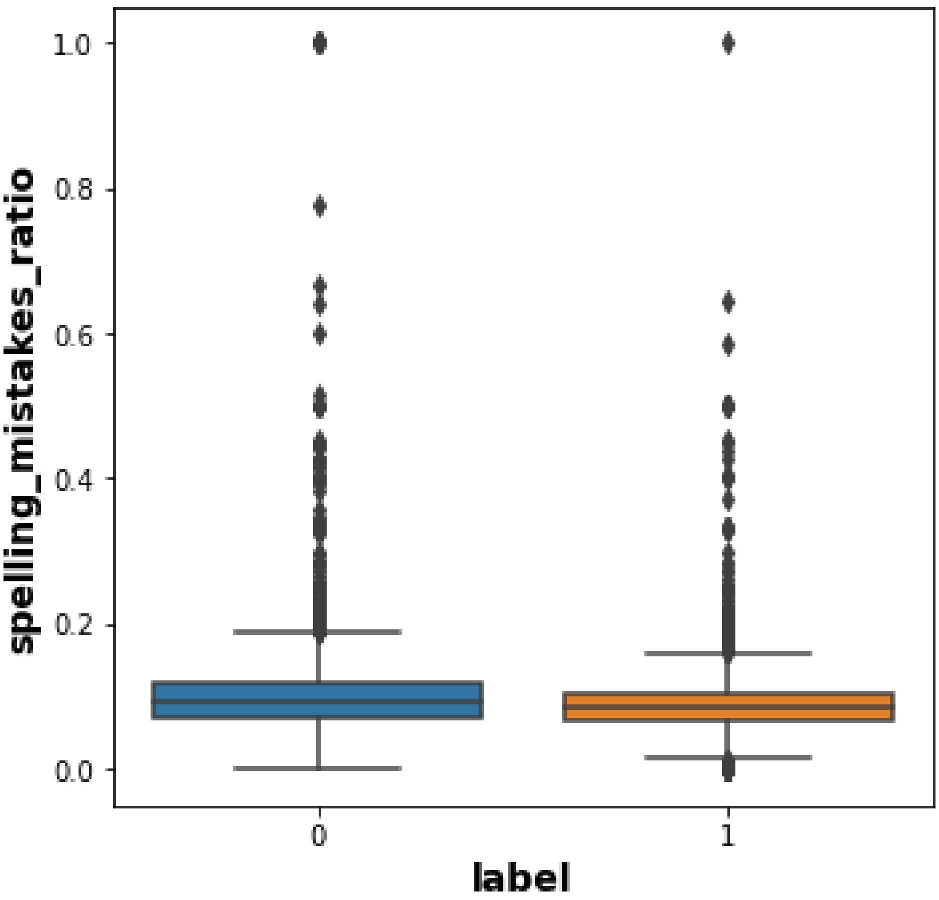
```
[253]: #spelling_mistakes_ratio

       plt.hist(df1['spelling_mistakes_ratio'])
```

```
[253]: (array([2.548e+03, 1.241e+03, 1.090e+02, 3.500e+01, 2.600e+01, 1.800e+01,
               3.000e+00, 1.000e+00, 0.000e+00, 9.000e+00]),
        array([0. , 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1. ]),
        <a list of 10 Patch objects>)
```



```
[254]: plt.figure(figsize=(5.5,5.5))

       sns.boxplot(x='label', y='spelling_mistakes_ratio', data = df1)

       plt.xlabel('label', fontsize=14, fontweight='bold')
       plt.ylabel('spelling_mistakes_ratio', fontsize=14, fontweight='bold')
```

```
[254]: Text(0, 0.5, 'spelling_mistakes_ratio')
```



[255]:
```
#LOg transform

import numpy as np

smr_log = np.log(df1["spelling_mistakes_ratio"])
print(smr_log.skew())
```

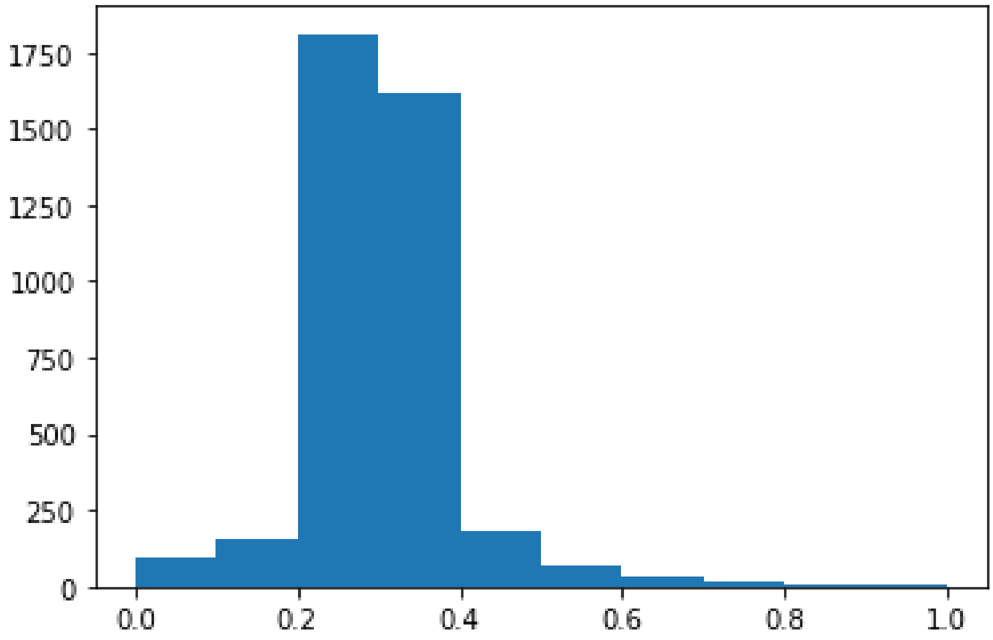
```
nan

/usr/local/lib/python3.7/dist-packages/pandas/core/arraylike.py:364:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

[256]:
```
#SQRT transform

smr_sqrt = np.sqrt(df1["spelling_mistakes_ratio"])
print(smr_sqrt.skew())
```

```
1.3379206696468149
```

[257]:
```
plt.hist(smr_sqrt)
```

[257]:
```
(array([  93.,  156., 1811., 1615.,  185.,   69.,   30.,   18.,    4.,
           9.]),
 array([0. , 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1. ]),
 <a list of 10 Patch objects>)
```



17 EDA categorial features

[258]:
```
cat_features
```

[258]:
```
['link',
 'page_description',
 'alchemy_category',
 'alchemy_category_score',
 'is_news',
 'news_front_page',
 'pd_lower',
 'pd_spec_rem',
 'link_new']
```

[259]:
```
discrete_feature
```

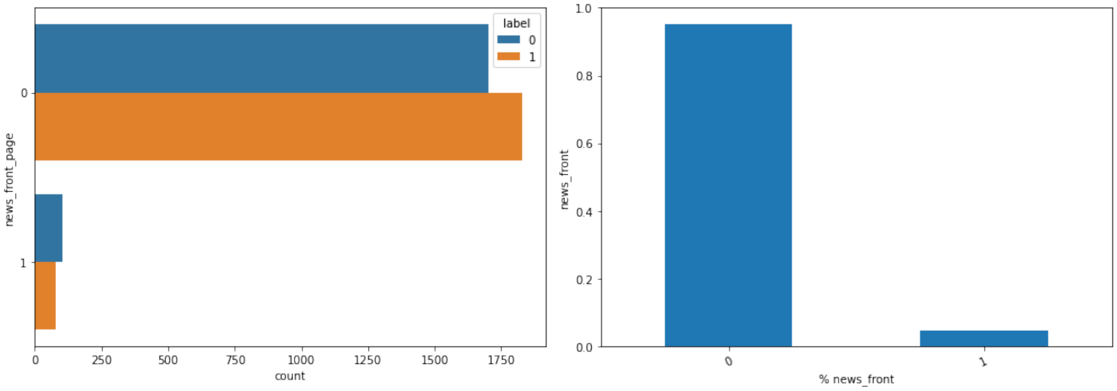
[259]:
```
['frame_based',
 'has_domain_link',
 'lengthy_link_domain',
 'number_of_words_in_url',
 'label']
```

[260]:
```
#link','page_description','alchemy_category' already done in starting
```

18 1. news_front_page

[261]:
```
stats_target = df1['news_front_page'].value_counts(normalize=True)
print(stats_target)

plt.figure(figsize=(14,5))
plt.subplot(1,2,1)
sns.countplot(data=df,y='news_front_page',hue='label')
plt.subplot(1,2,2)
stats_target.plot.bar(rot=25)
plt.ylabel('news_front')
plt.xlabel('% news_front')
plt.tight_layout()
plt.show()
```

```
0    0.952609
1    0.047391
Name: news_front_page, dtype: float64
```

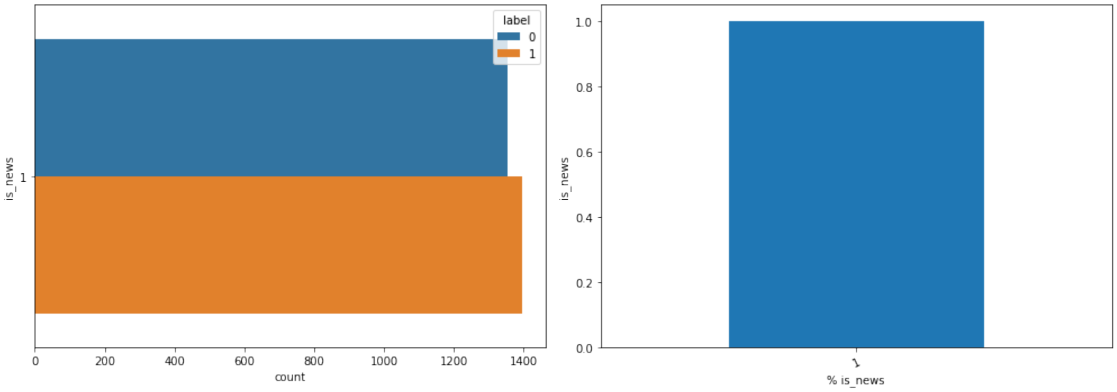


18.1 2. is_news

[262]:

```
stats_target = df1['is_news'].value_counts(normalize=True)
print(stats_target)

plt.figure(figsize=(14,5))
plt.subplot(1,2,1)
sns.countplot(data=df,y='is_news',hue='label')
plt.subplot(1,2,2)
stats_target.plot.bar(rot=25)
plt.ylabel('is_news')
plt.xlabel('% is_news')
plt.tight_layout()
plt.show()
```

```
1    1.0
Name: is_news, dtype: float64
```



19 3. "news_front_page"

20 4. alchemy_category_score

[263]:

```
#Imputing null values in 'alchemy_category_score' with mean
x = (df['alchemy_category_score'].astype('float64')).mean()
```

[264]:

```
df['alchemy_category_score'].fillna(x)
```

[264]:

```
0       0.471752
1       0.885088
2       0.716379
3       0.562999
4       0.893246
```

```
                 …
4432    0.764237
4433    0.604245
4434    0.159831
4435     0.84594
4436     0.93526
Name: alchemy_category_score, Length: 4437, dtype: object
```

[265]:

```
min_value = df['alchemy_category_score'].astype('float64').min()
max_value = df['alchemy_category_score'].astype('float64').max()
print(min_value)
print(max_value)
```

```
0.0708333
0.999274
```

[266]:

```
import numpy as np
bins_alch = np.linspace(min_value,max_value,4)
bins_alch
```

[266]:

```
array([0.0708333 , 0.38031353, 0.68979377, 0.999274  ])
```

[267]:

```
labels_alch = ['0.07to0.38','0.38to0.68','0.68to0.99']
```

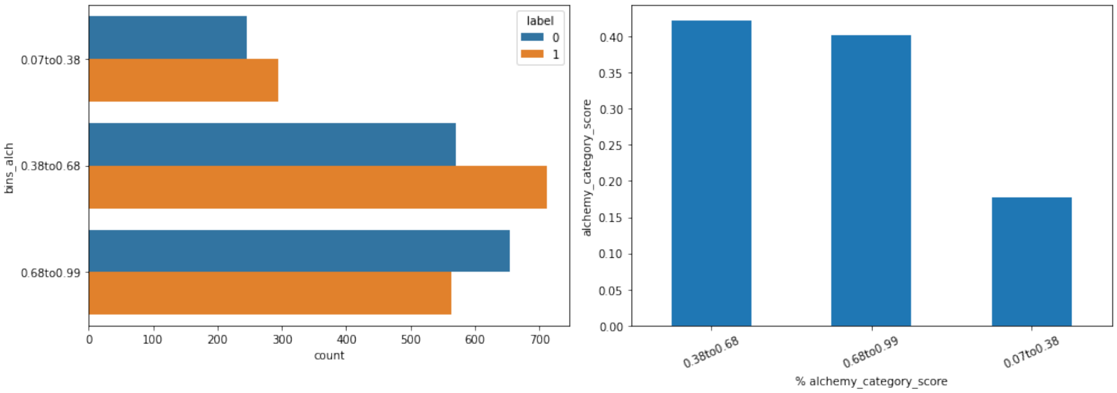
[268]:

```
df['bins_alch'] = pd.cut(df['alchemy_category_score'].astype('float64'),␣
 ↪bins=bins_alch, labels=labels_alch, include_lowest=True)
```

[269]:

```
import seaborn as sns
import matplotlib.pyplot as plt

stats_target = df['bins_alch'].value_counts(normalize=True)
print(stats_target)

plt.figure(figsize=(14,5))
plt.subplot(1,2,1)
sns.countplot(data=df,y='bins_alch',hue='label')
plt.subplot(1,2,2)
stats_target.plot.bar(rot=25)
plt.ylabel('alchemy_category_score')
plt.xlabel('% alchemy_category_score')
plt.tight_layout()
plt.show()
```

```
0.38to0.68    0.421711
0.68to0.99    0.400658
0.07to0.38    0.177632
Name: bins_alch, dtype: float64
```


label
0
1
bins_alch
0.07to0.38
0.38to0.68
0.68to0.99
0
100
200
300
400
500
600
700
count
alchemy_category_score
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.38to0.68
0.68to0.99
0.07to0.38
% alchemy_category_score

[269]:

[269]: