Wrangle and Analyze Data (WeRateDogs)

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Introduction

The dataset that you will be wrangling (and analyzing and visualizing) is the tweet archive of Twitter user @dog_rates, also known as WeRateDogs. WeRateDogs is a Twitter account that rates people's dogs with a humorous comment about the dog. These ratings almost always have a denominator of 10. The numerators, though? Almost always greater than 10. 11/10, 12/10, 13/10, etc. Why? Because "they're good dogs Brent." WeRateDogs has over 4 million followers and has received international media coverage.

The Data

The WeRateDogs Twitter archive contains basic tweet data for all 5000+ of their tweets, but not everything. One column the archive does contain though: each tweet's text, which I used to extract rating, dog name, and dog "stage" (i.e. doggo, floofer, pupper, and puppo) to make this Twitter archive "enhanced." Of the 5000+ tweets, I have filtered for tweets with ratings only (there are 2356).

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import requests
import json
import seaborn as sns
%matplotlib inline
```

```
c:\users\urt54\appdata\local\programs\python\python37\lib\site-packages\requests\__init__.py:91: Requ
estsDependencyWarning: urllib3 (1.26.5) or chardet (3.0.4) doesn't match a supported version!
  RequestsDependencyWarning)
```

Gathering Data

Gather data from a variety of sources and file formats.

In [2]:
```
#Read Twitter archive CSV file
twitter_archive = pd.read_csv('twitter-archive-enhanced.csv')
twitter_archive
```

Out[2]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retwee
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	
1	892177421306343426	NaN	NaN	2017-08-01 00:17:27 +0000	<a href="http://twitter.com/download/iphone" r...	This is Tilly. She's just checking pup on you....	
2	891815181378084864	NaN	NaN	2017-07-31 00:18:03 +0000	<a href="http://twitter.com/download/iphone" r...	This is Archie. He is a rare Norwegian Pouncin...	
3	891689557279858688	NaN	NaN	2017-07-30 15:58:51 +0000	<a href="http://twitter.com/download/iphone" r...	This is Darla. She commenced a snooze mid meal...	
4	891327558926688256	NaN	NaN	2017-07-29 16:00:24 +0000	<a href="http://twitter.com/download/iphone" r...	This is Franklin. He would like you to stop ca...	
...	...	...	...	...	...	...	
2351	666049248165822465	NaN	NaN	2015-11-16 00:24:50 +0000	<a href="http://twitter.com/download/iphone" r...	Here we have a 1949 1st generation vulpix. Enj...	
2352	666044226329800704	NaN	NaN	2015-11-16 00:04:52 +0000	<a href="http://twitter.com/download/iphone" r...	This is a purebred Piers Morgan. Loves to Netf...	
2353	666033412701032449	NaN	NaN	2015-11-15 23:21:54 +0000	<a href="http://twitter.com/download/iphone" r...	Here is a very happy pup. Big fan of well-main...	
2354	666029285002620928	NaN	NaN	2015-11-15 23:05:30 +0000	<a href="http://twitter.com/download/iphone" r...	This is a western brown Mitsubishi terrier. Up...	
2355	666020888022790149	NaN	NaN	2015-11-15 22:32:08 +0000	<a href="http://twitter.com/download/iphone" r...	Here we have a Japanese Irish Setter. Lost eye...	

2356 rows × 17 columns

In [3]:
```
#Download image predictions TSV file
url = 'https://d17h27t6h515a5.cloudfront.net/topher/2017/August/599fd2ad_image-predictions/image-predic
tions.tsv'

response = requests.get(url)

with open('image-predictions.tsv', mode ='wb') as file:
    file.write(response.content)
```

In [4]:
```
#Read image predictions TSV file
image_predictions = pd.read_csv('image-predictions.tsv',sep='\t')
image_predictions
```

Out[4]:

	tweet_id	jpg_url	img_num	p1	p1_conf	p1_dog	
0	666020888022790149	https://pbs.twimg.com/media/CT4udn0WwAA0aMy.jpg	1	Welsh_springer_spaniel	0.465074	True	
1	666029285002620928	https://pbs.twimg.com/media/CT42GRgUYAA5iDo.jpg	1	redbone	0.506826	True	miniature_
2	666033412701032449	https://pbs.twimg.com/media/CT4521TWwAEvMyu.jpg	1	German_shepherd	0.596461	True	
3	666044226329800704	https://pbs.twimg.com/media/CT5Dr8HUEAA-lEu.jpg	1	Rhodesian_ridgeback	0.408143	True	
4	666049248165822465	https://pbs.twimg.com/media/CT5IQmsXIAAKY4A.jpg	1	miniature_pinscher	0.560311	True	F
...	...	...	...	...	...	...	
2070	891327558926688256	https://pbs.twimg.com/media/DF6hr6BUMAAzZgT.jpg	2	basset	0.555712	True	English_
2071	891689557279858688	https://pbs.twimg.com/media/DF_q7IAWsAEuuN8.jpg	1	paper_towel	0.170278	False	Labrador_
2072	891815181378084864	https://pbs.twimg.com/media/DGBdLU1WsAANxJ9.jpg	1	Chihuahua	0.716012	True	r
2073	892177421306343426	https://pbs.twimg.com/media/DGGmoV4XsAAUL6n.jpg	1	Chihuahua	0.323581	True	
2074	892420643555336193	https://pbs.twimg.com/media/DGKD1-bXoAAIAUK.jpg	1	orange	0.097049	False	

2075 rows × 12 columns

Getting tweet data from Twitter API import tweepy from tweepy import OAuthHandler from timeit import default_timer as timer # Query Twitter API for each tweet in the Twitter archive and save JSON in a text file # These are hidden to comply with Twitter's API terms and conditions consumer_key = 'HIDDEN' consumer_secret = 'HIDDEN' access_token = 'HIDDEN' access_secret = 'HIDDEN' auth = OAuthHandler(consumer_key, consumer_secret) auth.set_access_token(access_token, access_secret) api = tweepy.API(auth, wait_on_rate_limit=True) # NOTE TO STUDENT WITH MOBILE VERIFICATION ISSUES: # df_1 is a DataFrame with the twitter_archive_enhanced.csv file. You may have to # change line 17 to match the name of your DataFrame with twitter_archive_enhanced.csv # NOTE TO REVIEWER: this student had mobile verification issues so the following # Twitter API code was sent to this student from a Udacity instructor # Tweet IDs for which to gather additional data via Twitter's API tweet_ids = df_1.tweet_id.values len(tweet_ids) # Query Twitter's API for JSON data for each tweet ID in the Twitter archive count = 0 fails_dict = {} start = timer() # Save each tweet's returned JSON as a new line in a .txt file with open('tweet_json.txt', 'w') as outfile: # This loop will likely take 20-30 minutes to run because of Twitter's rate limit for tweet_id in tweet_ids: count += 1 print(str(count) + ": " + str(tweet_id)) try: tweet = api.get_status(tweet_id, tweet_mode='extended') print("Success") json.dump(tweet._json, outfile) outfile.write('\n') except tweepy.TweepError as e: print("Fail") fails_dict[tweet_id] = e pass end = timer() print(end - start) print(fails_dict)

In [5]:
```
df_list = []
with open('tweet-json.txt') as file:
    for line in file:
        df_list.append(json.loads(line))
```

In [6]:
```
df_list[0]
```

Out[6]:


```
{'created_at': 'Tue Aug 01 16:23:56 +0000 2017',
 'id': 892420643555336193,
 'id_str': '892420643555336193',
 'full_text': "This is Phineas. He's a mystical boy. Only ever appears in the hole of a donut. 13/10
https://t.co/MgUWQ76dJU",
 'truncated': False,
 'display_text_range': [0, 85],
 'entities': {'hashtags': [],
  'symbols': [],
  'user_mentions': [],
  'urls': [],
  'media': [{'id': 892420639486877696,
    'id_str': '892420639486877696',
    'indices': [86, 109],
    'media_url': 'http://pbs.twimg.com/media/DGKD1-bXoAAIAUK.jpg',
    'media_url_https': 'https://pbs.twimg.com/media/DGKD1-bXoAAIAUK.jpg',
    'url': 'https://t.co/MgUWQ76dJU',
    'display_url': 'pic.twitter.com/MgUWQ76dJU',
    'expanded_url': 'https://twitter.com/dog_rates/status/892420643555336193/photo/1',
    'type': 'photo',
    'sizes': {'large': {'w': 540, 'h': 528, 'resize': 'fit'},
     'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
     'small': {'w': 540, 'h': 528, 'resize': 'fit'},
     'medium': {'w': 540, 'h': 528, 'resize': 'fit'}}}]},
 'extended_entities': {'media': [{'id': 892420639486877696,
    'id_str': '892420639486877696',
    'indices': [86, 109],
    'media_url': 'http://pbs.twimg.com/media/DGKD1-bXoAAIAUK.jpg',
    'media_url_https': 'https://pbs.twimg.com/media/DGKD1-bXoAAIAUK.jpg',
    'url': 'https://t.co/MgUWQ76dJU',
    'display_url': 'pic.twitter.com/MgUWQ76dJU',
    'expanded_url': 'https://twitter.com/dog_rates/status/892420643555336193/photo/1',
    'type': 'photo',
    'sizes': {'large': {'w': 540, 'h': 528, 'resize': 'fit'},
     'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
     'small': {'w': 540, 'h': 528, 'resize': 'fit'},
     'medium': {'w': 540, 'h': 528, 'resize': 'fit'}}}]},
 'source': '<a href="http://twitter.com/download/iphone" rel="nofollow">Twitter for iPhone</a>',
 'in_reply_to_status_id': None,
 'in_reply_to_status_id_str': None,
 'in_reply_to_user_id': None,
 'in_reply_to_user_id_str': None,
 'in_reply_to_screen_name': None,
 'user': {'id': 4196983835,
  'id_str': '4196983835',
  'name': 'WeRateDogs™ (author)',
  'screen_name': 'dog_rates',
  'location': 'DM YOUR DOGS, WE WILL RATE',
  'description': '#1 Source for Professional Dog Ratings | STORE: @ShopWeRateDogs | IG, FB & SC: WeRa
teDogs MOBILE APP: @GoodDogsGame | Business: dogratingtwitter@gmail.com',
  'url': 'https://t.co/N7sNNHAEXS',
  'entities': {'url': {'urls': [{'url': 'https://t.co/N7sNNHAEXS',
      'expanded_url': 'http://weratedogs.com',
      'display_url': 'weratedogs.com',
      'indices': [0, 23]}]},
   'description': {'urls': []}},
  'protected': False,
  'followers_count': 3200889,
  'friends_count': 104,
  'listed_count': 2784,
  'created_at': 'Sun Nov 15 21:41:29 +0000 2015',
  'favourites_count': 114031,
  'utc_offset': None,
  'time_zone': None,
  'geo_enabled': True,
  'verified': True,
  'statuses_count': 5288,
  'lang': 'en',
  'contributors_enabled': False,
  'is_translator': False,
  'is_translation_enabled': False,
  'profile_background_color': '000000',
  'profile_background_image_url': 'http://abs.twimg.com/images/themes/theme1/bg.png',
  'profile_background_image_url_https': 'https://abs.twimg.com/images/themes/theme1/bg.png',
  'profile_background_tile': False,
  'profile_image_url': 'http://pbs.twimg.com/profile_images/861415328504569856/R2xOOfwe_normal.jpg',
  'profile_image_url_https': 'https://pbs.twimg.com/profile_images/861415328504569856/R2xOOfwe_norma
l.jpg',
  'profile_banner_url': 'https://pbs.twimg.com/profile_banners/4196983835/1501129017',
  'profile_link_color': 'F5ABB5',
  'profile_sidebar_border_color': '000000',
  'profile_sidebar_fill_color': '000000',
  'profile_text_color': '000000',
  'profile_use_background_image': False,
  'has_extended_profile': True,
  'default_profile': False,
  'default_profile_image': False,
  'following': True,
  'follow_request_sent': False,
  'notifications': False,
  'translator_type': 'none'},
 'geo': None,
 'coordinates': None,
 'place': None,
 'contributors': None,
 'is_quote_status': False,
 'retweet_count': 8853,
 'favorite_count': 39467,
 'favorited': False,
 'retweeted': False,
 'possibly_sensitive': False,
 'possibly_sensitive_appealable': False,
 'lang': 'en'}
```


In [7]:
```
tweet_data = pd.DataFrame(df_list, columns = ['id', 'retweet_count', 'favorite_count'])
tweet_data = tweet_data.rename(columns = {'id':'tweet_id'})
tweet_data.to_csv('tweet_data.csv', index = False)
tweet_data
```

Out[7]:

	tweet_id	retweet_count	favorite_count
0	892420643555336193	8853	39467
1	892177421306343426	6514	33819
2	891815181378084864	4328	25461
3	891689557279858688	8964	42908
4	891327558926688256	9774	41048
...	...	...	...
2349	666049248165822465	41	111
2350	666044226329800704	147	311
2351	666033412701032449	47	128
2352	666029285002620928	48	132
2353	666020888022790149	532	2535

2354 rows × 3 columns

In [8]:
```
#Read Tweet Data CSV file
tweet_data = pd.read_csv('tweet_data.csv')
tweet_data
```

Out[8]:

	tweet_id	retweet_count	favorite_count
0	892420643555336193	8853	39467
1	892177421306343426	6514	33819
2	891815181378084864	4328	25461
3	891689557279858688	8964	42908
4	891327558926688256	9774	41048
...	...	...	...
2349	666049248165822465	41	111
2350	666044226329800704	147	311
2351	666033412701032449	47	128
2352	666029285002620928	48	132
2353	666020888022790149	532	2535

2354 rows × 3 columns

Assessing Data

Assess data visually and programmatically for quality and tidiness.

Two types of assessment:

- **Visual assessment:** scrolling through the data in your preferred software application (Google Sheets, Excel, a text editor, etc.).
- **Programmatic assessment:** using code to view specific portions and summaries of the data (pandas' head, tail, and info methods, for example).

At least eight (8) data quality issues and two (2) tidiness issues are detected.

- Quality: issues with content. Low quality data is also known as dirty data.
- Tidiness: issues with structure that prevent easy analysis. Untidy data is also known as messy data. Tidy data requirements:
  1. Each variable forms a column.
  2. Each observation forms a row.
  3. Each type of observational unit forms a table.

Assessing Enhanced Twitter Archive Data

In [9]:
```
twitter_archive.head()
```

Out[9]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retweeted_
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	
1	892177421306343426	NaN	NaN	2017-08-01 00:17:27 +0000	<a href="http://twitter.com/download/iphone" r...	This is Tilly. She's just checking pup on you....	
2	891815181378084864	NaN	NaN	2017-07-31 00:18:03 +0000	<a href="http://twitter.com/download/iphone" r...	This is Archie. He is a rare Norwegian Pouncin...	
3	891689557279858688	NaN	NaN	2017-07-30 15:58:51 +0000	<a href="http://twitter.com/download/iphone" r...	This is Darla. She commenced a snooze mid meal...	
4	891327558926688256	NaN	NaN	2017-07-29 16:00:24 +0000	<a href="http://twitter.com/download/iphone" r...	This is Franklin. He would like you to stop ca...	

In [10]:
```
twitter_archive.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2356 entries, 0 to 2355
Data columns (total 17 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   tweet_id                    2356 non-null   int64  
 1   in_reply_to_status_id       78 non-null     float64
 2   in_reply_to_user_id         78 non-null     float64
 3   timestamp                   2356 non-null   object 
 4   source                      2356 non-null   object 
 5   text                        2356 non-null   object 
 6   retweeted_status_id         181 non-null    float64
 7   retweeted_status_user_id    181 non-null    float64
 8   retweeted_status_timestamp  181 non-null    object 
 9   expanded_urls               2297 non-null   object 
 10  rating_numerator            2356 non-null   int64  
 11  rating_denominator          2356 non-null   int64  
 12  name                        2356 non-null   object 
 13  doggo                       2356 non-null   object 
 14  floofer                     2356 non-null   object 
 15  pupper                      2356 non-null   object 
 16  puppo                       2356 non-null   object 
dtypes: float64(4), int64(3), object(10)
memory usage: 313.0+ KB
```

In [11]:
```
twitter_archive['rating_numerator'].describe()
```

Out[11]:
```
count    2356.000000
mean       13.126486
std        45.876648
min         0.000000
25%        10.000000
50%        11.000000
75%        12.000000
max      1776.000000
Name: rating_numerator, dtype: float64
```

In [12]:
```
# checking count rating_numerator less than 10
twitter_archive[twitter_archive['rating_numerator'] < 10].count()[0]
```

Out[12]:
```
440
```

In [13]:
```
# checking which tweet_id have rating_numerator less than 10
twitter_archive[twitter_archive['rating_numerator'] < 10]['tweet_id']
```

Out[13]:
```
45      883482846933004288
229     848212111729840128
315     835152434251116546
387     826598799820865537
462     817502432452313088
               ...        
2351    666049248165822465
2352    666044226329800704
2353    666033412701032449
2354    666029285002620928
2355    666020888022790149
Name: tweet_id, Length: 440, dtype: int64
```

In [14]:
```
# checking rating_numerator of tweet_id is 666049248165822465
twitter_archive.loc[(twitter_archive['tweet_id'] == 666049248165822465),'rating_numerator']
```

Out[14]:
```
2351    5
Name: rating_numerator, dtype: int64
```

In [15]:
```
# checking text of tweet id is 666049248165822465
twitter_archive.loc[2351 , 'text']
```

Out[15]:
```
'Here we have a 1949 1st generation vulpix. Enjoys sweat tea and Fox News. Cannot be phased. 5/10 htt
ps://t.co/4B7cOc1EDq'
```

In [16]:
```
twitter_archive['rating_denominator'].describe()
```

Out[16]:
```
count    2356.000000
mean       10.455433
std         6.745237
min         0.000000
25%        10.000000
50%        10.000000
75%        10.000000
max       170.000000
Name: rating_denominator, dtype: float64
```

In [17]:
```
# checking which tweet_id have rating_denominator equal 0
twitter_archive[twitter_archive['rating_denominator'] == 0]['tweet_id']
```

Out[17]:
```
313    835246439529840640
Name: tweet_id, dtype: int64
```

In [18]:
```
# checking text of tweet id is 835246439529840640
twitter_archive.loc[313 , 'text']
```

Out[18]:
```
"@jonnysun @Lin_Manuel ok jomny I know you're excited but 960/00 isn't a valid rating, 13/10 is tho"
```

In [19]:
```
# checking count rating_denominator not equal 10
twitter_archive[twitter_archive['rating_denominator'] != 10].count()[0]
```

Out[19]:
```
23
```

In [20]:
```
twitter_archive['name'].value_counts()
```

Out[20]:
```
None       745
a           55
Charlie     12
Oliver      11
Cooper      11
          ... 
Spark        1
Mairi        1
Iggy         1
Lillie       1
Derby        1
Name: name, Length: 957, dtype: int64
```

Assessing Image Predictions Data

In [21]:
```
image_predictions.head()
```

Out[21]:

	tweet_id	jpg_url	img_num	p1	p1_conf	p1_dog	
0	666020888022790149	https://pbs.twimg.com/media/CT4udn0WwAA0aMy.jpg	1	Welsh_springer_spaniel	0.465074	True	c
1	666029285002620928	https://pbs.twimg.com/media/CT42GRgUYAA5iDo.jpg	1	redbone	0.506826	True	miniature_pins
2	666033412701032449	https://pbs.twimg.com/media/CT4521TWwAEvMyu.jpg	1	German_shepherd	0.596461	True	mal
3	666044226329800704	https://pbs.twimg.com/media/CT5Dr8HUEAA-lEu.jpg	1	Rhodesian_ridgeback	0.408143	True	redl
4	666049248165822465	https://pbs.twimg.com/media/CT5IQmsXIAAKY4A.jpg	1	miniature_pinscher	0.560311	True	Rottw

In [22]:
```
image_predictions.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2075 entries, 0 to 2074
Data columns (total 12 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   tweet_id  2075 non-null   int64  
 1   jpg_url   2075 non-null   object 
 2   img_num   2075 non-null   int64  
 3   p1        2075 non-null   object 
 4   p1_conf   2075 non-null   float64
 5   p1_dog    2075 non-null   bool   
 6   p2        2075 non-null   object 
 7   p2_conf   2075 non-null   float64
 8   p2_dog    2075 non-null   bool   
 9   p3        2075 non-null   object 
 10  p3_conf   2075 non-null   float64
 11  p3_dog    2075 non-null   bool   
dtypes: bool(3), float64(3), int64(2), object(4)
memory usage: 152.1+ KB
```

Assessing Tweet Data From API

In [23]:
```
tweet_data.head()
```

Out[23]:

	tweet_id	retweet_count	favorite_count
0	892420643555336193	8853	39467
1	892177421306343426	6514	33819
2	891815181378084864	4328	25461
3	891689557279858688	8964	42908
4	891327558926688256	9774	41048

In [24]:
```
tweet_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2354 entries, 0 to 2353
Data columns (total 3 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   tweet_id        2354 non-null   int64
 1   retweet_count   2354 non-null   int64
 2   favorite_count  2354 non-null   int64
dtypes: int64(3)
memory usage: 55.3 KB
```

Tidiness Issues

- doggo, floofer, pepper, and puppo columns should be one column (merge columns).
- twitter_archive, image_predictions, and tweet_data Dataframes should be part of one Dataframe (merge dataframes).

Quality Issues

- Delete retweets by filtering the NaN of retweeted_status_user_id.
- Delete in_reply_to_status_id, retweeted_status_id, in_reply_to_user_id retweeted_status_user_id, retweeted_status_timestamp columns.
- Correcting data type in tweet_id (from int into string).
- Correcting data type in timestamp (from string into datetime).
- Delete rows with jpg_url have missing.
- Create 1 column for dog image prediction and 1 column for dog image prediction confidence.
- Delete p1, p1_conf, p1_dog, p2, p2_conf, p2_dog, p3, p3_conf, p3_dog, img_num columns.
- Convert underscore to space and convert lowercase to uppercase in prediction_dog.

Cleaning Data

In [25]:
```
twitter_archive_clean = twitter_archive.copy()
image_predictions_clean = image_predictions.copy()
tweet_data_clean = tweet_data.copy()
```

In [26]:
```
twitter_archive_clean.head(1)
```

Out[26]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retweeted_sta
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	

In [27]:
```
image_predictions_clean.head(1)
```

Out[27]:

	tweet_id	jpg_url	img_num	p1	p1_conf	p1_dog	p2	p2_c
0	666020888022790149	https://pbs.twimg.com/media/CT4udn0WwAA0aMy.jpg	1	Welsh_springer_spaniel	0.465074	True	collie	0.1566

In [28]:
```
tweet_data_clean.head(1)
```

Out[28]:

	tweet_id	retweet_count	favorite_count
0	892420643555336193	8853	39467

Cleaning Tidiness Issues

Tidiness Issue_1

Define

- doggo, floofer, pupper, and puppo columns should be one column (merge columns).

Code

In [29]:
```
twitter_archive_clean['dog_stage'] = twitter_archive_clean['text'].str.extract('(doggo|floofer|pupper|p
uppo)')
twitter_archive_clean = twitter_archive_clean.drop(columns = ['doggo', 'floofer', 'pupper', 'puppo'] )
```

Test

In [30]:
```
twitter_archive_clean.head(1)
```

Out[30]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retweeted_sta
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	

In [31]:
```
twitter_archive_clean['dog_stage'].value_counts()
```

Out[31]:
```
pupper     265
doggo       93
puppo       37
floofer      4
Name: dog_stage, dtype: int64
```

Tidiness Issue_2

Define

- twitter_archive, image_predictions, and tweet_data Dataframes should be part of one Dataframe (merge dataframes).

Code

In [32]:
```
df_clean = pd.merge(twitter_archive_clean, tweet_data_clean, on='tweet_id', how='left')
df_clean = pd.merge(df_clean, image_predictions_clean, on='tweet_id', how='left')
```

Test

In [33]:
```
df_clean.head(1)
```

Out[33]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retweeted_sta
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	

1 rows × 27 columns

In [34]:
```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2356 entries, 0 to 2355
Data columns (total 27 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   tweet_id                    2356 non-null   int64  
 1   in_reply_to_status_id       78 non-null     float64
 2   in_reply_to_user_id         78 non-null     float64
 3   timestamp                   2356 non-null   object 
 4   source                      2356 non-null   object 
 5   text                        2356 non-null   object 
 6   retweeted_status_id         181 non-null    float64
 7   retweeted_status_user_id    181 non-null    float64
 8   retweeted_status_timestamp  181 non-null    object 
 9   expanded_urls               2297 non-null   object 
 10  rating_numerator            2356 non-null   int64  
 11  rating_denominator          2356 non-null   int64  
 12  name                        2356 non-null   object 
 13  dog_stage                   399 non-null    object 
 14  retweet_count               2354 non-null   float64
 15  favorite_count              2354 non-null   float64
 16  jpg_url                     2075 non-null   object 
 17  img_num                     2075 non-null   float64
 18  p1                          2075 non-null   object 
 19  p1_conf                     2075 non-null   float64
 20  p1_dog                      2075 non-null   object 
 21  p2                          2075 non-null   object 
 22  p2_conf                     2075 non-null   float64
 23  p2_dog                      2075 non-null   object 
 24  p3                          2075 non-null   object 
 25  p3_conf                     2075 non-null   float64
 26  p3_dog                      2075 non-null   object 
dtypes: float64(10), int64(3), object(14)
memory usage: 515.4+ KB
```

Cleaning Quality Issues

Quality Issue_1

Define

- Delete retweets by filtering the NaN of retweeted_status_user_id.

Code

In [35]:
```
df_clean = df_clean[pd.isnull(df_clean['retweeted_status_user_id'])]
```

Test

In [36]:
```
df_clean.head(1)
```

Out[36]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	source	text	retweeted_sta
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	

1 rows × 27 columns

In [37]:
```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2175 entries, 0 to 2355
Data columns (total 27 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   tweet_id                    2175 non-null   int64  
 1   in_reply_to_status_id       78 non-null     float64
 2   in_reply_to_user_id         78 non-null     float64
 3   timestamp                   2175 non-null   object 
 4   source                      2175 non-null   object 
 5   text                        2175 non-null   object 
 6   retweeted_status_id         0 non-null      float64
 7   retweeted_status_user_id    0 non-null      float64
 8   retweeted_status_timestamp  0 non-null      object 
 9   expanded_urls               2117 non-null   object 
 10  rating_numerator            2175 non-null   int64  
 11  rating_denominator          2175 non-null   int64  
 12  name                        2175 non-null   object 
 13  dog_stage                   364 non-null    object 
 14  retweet_count               2175 non-null   float64
 15  favorite_count              2175 non-null   float64
 16  jpg_url                     1994 non-null   object 
 17  img_num                     1994 non-null   float64
 18  p1                          1994 non-null   object 
 19  p1_conf                     1994 non-null   float64
 20  p1_dog                      1994 non-null   object 
 21  p2                          1994 non-null   object 
 22  p2_conf                     1994 non-null   float64
 23  p2_dog                      1994 non-null   object 
 24  p3                          1994 non-null   object 
 25  p3_conf                     1994 non-null   float64
 26  p3_dog                      1994 non-null   object 
dtypes: float64(10), int64(3), object(14)
memory usage: 475.8+ KB
```

Quality Issue_2

Define

- Delete in_reply_to_status_id, retweeted_status_id, in_reply_to_user_id retweeted_status_user_id, retweeted_status_timestamp columns.

Code

In [38]:
```
df_clean = df_clean.drop(columns = ['in_reply_to_status_id',
                                    'in_reply_to_user_id',
                                    'retweeted_status_id',
                                    'retweeted_status_user_id',
                                    'retweeted_status_timestamp'])
```

Test

In [39]:
```
df_clean.head(1)
```
Out[39]:

	tweet_id	timestamp	source	text	expanded_urls	rating_nume
0	892420643555336193	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	https://twitter.com/dog_rates/status/892420643...	

1 rows × 22 columns

In [40]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2175 entries, 0 to 2355
Data columns (total 22 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   tweet_id            2175 non-null   int64
 1   timestamp           2175 non-null   object
 2   source              2175 non-null   object
 3   text                2175 non-null   object
 4   expanded_urls       2117 non-null   object
 5   rating_numerator    2175 non-null   int64
 6   rating_denominator  2175 non-null   int64
 7   name                2175 non-null   object
 8   dog_stage           364 non-null    object
 9   retweet_count       2175 non-null   float64
 10  favorite_count      2175 non-null   float64
 11  jpg_url             1994 non-null   object
 12  img_num             1994 non-null   float64
 13  p1                  1994 non-null   object
 14  p1_conf             1994 non-null   float64
 15  p1_dog              1994 non-null   object
 16  p2                  1994 non-null   object
 17  p2_conf             1994 non-null   float64
 18  p2_dog              1994 non-null   object
 19  p3                  1994 non-null   object
 20  p3_conf             1994 non-null   float64
 21  p3_dog              1994 non-null   object
dtypes: float64(6), int64(3), object(13)
memory usage: 390.8+ KB
```

Quality Issue_3

Define

- Correcting data type in tweet_id (from int into string).

Code

In [41]:
```
df_clean['tweet_id'] = df_clean['tweet_id'].astype(str)
```

Test

In [42]:
```
df_clean.head(1)
```
Out[42]:

	tweet_id	timestamp	source	text	expanded_urls	rating_nume
0	892420643555336193	2017-08-01 16:23:56 +0000	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	https://twitter.com/dog_rates/status/892420643...	

1 rows × 22 columns

In [43]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2175 entries, 0 to 2355
Data columns (total 22 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   tweet_id            2175 non-null   object
 1   timestamp           2175 non-null   object
 2   source              2175 non-null   object
 3   text                2175 non-null   object
 4   expanded_urls       2117 non-null   object
 5   rating_numerator    2175 non-null   int64
 6   rating_denominator  2175 non-null   int64
 7   name                2175 non-null   object
 8   dog_stage           364 non-null    object
 9   retweet_count       2175 non-null   float64
 10  favorite_count      2175 non-null   float64
 11  jpg_url             1994 non-null   object
 12  img_num             1994 non-null   float64
 13  p1                  1994 non-null   object
 14  p1_conf             1994 non-null   float64
 15  p1_dog              1994 non-null   object
 16  p2                  1994 non-null   object
 17  p2_conf             1994 non-null   float64
 18  p2_dog              1994 non-null   object
 19  p3                  1994 non-null   object
 20  p3_conf             1994 non-null   float64
 21  p3_dog              1994 non-null   object
dtypes: float64(6), int64(2), object(14)
memory usage: 390.8+ KB
```

Quality Issue_4

Define

- Correcting data type in timestamp (from string into datetime).

Code

In [44]:
```
df_clean['timestamp'] = pd.to_datetime(df_clean['timestamp'] )
```

Test

In [45]:
```
df_clean.head(1)
```
Out[45]:

	tweet_id	timestamp	source	text	expanded_urls	rating_n
0	892420643555336193	2017-08-01 16:23:56+00:00	<a href="http://twitter.com/download/iphone" r...	This is Phineas. He's a mystical boy. Only eve...	https://twitter.com/dog_rates/status/892420643...	

1 rows × 22 columns

In [46]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2175 entries, 0 to 2355
Data columns (total 22 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   tweet_id            2175 non-null   object
 1   timestamp           2175 non-null   datetime64[ns, UTC]
 2   source              2175 non-null   object
 3   text                2175 non-null   object
 4   expanded_urls       2117 non-null   object
 5   rating_numerator    2175 non-null   int64
 6   rating_denominator  2175 non-null   int64
 7   name                2175 non-null   object
 8   dog_stage           364 non-null    object
 9   retweet_count       2175 non-null   float64
 10  favorite_count      2175 non-null   float64
 11  jpg_url             1994 non-null   object
 12  img_num             1994 non-null   float64
 13  p1                  1994 non-null   object
 14  p1_conf             1994 non-null   float64
 15  p1_dog              1994 non-null   object
 16  p2                  1994 non-null   object
 17  p2_conf             1994 non-null   float64
 18  p2_dog              1994 non-null   object
 19  p3                  1994 non-null   object
 20  p3_conf             1994 non-null   float64
 21  p3_dog              1994 non-null   object
dtypes: datetime64[ns, UTC](1), float64(6), int64(2), object(13)
memory usage: 390.8+ KB
```

Quality Issue_5

Define

- Delete rows with jpg_url have missing.

Code

In [47]:
```
df_clean = df_clean[df_clean['jpg_url'].notnull()]
```

Test

In [48]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1994 entries, 0 to 2355
Data columns (total 22 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   tweet_id            1994 non-null   object
 1   timestamp           1994 non-null   datetime64[ns, UTC]
 2   source              1994 non-null   object
 3   text                1994 non-null   object
 4   expanded_urls       1994 non-null   object
 5   rating_numerator    1994 non-null   int64
 6   rating_denominator  1994 non-null   int64
 7   name                1994 non-null   object
 8   dog_stage           326 non-null    object
 9   retweet_count       1994 non-null   float64
 10  favorite_count      1994 non-null   float64
 11  jpg_url             1994 non-null   object
 12  img_num             1994 non-null   float64
 13  p1                  1994 non-null   object
 14  p1_conf             1994 non-null   float64
 15  p1_dog              1994 non-null   object
 16  p2                  1994 non-null   object
 17  p2_conf             1994 non-null   float64
 18  p2_dog              1994 non-null   object
 19  p3                  1994 non-null   object
 20  p3_conf             1994 non-null   float64
 21  p3_dog              1994 non-null   object
dtypes: datetime64[ns, UTC](1), float64(6), int64(2), object(13)
memory usage: 358.3+ KB
```

Quality Issue_6

Define

- Create 1 column for dog image prediction and 1 column for dog image prediction confidence.

Code

In [49]:
```
prediction_dog = []
prediction_dog_confidence = []

def dog_image(df_clean):
    if df_clean['p1_dog'] == True:
        prediction_dog.append(df_clean['p1'])
        prediction_dog_confidence.append(df_clean['p1_conf'])
    elif df_clean['p2_dog'] == True:
        prediction_dog.append(df_clean['p2'])
        prediction_dog_confidence.append(df_clean['p2_conf'])
    elif df_clean['p3_dog'] == True:
        prediction_dog.append(df_clean['p3'])
        prediction_dog_confidence.append(df_clean['p3_conf'])
    else:
        prediction_dog.append('Error')
        prediction_dog_confidence.append('Error')

df_clean.apply(dog_image, axis=1)

df_clean['prediction_dog'] = prediction_dog
df_clean['prediction_dog_confidence'] = prediction_dog_confidence
df_clean = df_clean[df_clean['prediction_dog'] != 'Error']
```

Test

In [50]:
```
df_clean.head(4)
```
Out[50]:

	tweet_id	timestamp	source	text	expanded_urls	ratin
1	892177421306343426	2017-08-01 00:17:27+00:00	<a href="http://twitter.com/download/iphone" r...	This is Tilly. She's just checking pup on you....	https://twitter.com/dog_rates/status/892177421...	
2	891815181378084864	2017-07-31 00:18:03+00:00	<a href="http://twitter.com/download/iphone" r...	This is Archie. He is a rare Norwegian Pouncin...	https://twitter.com/dog_rates/status/891815181...	
3	891689557279858688	2017-07-30 15:58:51+00:00	<a href="http://twitter.com/download/iphone" r...	This is Darla. She commenced a snooze mid meal...	https://twitter.com/dog_rates/status/891689557...	
4	891327558926688256	2017-07-29 16:00:24+00:00	<a href="http://twitter.com/download/iphone" r...	This is Franklin. He would like you to stop ca...	https://twitter.com/dog_rates/status/891327558...	

4 rows × 24 columns

In [51]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1686 entries, 1 to 2355
Data columns (total 24 columns):
 #   Column                     Non-Null Count  Dtype
---  ------                     --------------  -----
 0   tweet_id                   1686 non-null   object
 1   timestamp                  1686 non-null   datetime64[ns, UTC]
 2   source                     1686 non-null   object
 3   text                       1686 non-null   object
 4   expanded_urls              1686 non-null   object
 5   rating_numerator           1686 non-null   int64
 6   rating_denominator         1686 non-null   int64
 7   name                       1686 non-null   object
 8   dog_stage                  274 non-null    object
 9   retweet_count              1686 non-null   float64
 10  favorite_count             1686 non-null   float64
 11  jpg_url                    1686 non-null   object
 12  img_num                    1686 non-null   float64
 13  p1                         1686 non-null   object
 14  p1_conf                    1686 non-null   float64
 15  p1_dog                     1686 non-null   object
 16  p2                         1686 non-null   object
 17  p2_conf                    1686 non-null   float64
 18  p2_dog                     1686 non-null   object
 19  p3                         1686 non-null   object
 20  p3_conf                    1686 non-null   float64
 21  p3_dog                     1686 non-null   object
 22  prediction_dog             1686 non-null   object
 23  prediction_dog_confidence  1686 non-null   object
dtypes: datetime64[ns, UTC](1), float64(6), int64(2), object(15)
memory usage: 329.3+ KB
```

Quality Issue_7

Define

- Delete p1, p1_conf, p1_dog, p2, p2_conf, p2_dog, p3, p3_conf, p3_dog, img_num columns.

Code

In [52]:
```
df_clean = df_clean.drop(columns = ['p1',
                                    'p1_conf',
                                    'p1_dog',
                                    'p2',
                                    'p2_conf',
                                    'p2_dog',
                                    'p3',
                                    'p3_conf',
                                    'p3_dog',
                                    'img_num'])
```

Test

In [53]:
```
df_clean.head(1)
```
Out[53]:

	tweet_id	timestamp	source	text	expanded_urls	rating_r
1	892177421306343426	2017-08-01 00:17:27+00:00	<a href="http://twitter.com/download/iphone" r...	This is Tilly. She's just checking pup on you....	https://twitter.com/dog_rates/status/892177421...	

In [54]:
```
df_clean.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1686 entries, 1 to 2355
Data columns (total 14 columns):
 #   Column                     Non-Null Count  Dtype
---  ------                     --------------  -----
 0   tweet_id                   1686 non-null   object
 1   timestamp                  1686 non-null   datetime64[ns, UTC]
 2   source                     1686 non-null   object
 3   text                       1686 non-null   object
 4   expanded_urls              1686 non-null   object
 5   rating_numerator           1686 non-null   int64
 6   rating_denominator         1686 non-null   int64
 7   name                       1686 non-null   object
 8   dog_stage                  274 non-null    object
 9   retweet_count              1686 non-null   float64
 10  favorite_count             1686 non-null   float64
 11  jpg_url                    1686 non-null   object
 12  prediction_dog             1686 non-null   object
 13  prediction_dog_confidence  1686 non-null   object
dtypes: datetime64[ns, UTC](1), float64(2), int64(2), object(9)
memory usage: 197.6+ KB
```

Quality Issue_8

Define

- Convert underscore to space and convert lowercase to uppercase in prediction_dog.

Code

In [55]:
```
df_clean['prediction_dog'] = df_clean['prediction_dog'].str.replace('_',' ')
df_clean['prediction_dog'] = df_clean['prediction_dog'].str.title()
```

Test

In [56]:
```
df_clean['prediction_dog']
```
Out[56]:
```
1                       Chihuahua
2                       Chihuahua
3              Labrador Retriever
4                          Basset
5        Chesapeake Bay Retriever
                  ...
2351           Miniature Pinscher
2352          Rhodesian Ridgeback
2353              German Shepherd
2354                      Redbone
2355         Welsh Springer Spaniel
Name: prediction_dog, Length: 1686, dtype: object
```

Storing Data

In [57]:
```
df_clean.to_csv('twitter_archive_master.csv')
```

Analyzing and Visualizing Data

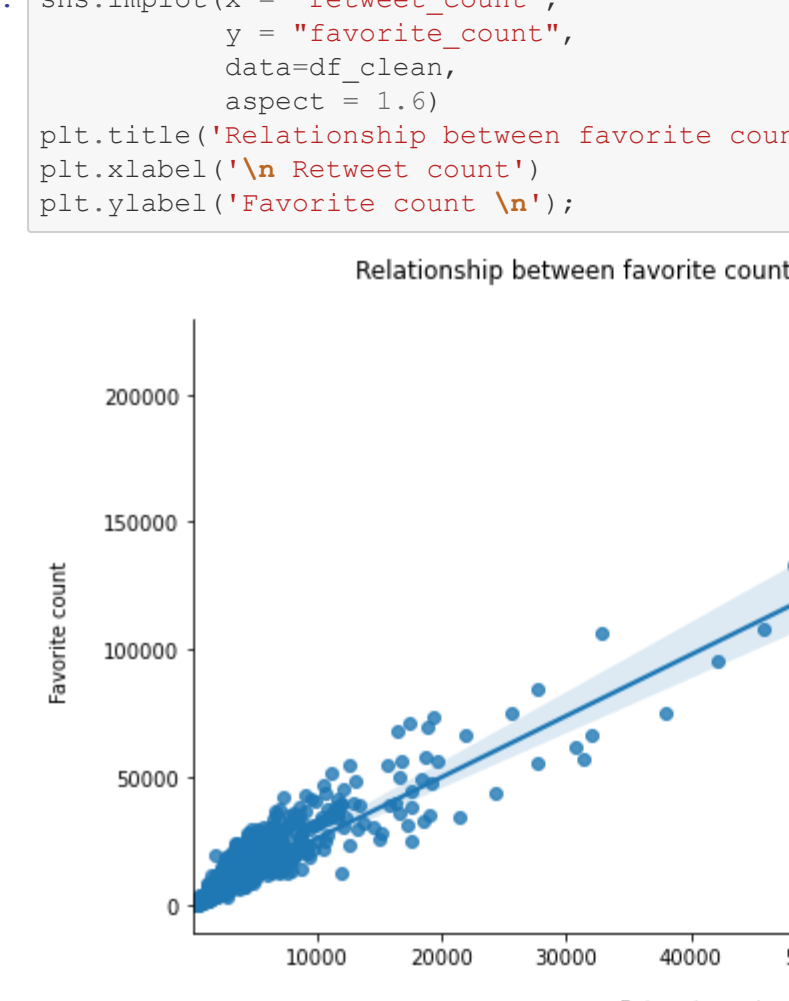
- The top ten of the most prediction dog type.
- The percentage of different dog stages.
- Relationship between favorite count and retweet count.

Insight and visualization

- The top ten of the most prediction dog type.

In [58]:
```
prediction_dog = df_clean['prediction_dog'].value_counts()
prediction_dog = prediction_dog.head(10)
prediction_dog
```
Out[58]:
```
Golden Retriever      158
Labrador Retriever    108
Pembroke               95
Chihuahua              91
Pug                    62
Toy Poodle             51
Chow                   48
Pomeranian             42
Samoyed                42
Malamute               33
Name: prediction_dog, dtype: int64
```

In [59]:
```
prediction_dog.plot(kind = 'barh')
plt.title('The top ten of the most prediction dog type \n')
plt.xlabel('\n Count')
plt.ylabel('Dog \n')
```
Out[59]:
```
Text(0, 0.5, 'Dog \n')
```



From the previous bar chart, I've concluded that Golden Retriever, Labrador Retriever, Pembroke, Chihuahua, Pug, Toy Poodle, Chow, Samoyed, Pomeranian, and Malamute are the top ten of the most predicted dog types.

Insight and visualization

- The percentage of different dog stages.

In [60]:
```
dog_stage = df_clean['dog_stage'].value_counts()
dog_stage
```
Out[60]:
```
pupper     183
doggo       61
puppo       27
floofer      3
Name: dog_stage, dtype: int64
```

In [61]:
```
dog_stage.plot(kind='pie', figsize = (8,8), autopct='%1.1f%%')
plt.title("The percentage of different dog stages")
```
Out[61]:
```
Text(0.5, 1.0, 'The percentage of different dog stages')
```


From the previous pie chart, I've concluded that floofer has the lowest percentage and pupper has the highest percentage.

Insight and visualization

- Relationship between favorite count and retweet count.

In [62]:
```
sns.lmplot(x = "retweet_count",
           y = "favorite_count",
           data=df_clean,
           aspect = 1.6)
plt.title('Relationship between favorite count and retweet count\n')
plt.xlabel('\n Retweet count')
plt.ylabel('Favorite count \n');
```


From the previous scatter plot, I've concluded that the relationship between favorite count and retweet count are linear and positively correlated.