Project: Wrangling and Analyze Data

In [1]:
```
import sqlite3
import urllib

from configparser import ConfigParser
from io import BytesIO
from itertools import islice
from json import dump, loads
from os import environ
from pathlib import Path

import requests
import tweepy

import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from IPython.display import clear_output, display, Image

sns.set_theme(style="darkgrid")
%matplotlib inline
```

We'll store all downloaded and generated files in this directory. We create it if it doesn't exist.

In [2]:
```
data_dir = Path("data")
data_dir.mkdir(exist_ok=True)
```

Table of Contents

Data Gathering

In the cell below, gather **all** three pieces of data for this project and load them in the notebook. **Note:** the methods required to gather each data are different.

1. Directly download the WeRateDogs Twitter archive data (twitter_archive_enhanced.csv)

We have to assume this file was downloaded manually, we'll first check if it exists, and if it doesn't, we'll download it and open it as if it was already on the filesystem.

```
In [3]: twitter_archived_enhanced_csv = data_dir / "twitter-archive-enhanced.csv"
```

```
In [4]: if not twitter_archived_enhanced_csv.exists():
            with requests.get(
                "https://d17h27t6h515a5.cloudfront.net/topher/2017/August/59a4e958_t
                stream=True
            ) as response:
                response.raise_for_status()
                with open(twitter_archived_enhanced_csv, "wb") as f:
                    for chunk in response.iter_content(chunk_size=32768):
                        f.write(chunk)
```

Before we open the file, let's check the first few lines to determine the proper way of open it with pandas:

```
In [5]: with open(twitter_archived_enhanced_csv, "r") as f:
            for line in islice(f, 5):
                print(line)
```

```
tweet_id,in_reply_to_status_id,in_reply_to_user_id,timestamp,source,text,re
tweeted_status_id,retweeted_status_user_id,retweeted_status_timestamp,expan
ded_urls,rating_numerator,rating_denominator,name,doggo,floofer,pupper,pupp
o

892420643555336193,,,2017-08-01 16:23:56 +0000,"<a href=""http://twitter.co
m/download/iphone"" rel=""nofollow"">Twitter for iPhone</a>",This is Phinea
s. He's a mystical boy. Only ever appears in the hole of a donut. 13/10 htt
ps://t.co/MgUWQ76dJU,,,,https://twitter.com/dog_rates/status/89242064355533
6193/photo/1,13,10,Phineas,None,None,None,None

892177421306343426,,,2017-08-01 00:17:27 +0000,"<a href=""http://twitter.co
m/download/iphone"" rel=""nofollow"">Twitter for iPhone</a>","This is Till
y. She's just checking pup on you. Hopes you're doing ok. If not, she's ava
ilable for pats, snugs, boops, the whole bit. 13/10 https://t.co/0Xxu71qeI
V",,,,https://twitter.com/dog_rates/status/892177421306343426/photo/1,13,1
0,Tilly,None,None,None,None

891815181378084864,,,2017-07-31 00:18:03 +0000,"<a href=""http://twitter.co
m/download/iphone"" rel=""nofollow"">Twitter for iPhone</a>",This is Archi
e. He is a rare Norwegian Pouncing Corgo. Lives in the tall grass. You neve
r know when one may strike. 12/10 https://t.co/wUnZnhtVJB,,,,https://twitte
r.com/dog_rates/status/891815181378084864/photo/1,12,10,Archie,None,None,No
ne,None

891689557279858688,,,2017-07-30 15:58:51 +0000,"<a href=""http://twitter.co
m/download/iphone"" rel=""nofollow"">Twitter for iPhone</a>",This is Darla.
She commenced a snooze mid meal. 13/10 happens to the best of us https://t.
co/tD36da7qLQ,,,,https://twitter.com/dog_rates/status/891689557279858688/ph
oto/1,13,10,Darla,None,None,None,None
```

There's nothing out of the ordinary, so we can just use `pandas.read_csv` as usual:

In [6]:
```
twitter_archived_enhanced_df = pd.read_csv(twitter_archived_enhanced_csv)
```

In [7]:
```
twitter_archived_enhanced_df.head(1)
```

Out[7]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	href="http://t /download/i

2. Use the Requests library to download the tweet image prediction (image_predictions.tsv)

Since we're hitting an external service, we first check if we haven't saved the loaded dataframe before. This isn't part of the wrangling process per se, but a convenience to avoid hitting external services mutiple times while running the notebook.

In [8]:
```
image_predictions_df = None
```

In [9]:
```
image_predictions_df_pkl = data_dir / "image_predictions_df.pkl"
```

In [10]:
```
if image_predictions_df_pkl.exists():
    image_predictions_df = pd.read_pickle(image_predictions_df_pkl)
```

If we haven't created the local pickled version, proceed with the expected download process:

In [11]:
```
image_predictions_tsv_url = "https://d17h27t6h515a5.cloudfront.net/topher/20
```

In [12]:
```
if image_predictions_df is None:
    # First we read the first few lines of the file to determine the right w
    with requests.get(image_predictions_tsv_url) as response:
        response.raise_for_status()

        for line in islice(
            filter(lambda l: bool(l), response.iter_lines(decode_unicode=Tru
            5
        ):
            print(line)
```

As we might have guessed by the file extension, this is a tab separated file with a header, which pandas can handle without any issues if the right `sep` value is used:

In [13]:
```
if image_predictions_df is None:
    with requests.get(image_predictions_tsv_url) as response:
        response.raise_for_status()
        image_predictions_df = pd.read_csv(BytesIO(response.content), sep="\
        image_predictions_df.to_pickle(image_predictions_df_pkl)
```

Alternatively, we could have saved the file and then open it with pandas:

```
with requests.get(image_predictions_tsv_url) as response:
    response.raise_for_status()

    with open(data_dir / "image_predictions.tsv", "wb") as f:
        f.write(response.content)

    image_predictions_df = pd.read_csv(data_dir /
"image_predictions.tsv", sep="\t")
```

Or even better, let pandas handle everything for us:

```
image_predictions_df = pd.read_csv(image_predictions_tsv_url,
sep="\t")
```

In [14]:
```
image_predictions_df.head()
```

Out[14]:

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

3. Use the Tweepy library to query additional data via the Twitter API (tweet_json.txt)

First we need to instantiate `tweepy` 's `API` object. Notice that Twitter's credentials need to be set in `config.ini` :

In [15]:
```
config = ConfigParser()
config.read("config.ini");
```

In [16]:
```
assert "twitter" in config.sections()
assert {'consumer_key', 'consumer_secret', 'access_token', 'access_token_sec
assert bool(config["twitter"]["consumer_key"])
assert bool(config["twitter"]["consumer_secret"])
assert bool(config["twitter"]["access_token"])
assert bool(config["twitter"]["access_token_secret"])
```

In [17]:
```
auth = tweepy.OAuthHandler(
    config["twitter"]["consumer_key"],
    config["twitter"]["consumer_secret"],
    access_token=config["twitter"]["access_token"],
    access_token_secret=config["twitter"]["access_token_secret"]
)
api = tweepy.API(
    auth,
    wait_on_rate_limit=True
)
```

Given Twitter's API rate limits, we need to compute the rate at which we can safely fetch the tweet info based on the total number of tweets. As of this writing, we can only fetch 900 tweets every 15 minutes, so I need to wait at least 1 second ((15 * 60) / 900) between each request. Given that the total number of unique tweets is:

```
In [18]: total_no_tweets = twitter_archived_enhanced_df.tweet_id.nunique()
         print(total_no_tweets)
```

```
2356
```

It'll take us about 40 minutes to fetch the tweet information.

```
In [19]: tweet_json_txt = data_dir / "tweet_json.txt"
```

```
In [20]: errors = []  # We'll keep track of errors

         if not tweet_json_txt.exists():
             with open(tweet_json_txt, "w") as f:
                 # We're iterating of unique tweet ids in case there are duplicates o
                 for i, tweet_id in enumerate(twitter_archived_enhanced_df.tweet_id.u
                     tweet = None

                     try:
                         tweet = api.get_status(
                             tweet_id,
                             tweet_mode='extended'  # Requesting extended tweets as p
                         )

                         #
                         # Print progress
                         #
                         clear_output(wait=True)
                         print(f"{i}/{total_no_tweets}: {tweet_id}")

                         #
                         # Notice that we're using a JSONL (JSON lines) format. This
                         # the progress as we can tail tweet_json.txt while we're fet
                         #
                         dump(tweet._json, f)
                         f.write("\n")
                     except Exception as e:
                         print(f"Exception raised while fetching tweet status. tweet_
                         errors.append((tweet_id, e, tweet))
```

Let's check how many errors were encountered during the fetch process:

```
In [21]: len(errors)  # It might be 0 if we skipped fetching the tweet information
```

```
Out[21]: 0
```

Let's show the first few lines of `tweet_json.txt` to verify it was written correctly. We've used the JSONL (JSON lines) format they're easier to work with then streaming JSON data.

```
In [22]: with open(tweet_json_txt, "r") as f:
             for line in islice(f, 5):  # Take only the first 5 lines
                 print(line)
```

```
{"created_at": "Tue Aug 01 16:23:56 +0000 2017", "id": 892420643555336193,
"id_str": "892420643555336193", "full_text": "This is Phineas. He's a mysti
cal boy. Only ever appears in the hole of a donut. 13/10 https://t.co/MgUWQ
76dJU", "truncated": false, "display_text_range": [0, 85], "entities": {"ha
shtags": [], "symbols": [], "user_mentions": [], "urls": [], "media": [{"i
d": 892420639486877696, "id_str": "892420639486877696", "indices": [86, 10
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s://t.co/MgUWQ76dJU", "display_url": "pic.twitter.com/MgUWQ76dJU", "expande
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28, "resize": "fit"}, "large": {"w": 540, "h": 528, "resize": "fit"}}}]}, "
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639486877696", "indices": [86, 109], "media_url": "http://pbs.twimg.com/med
ia/DGKD1-bXoAAIAUK.jpg", "media_url_https": "https://pbs.twimg.com/media/DG
KD1-bXoAAIAUK.jpg", "url": "https://t.co/MgUWQ76dJU", "display_url": "pic.t
witter.com/MgUWQ76dJU", "expanded_url": "https://twitter.com/dog_rates/stat
us/892420643555336193/photo/1", "type": "photo", "sizes": {"thumb": {"w": 1
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fit"}, "small": {"w": 540, "h": 528, "resize": "fit"}, "large": {"w": 540,
"h": 528, "resize": "fit"}}}]}, "source": "<a href=\"http://twitter.com/dow
nload/iphone\" rel=\"nofollow\">Twitter for iPhone</a>", "in_reply_to_statu
s_id": null, "in_reply_to_status_id_str": null, "in_reply_to_user_id": nul
l, "in_reply_to_user_id_str": null, "in_reply_to_screen_name": null, "use
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"screen_name": "dog_rates", "location": "all our links \u279c", "descriptio
n": "Your Only Source For Professional Dog Ratings \nInstagram and Facebook
\u279c WeRateDogs \npartnerships@weratedogs.com | nonprofit: @15outof10 \u2
800\u2800\u2800\u2800\u2800\u2800\u2800\u2800\u2800\u2800\u2800\u2800", "ur
l": "https://t.co/YPc2XqmwyC", "entities": {"url": {"urls": [{"url": "http
s://t.co/YPc2XqmwyC", "expanded_url": "http://links.weratedogs.com", "displ
ay_url": "links.weratedogs.com", "indices": [0, 23]}]}, "description": {"ur
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normal.jpg", "profile_banner_url": "https://pbs.twimg.com/profile_banners/4
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slator_type": "none", "withheld_in_countries": []}, "geo": null, "coordinat
es": null, "place": null, "contributors": null, "is_quote_status": false, "
retweet_count": 6978, "favorite_count": 33722, "favorited": false, "retweet
ed": false, "possibly_sensitive": false, "possibly_sensitive_appealable": f
alse, "lang": "en"}
```

```
{"created_at": "Tue Aug 01 00:17:27 +0000 2017", "id": 892177421306343426,
"id_str": "892177421306343426", "full_text": "This is Tilly. She's just che
cking pup on you. Hopes you're doing ok. If not, she's available for pats,
snugs, boops, the whole bit. 13/10 https://t.co/0Xxu71qeIV", "truncated": f
alse, "display_text_range": [0, 138], "entities": {"hashtags": [], "symbol
s": [], "user_mentions": [], "urls": [], "media": [{"id": 89217741319462502
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p://pbs.twimg.com/media/DGGmoV4XsAAUL6n.jpg", "media_url_https": "https://p
bs.twimg.com/media/DGGmoV4XsAAUL6n.jpg", "url": "https://t.co/0Xxu71qeIV",
"display_url": "pic.twitter.com/0Xxu71qeIV", "expanded_url": "https://twitt
er.com/dog_rates/status/892177421306343426/photo/1", "type": "photo", "size
s": {"thumb": {"w": 150, "h": 150, "resize": "crop"}, "medium": {"w": 1055,
"h": 1200, "resize": "fit"}, "small": {"w": 598, "h": 680, "resize": "fi
t"}, "large": {"w": 1407, "h": 1600, "resize": "fit"}}}]}, "extended_entiti
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UL6n.jpg", "media_url_https": "https://pbs.twimg.com/media/DGGmoV4XsAAUL6n.
jpg", "url": "https://t.co/0Xxu71qeIV", "display_url": "pic.twitter.com/0Xx
u71qeIV", "expanded_url": "https://twitter.com/dog_rates/status/89217742130
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"resize": "crop"}, "medium": {"w": 1055, "h": 1200, "resize": "fit"}, "smal
l": {"w": 598, "h": 680, "resize": "fit"}, "large": {"w": 1407, "h": 1600,
"resize": "fit"}}}]}, "source": "<a href=\"http://twitter.com/download/ipho
ne\" rel=\"nofollow\">Twitter for iPhone</a>", "in_reply_to_status_id": nul
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e": "dog_rates", "location": "all our links \u279c", "description": "Your O
nly Source For Professional Dog Ratings \nInstagram and Facebook \u279c WeR
ateDogs \npartnerships@weratedogs.com | nonprofit: @15outof10 \u2800\u2800\
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links.weratedogs.com", "indices": [0, 23]}]}, "description": {"urls": []}},
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d_count": 7566, "created_at": "Sun Nov 15 21:41:29 +0000 2015", "favourites
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nt": 5279, "favorite_count": 29251, "favorited": false, "retweeted": false,
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g": "en"}
```

```
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Norwegian Pouncing Corgo. Lives in the tall grass. You never know when one
may strike. 12/10 https://t.co/wUnZnhtVJB", "truncated": false, "display_te
xt_range": [0, 121], "entities": {"hashtags": [], "symbols": [], "user_ment
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c.twitter.com/wUnZnhtVJB", "expanded_url": "https://twitter.com/dog_rates/s
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t"}}}]}, "source": "<a href=\"http://twitter.com/download/iphone\" rel=\"no
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r Professional Dog Ratings \nInstagram and Facebook \u279c WeRateDogs \npar
tnerships@weratedogs.com | nonprofit: @15outof10 \u2800\u2800\u2800\u2800\u
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The first few lines are ok. Let's load all of the lines onto a list.

In [23]:
```
tweet_json_txt_json = []
with open(tweet_json_txt, "r") as f:
    tweet_json_txt_json = [
        loads(line)
        for line in f
    ]
tweet_json_txt_json[:5]
```

Out[23]:

```
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   'user_mentions': [],
   'urls': [],
   'media': [{'id': 891815175371796480,
     'id_str': '891815175371796480',
     'indices': [122, 145],
     'media_url': 'http://pbs.twimg.com/media/DGBdLU1WsAANxJ9.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DGBdLU1WsAANxJ9.jpg',
     'url': 'https://t.co/wUnZnhtVJB',
     'display_url': 'pic.twitter.com/wUnZnhtVJB',
     'expanded_url': 'https://twitter.com/dog_rates/status/8918151813780848
64/photo/1',
     'type': 'photo',
     'sizes': {'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 510, 'h': 680, 'resize': 'fit'},
      'medium': {'w': 901, 'h': 1200, 'resize': 'fit'},
      'large': {'w': 1201, 'h': 1600, 'resize': 'fit'}}}]},
  'extended_entities': {'media': [{'id': 891815175371796480,
     'id_str': '891815175371796480',
     'indices': [122, 145],
     'media_url': 'http://pbs.twimg.com/media/DGBdLU1WsAANxJ9.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DGBdLU1WsAANxJ9.jpg',
     'url': 'https://t.co/wUnZnhtVJB',
     'display_url': 'pic.twitter.com/wUnZnhtVJB',
     'expanded_url': 'https://twitter.com/dog_rates/status/8918151813780848
64/photo/1',
     'type': 'photo',
     'sizes': {'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 510, 'h': 680, 'resize': 'fit'},
      'medium': {'w': 901, 'h': 1200, 'resize': 'fit'},
      'large': {'w': 1201, 'h': 1600, 'resize': 'fit'}}}]},
  'source': '<a href="http://twitter.com/download/iphone" rel="nofollow">Tw
itter 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®',
   'screen_name': 'dog_rates',
   'location': 'all our links ➔',
   'description': 'Your Only Source For Professional Dog Ratings \nInstagra
m and Facebook ➔ WeRateDogs \npartnerships@weratedogs.com | nonprofit: @15o
utof10               ',
    'url': 'https://t.co/YPc2XqmwyC',
    'entities': {'url': {'urls': [{'url': 'https://t.co/YPc2XqmwyC',
        'expanded_url': 'http://links.weratedogs.com',
        'display_url': 'links.weratedogs.com',
        'indices': [0, 23]}]},
     'description': {'urls': []}},
    'protected': False,
    'followers_count': 9339224,
    'friends_count': 21,
    'listed_count': 7566,
    'created_at': 'Sun Nov 15 21:41:29 +0000 2015',
    'favourites_count': 147205,
    'utc_offset': None,
    'time_zone': None,
    'geo_enabled': True,
    'verified': True,
    'statuses_count': 16089,
    'lang': None,
    'contributors_enabled': False,
    'is_translator': False,
    'is_translation_enabled': False,
    'profile_background_color': '000000',
    'profile_background_image_url': 'http://abs.twimg.com/images/themes/them
e1/bg.png',
    'profile_background_image_url_https': 'https://abs.twimg.com/images/them
es/theme1/bg.png',
    'profile_background_tile': False,
    'profile_image_url': 'http://pbs.twimg.com/profile_images/15529957290142
47425/TaJbIdmK_normal.jpg',
    'profile_image_url_https': 'https://pbs.twimg.com/profile_images/1552995
729014247425/TaJbIdmK_normal.jpg',
    'profile_banner_url': 'https://pbs.twimg.com/profile_banners/4196983835/
1617810473',
    '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': False,
    'default_profile': False,
    'default_profile_image': False,
    'following': True,
    'follow_request_sent': False,
    'notifications': False,
    'translator_type': 'none',
    'withheld_in_countries': []},
   'geo': None,
   'coordinates': None,
   'place': None,
   'contributors': None,
   'is_quote_status': False,
   'retweet_count': 3465,
   'favorite_count': 21985,
   'favorited': False,
   'retweeted': False,
   'possibly_sensitive': False,
  'possibly_sensitive_appealable': False,
  'lang': 'en'},
 {'created_at': 'Sun Jul 30 15:58:51 +0000 2017',
  'id': 891689557279858688,
  'id_str': '891689557279858688',
  'full_text': 'This is Darla. She commenced a snooze mid meal. 13/10 happe
ns to the best of us https://t.co/tD36da7qLQ',
  'truncated': False,
  'display_text_range': [0, 79],
  'entities': {'hashtags': [],
   'symbols': [],
   'user_mentions': [],
   'urls': [],
   'media': [{'id': 891689552724799489,
     'id_str': '891689552724799489',
     'indices': [80, 103],
     'media_url': 'http://pbs.twimg.com/media/DF_q7IAWsAEuuN8.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DF_q7IAWsAEuuN8.jpg',
     'url': 'https://t.co/tD36da7qLQ',
     'display_url': 'pic.twitter.com/tD36da7qLQ',
     'expanded_url': 'https://twitter.com/dog_rates/status/8916895572798586
88/photo/1',
     'type': 'photo',
     'sizes': {'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 510, 'h': 680, 'resize': 'fit'},
      'medium': {'w': 901, 'h': 1200, 'resize': 'fit'},
      'large': {'w': 1201, 'h': 1600, 'resize': 'fit'}}}]},
  'extended_entities': {'media': [{'id': 891689552724799489,
     'id_str': '891689552724799489',
     'indices': [80, 103],
     'media_url': 'http://pbs.twimg.com/media/DF_q7IAWsAEuuN8.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DF_q7IAWsAEuuN8.jpg',
     'url': 'https://t.co/tD36da7qLQ',
     'display_url': 'pic.twitter.com/tD36da7qLQ',
     'expanded_url': 'https://twitter.com/dog_rates/status/8916895572798586
88/photo/1',
     'type': 'photo',
     'sizes': {'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 510, 'h': 680, 'resize': 'fit'},
      'medium': {'w': 901, 'h': 1200, 'resize': 'fit'},
      'large': {'w': 1201, 'h': 1600, 'resize': 'fit'}}}]},
  'source': '<a href="http://twitter.com/download/iphone" rel="nofollow">Tw
itter 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®',
   'screen_name': 'dog_rates',
   'location': 'all our links ➜',
   'description': 'Your Only Source For Professional Dog Ratings \nInstagra
m and Facebook ➜ WeRateDogs \npartnerships@weratedogs.com | nonprofit: @15o
utof10              ',
    'url': 'https://t.co/YPc2XqmwyC',
    'entities': {'url': {'urls': [{'url': 'https://t.co/YPc2XqmwyC',
        'expanded_url': 'http://links.weratedogs.com',
        'display_url': 'links.weratedogs.com',
        'indices': [0, 23]}]},
     'description': {'urls': []}},
    'protected': False,
    'followers_count': 9339224,
    'friends_count': 21,
    'listed_count': 7566,
    'created_at': 'Sun Nov 15 21:41:29 +0000 2015',
    'favourites_count': 147205,
    'utc_offset': None,
    'time_zone': None,
    'geo_enabled': True,
    'verified': True,
    'statuses_count': 16089,
    'lang': None,
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    'is_translator': False,
    'is_translation_enabled': False,
    'profile_background_color': '000000',
    'profile_background_image_url': 'http://abs.twimg.com/images/themes/them
e1/bg.png',
    'profile_background_image_url_https': 'https://abs.twimg.com/images/them
es/theme1/bg.png',
    'profile_background_tile': False,
    'profile_image_url': 'http://pbs.twimg.com/profile_images/15529957290142
47425/TaJbIdmK_normal.jpg',
    'profile_image_url_https': 'https://pbs.twimg.com/profile_images/1552995
729014247425/TaJbIdmK_normal.jpg',
    'profile_banner_url': 'https://pbs.twimg.com/profile_banners/4196983835/
1617810473',
    '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': False,
    'default_profile': False,
    'default_profile_image': False,
    'following': True,
    'follow_request_sent': False,
    'notifications': False,
    'translator_type': 'none',
    'withheld_in_countries': []},
   'geo': None,
   'coordinates': None,
   'place': None,
   'contributors': None,
   'is_quote_status': False,
   'retweet_count': 7198,
   'favorite_count': 36817,
   'favorited': False,
   'retweeted': False,
   'possibly_sensitive': False,
  'possibly_sensitive_appealable': False,
  'lang': 'en'},
 {'created_at': 'Sat Jul 29 16:00:24 +0000 2017',
  'id': 891327558926688256,
  'id_str': '891327558926688256',
  'full_text': 'This is Franklin. He would like you to stop calling him "cu
te." He is a very fierce shark and should be respected as such. 12/10 #Bark
Week https://t.co/AtUZn91f7f',
  'truncated': False,
  'display_text_range': [0, 138],
  'entities': {'hashtags': [{'text': 'BarkWeek', 'indices': [129, 138]}],
   'symbols': [],
   'user_mentions': [],
   'urls': [],
   'media': [{'id': 891327551943041024,
     'id_str': '891327551943041024',
     'indices': [139, 162],
     'media_url': 'http://pbs.twimg.com/media/DF6hr6AVYAAZ8G8.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DF6hr6AVYAAZ8G8.jpg',
     'url': 'https://t.co/AtUZn91f7f',
     'display_url': 'pic.twitter.com/AtUZn91f7f',
     'expanded_url': 'https://twitter.com/dog_rates/status/8913275589266882
56/photo/1',
     'type': 'photo',
     'sizes': {'medium': {'w': 720, 'h': 540, 'resize': 'fit'},
      'large': {'w': 720, 'h': 540, 'resize': 'fit'},
      'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 680, 'h': 510, 'resize': 'fit'}}}]},
  'extended_entities': {'media': [{'id': 891327551943041024,
     'id_str': '891327551943041024',
     'indices': [139, 162],
     'media_url': 'http://pbs.twimg.com/media/DF6hr6AVYAAZ8G8.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DF6hr6AVYAAZ8G8.jpg',
     'url': 'https://t.co/AtUZn91f7f',
     'display_url': 'pic.twitter.com/AtUZn91f7f',
     'expanded_url': 'https://twitter.com/dog_rates/status/8913275589266882
56/photo/1',
     'type': 'photo',
     'sizes': {'medium': {'w': 720, 'h': 540, 'resize': 'fit'},
      'large': {'w': 720, 'h': 540, 'resize': 'fit'},
      'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 680, 'h': 510, 'resize': 'fit'}}},
    {'id': 891327551947157504,
     'id_str': '891327551947157504',
     'indices': [139, 162],
     'media_url': 'http://pbs.twimg.com/media/DF6hr6BUMAAzZgT.jpg',
     'media_url_https': 'https://pbs.twimg.com/media/DF6hr6BUMAAzZgT.jpg',
     'url': 'https://t.co/AtUZn91f7f',
     'display_url': 'pic.twitter.com/AtUZn91f7f',
     'expanded_url': 'https://twitter.com/dog_rates/status/8913275589266882
56/photo/1',
     'type': 'photo',
     'sizes': {'medium': {'w': 720, 'h': 540, 'resize': 'fit'},
      'large': {'w': 720, 'h': 540, 'resize': 'fit'},
      'thumb': {'w': 150, 'h': 150, 'resize': 'crop'},
      'small': {'w': 680, 'h': 510, 'resize': 'fit'}}}]},
  'source': '<a href="http://twitter.com/download/iphone" rel="nofollow">Tw
itter 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®',
   'screen_name': 'dog_rates',
   'location': 'all our links ➝',
   'description': 'Your Only Source For Professional Dog Ratings \nInstagra
m and Facebook ➝ WeRateDogs \npartnerships@weratedogs.com | nonprofit: @15o
utof10               ',
   'url': 'https://t.co/YPc2XqmwyC',
   'entities': {'url': {'urls': [{'url': 'https://t.co/YPc2XqmwyC',
       'expanded_url': 'http://links.weratedogs.com',
       'display_url': 'links.weratedogs.com',
       'indices': [0, 23]}]},
    'description': {'urls': []}},
   'protected': False,
   'followers_count': 9339224,
   'friends_count': 21,
   'listed_count': 7566,
   'created_at': 'Sun Nov 15 21:41:29 +0000 2015',
   'favourites_count': 147205,
   'utc_offset': None,
   'time_zone': None,
   'geo_enabled': True,
   'verified': True,
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   'is_translator': False,
   'is_translation_enabled': False,
   'profile_background_color': '000000',
   'profile_background_image_url': 'http://abs.twimg.com/images/themes/them
e1/bg.png',
   'profile_background_image_url_https': 'https://abs.twimg.com/images/them
es/theme1/bg.png',
   'profile_background_tile': False,
   'profile_image_url': 'http://pbs.twimg.com/profile_images/15529957290142
47425/TaJbIdmK_normal.jpg',
   'profile_image_url_https': 'https://pbs.twimg.com/profile_images/1552995
729014247425/TaJbIdmK_normal.jpg',
   'profile_banner_url': 'https://pbs.twimg.com/profile_banners/4196983835/
1617810473',
   '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': False,
   'default_profile': False,
   'default_profile_image': False,
  'following': True,
  'follow_request_sent': False,
  'notifications': False,
  'translator_type': 'none',
  'withheld_in_countries': []},
 'geo': None,
 'coordinates': None,
 'place': None,
 'contributors': None,
 'is_quote_status': False,
 'retweet_count': 7722,
 'favorite_count': 35202,
 'favorited': False,
 'retweeted': False,
 'possibly_sensitive': False,
 'possibly_sensitive_appealable': False,
 'lang': 'en'}]
```

Now we can create a dataframe with `DataFrame.from_records` :

```
In [24]: tweet_json_txt_df = pd.DataFrame.from_records(tweet_json_txt_json)
```

```
In [25]: tweet_json_txt_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2327 entries, 0 to 2326
Data columns (total 32 columns):
 #   Column                         Non-Null Count  Dtype  
---  ------                         --------------  -----  
 0   created_at                     2327 non-null   object 
 1   id                             2327 non-null   int64  
 2   id_str                         2327 non-null   object 
 3   full_text                      2327 non-null   object 
 4   truncated                      2327 non-null   bool   
 5   display_text_range             2327 non-null   object 
 6   entities                       2327 non-null   object 
 7   extended_entities              2057 non-null   object 
 8   source                         2327 non-null   object 
 9   in_reply_to_status_id          77 non-null     float64
 10  in_reply_to_status_id_str      77 non-null     object 
 11  in_reply_to_user_id            77 non-null     float64
 12  in_reply_to_user_id_str        77 non-null     object 
 13  in_reply_to_screen_name        77 non-null     object 
 14  user                           2327 non-null   object 
 15  geo                            0 non-null      object 
 16  coordinates                    0 non-null      object 
 17  place                          1 non-null      object 
 18  contributors                   0 non-null      object 
 19  is_quote_status                2327 non-null   bool   
 20  retweet_count                  2327 non-null   int64  
 21  favorite_count                 2327 non-null   int64  
 22  favorited                      2327 non-null   bool   
 23  retweeted                      2327 non-null   bool   
 24  possibly_sensitive             2195 non-null   object 
 25  possibly_sensitive_appealable  2195 non-null   object 
 26  lang                           2327 non-null   object 
 27  retweeted_status               160 non-null    object 
 28  quoted_status_id               26 non-null     float64
 29  quoted_status_id_str           26 non-null     object 
 30  quoted_status_permalink        26 non-null     object 
 31  quoted_status                  24 non-null     object 
dtypes: bool(4), float64(3), int64(3), object(22)
memory usage: 518.2+ KB
```

In [26]:
```
tweet_json_txt_df.head()
```

```
Out[26]:
```

	created_at	id	id_str	full_text	truncated	display_
0	Tue Aug 01 16:23:56 +0000 2017	892420643555336193	892420643555336193	This is Phineas. He's a mystical boy. Only eve...	False	
1	Tue Aug 01 00:17:27 +0000 2017	892177421306343426	892177421306343426	This is Tilly. She's just checking pup on you....	False	
2	Mon Jul 31 00:18:03 +0000 2017	891815181378084864	891815181378084864	This is Archie. He is a rare Norwegian Pouncin...	False	
3	Sun Jul 30 15:58:51 +0000 2017	891689557279858688	891689557279858688	This is Darla. She commenced a snooze mid meal...	False	
4	Sat Jul 29 16:00:24 +0000 2017	891327558926688256	891327558926688256	This is Franklin. He would like you to stop ca...	False	

5 rows × 32 columns

Since we only need id, retweet count, and favorite count, let's project the rest of the columns out:

```
In [27]: tweet_json_txt_df = tweet_json_txt_df[["id", "retweet_count", "favorite_coun
```

Assessing Data

In this section, detect and document at least **eight (8) quality issues and two (2) tidiness issue**. You must use **both** visual assessment programmatic assessement to assess the data.

Note: pay attention to the following key points when you access the data.

- You only want original ratings (no retweets) that have images. Though there are 5000+ tweets in the dataset, not all are dog ratings and some are retweets.
- Assessing and cleaning the entire dataset completely would require a lot of time, and is not necessary to practice and demonstrate your skills in data wrangling. Therefore, the requirements of this project are only to assess and clean at least 8 quality issues and at least 2 tidiness issues in this dataset.
- The fact that the rating numerators are greater than the denominators does not need to be cleaned. This unique rating system is a big part of the popularity of WeRateDogs.
- You do not need to gather the tweets beyond August 1st, 2017. You can, but note that you won't be able to gather the image predictions for these tweets since you don't have access to the algorithm used.

twitter_archived_enhanced_df

In [28]:
```
twitter_archived_enhanced_df.head()
```

Out[28]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56 +0000	href="http:// /download/
1	892177421306343426	NaN	NaN	2017-08-01 00:17:27 +0000	href="http:// /download/
2	891815181378084864	NaN	NaN	2017-07-31 00:18:03 +0000	href="http:// /download/
3	891689557279858688	NaN	NaN	2017-07-30 15:58:51 +0000	href="http:// /download/
4	891327558926688256	NaN	NaN	2017-07-29 16:00:24 +0000	href="http:// /download/

In [29]:

```
twitter_archived_enhanced_df.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
```

No missing text, ratings, names, or stages.

```
In [30]: twitter_archived_enhanced_df.tweet_id.duplicated().sum()  # No duplicate twe
```

```
Out[30]: 0
```

```
In [31]: (~twitter_archived_enhanced_df.in_reply_to_status_id.isna()).sum()  # There
```

```
Out[31]: 78
```

```
In [32]: (~twitter_archived_enhanced_df.retweeted_status_id.isna()).sum()  # There ar
```

```
Out[32]: 181
```

Let's filter out replies and retweets (only for assessing purposes):

```
In [33]: twitter_archived_enhanced_valid_df = twitter_archived_enhanced_df[
             twitter_archived_enhanced_df.in_reply_to_status_id.isna()
             & twitter_archived_enhanced_df.retweeted_status_id.isna()
         ]
```

```
In [34]: twitter_archived_enhanced_valid_df.shape[0]  # We've got 2097 potentially va
```

```
Out[34]: 2097
```

Let's look for rating numerators/denominators outside of the tranditional WeRateDogs rating system. Historically, the ranking goes from 0/10 to 15/10. Let's look at numerators:

```
In [35]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator > 15
         ].rating_numerator.value_counts()
```

```
Out[35]: 84      1
         24      1
         88      1
         144     1
         26      1
         121     1
         44      1
         60      1
         45      1
         80      1
         99      1
         50      1
         204     1
         1776    1
         165     1
         27      1
         75      1
         420     1
         Name: rating_numerator, dtype: int64
```

In [36]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 84
][["tweet_id", "text"]].values
```

Out[36]:
```
array([[820690176645140481,
        'The floofs have been released I repeat the floofs have been releas
ed. 84/70 https://t.co/NIYC820tmd']],
      dtype=object)
```

In [37]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 24
][["tweet_id", "text"]].values
```

Out[37]:
```
array([[810984652412424192,
        'Meet Sam. She smiles 24/7 &amp; secretly aspires to be a reindeer.
\nKeep Sam smiling by clicking and sharing this link:\nhttps://t.co/98tB8y7
y7t https://t.co/LouL5vdvxx']],
      dtype=object)
```

In [38]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 88
][["tweet_id", "text"]].values
```

Out[38]:
```
array([[675853064436391936,
        'Here we have an entire platoon of puppers. Total score: 88/80 woul
d pet all at once https://t.co/y93p6FLvVw']],
      dtype=object)
```

In [39]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 26
][["tweet_id", "text"]].values
```

Out[39]:
```
array([[680494726643068929,
        'Here we have uncovered an entire battalion of holiday puppers. Ave
rage of 11.26/10 https://t.co/eNm2S6p9BD']],
      dtype=object)
```

In [40]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 121
][["tweet_id", "text"]].values
```

Out[40]:
```
array([[684222868335505415,
        'Someone help the girl is being mugged. Several are distracting her
while two steal her shoes. Clever puppers 121/110 https://t.co/1zfnTJLt55
']],
      dtype=object)
```

In [41]:
```
twitter_archived_enhanced_valid_df[
    twitter_archived_enhanced_valid_df.rating_numerator == 44
][["tweet_id", "text"]].values
```

Out[41]:
```
array([[697463031882764288,
        "Happy Wednesday here's a bucket of pups. 44/40 would pet all at on
ce https://t.co/HppvrYuamZ"]],
      dtype=object)
```

```
In [42]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 60
         ][["tweet_id", "text"]].values
```

```
Out[42]: array([[704054845121142784,
                 "Here is a whole flock of puppers.  60/50 I'll take the lot http
         s://t.co/9dpcw6MdWa"]],
               dtype=object)
```

```
In [43]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 45
         ][["tweet_id", "text"]].values
```

```
Out[43]: array([[709198395643068416,
                 'From left to right:\nCletus, Jerome, Alejandro, Burp, &amp; Titso
         n\nNone know where camera is. 45/50 would hug all at once https://t.co/sedr
         e1ivTK']],
               dtype=object)
```

```
In [44]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 80
         ][["tweet_id", "text"]].values
```

```
Out[44]: array([[710658690886586372,
                 "Here's a brigade of puppers. All look very prepared for whatever h
         appens next. 80/80 https://t.co/0eb7R1Om12"]],
               dtype=object)
```

```
In [45]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 99
         ][["tweet_id", "text"]].values
```

```
Out[45]: array([[713900603437621249,
                 "Happy Saturday here's 9 puppers on a bench. 99/90 good work everyb
         ody https://t.co/mpvaVxKmc1"]],
               dtype=object)
```

```
In [46]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 50
         ][["tweet_id", "text"]].values
```

```
Out[46]: array([[716439118184652801,
                 'This is Bluebert. He just saw that both #FinalFur match ups are sp
         lit 50/50. Amazed af. 11/10 https://t.co/Kky1DPG4iq']],
               dtype=object)
```

```
In [47]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 204
         ][["tweet_id", "text"]].values
```

```
Out[47]: array([[731156023742988288,
                 'Say hello to this unbelievably well behaved squad of doggos. 204/1
         70 would try to pet all at once https://t.co/yGQI3He3xv']],
               dtype=object)
```

A joke rating but technically still valid:

```
In [48]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 1776
         ][["tweet_id", "text"]].values
```

```
Out[48]: array([[749981277374128128,
                 "This is Atticus. He's quite simply America af. 1776/10 https://t.c
         o/GRXwMxLBkh"]],
               dtype=object)
```

```
In [49]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 165
         ][["tweet_id", "text"]].values
```

```
Out[49]: array([[758467244762497024,
                 'Why does this never happen at my front door... 165/150 https://t.c
         o/HmwrdfEfUE']],
               dtype=object)
```

```
In [50]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 27
         ][["tweet_id", "text"]].values
```

```
Out[50]: array([[778027034220126208,
                 "This is Sophie. She's a Jubilant Bush Pupper. Super h*ckin rare. A
         ppears at random just to smile at the locals. 11.27/10 would smile back htt
         ps://t.co/QFaUiIHxHq"]],
               dtype=object)
```

```
In [51]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 75
         ][["tweet_id", "text"]].values
```

```
Out[51]: array([[786709082849828864,
                 "This is Logan, the Chow who lived. He solemnly swears he's up to l
         ots of good. H*ckin magical af 9.75/10 https://t.co/yBO5wuqaPS"]],
               dtype=object)
```

```
In [52]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_numerator == 420
         ][["tweet_id", "text"]].values
```

```
Out[52]: array([[670842764863651840,
                 'After so many requests... here you go.\n\nGood dogg. 420/10 http
         s://t.co/yfAAo1gdeY']],
               dtype=object)
```

Now let's check the denominators. Anything that is not a 10 and does not contain multiple doggos is to be considered suspicious.

```
In [53]: twitter_archived_enhanced_valid_df[
             (twitter_archived_enhanced_valid_df.rating_denominator != 10) &
             (~twitter_archived_enhanced_valid_df.tweet_id.isin([
                 820690176645140481, 675853064436391936, 677716515794329600, 68422286
                 704054845121142784, 709198395643068416, 710658690886586372, 71390060
                 758467244762497024
             ]))
         ].rating_denominator.value_counts()

Out[53]: 11    2
         7     1
         20    1
         50    1
         2     1
         Name: rating_denominator, dtype: int64

In [54]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_denominator == 11
         ][["tweet_id", "text"]].values

Out[54]: array([[740373189193256964,
                 'After so many requests, this is Bretagne. She was the last survivi
         ng 9/11 search dog, and our second ever 14/10. RIP https://t.co/XAVDNDaVgQ
         '],
                [682962037429899265,
                 'This is Darrel. He just robbed a 7/11 and is in a high speed polic
         e chase. Was just spotted by the helicopter 10/10 https://t.co/7EsP8LmSp5
         ']],
               dtype=object)

In [55]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_denominator == 7
         ][["tweet_id", "text"]].values

Out[55]: array([[810984652412424192,
                 'Meet Sam. She smiles 24/7 &amp; secretly aspires to be a reindeer.
         \nKeep Sam smiling by clicking and sharing this link:\nhttps://t.co/98tB8y7
         y7t https://t.co/LouL5vdvxx']],
               dtype=object)

In [56]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_denominator == 20
         ][["tweet_id", "text"]].values

Out[56]: array([[722974582966214656,
                 'Happy 4/20 from the squad! 13/10 for all https://t.co/eV1diwds8a
         ']],
               dtype=object)

In [57]: twitter_archived_enhanced_valid_df[
             twitter_archived_enhanced_valid_df.rating_denominator == 2
         ][["tweet_id", "text"]].values
```

```
Out[57]: array([[666287406224695296,
                 'This is an Albanian 3 1/2 legged  Episcopalian. Loves well-polishe
         d hardwood flooring. Penis on the collar. 9/10 https://t.co/d9NcXFKwLv']],
               dtype=object)
```

Now let's check the names:

```
In [58]: twitter_archived_enhanced_valid_df.name.value_counts()
```

```
Out[58]: None          603
         a              55
         Lucy           11
         Charlie        11
         Oliver         10
                      ...
         Lenox           1
         Harvey          1
         Blanket         1
         Burt            1
         Christoper      1
         Name: name, Length: 955, dtype: int64
```

```
In [59]: twitter_archived_enhanced_valid_df[twitter_archived_enhanced_valid_df.name =
Out[59]: array([[881536004380872706,
                'Here is a pupper approaching maximum borkdrive. Zooming at never b
         efore seen speeds. 14/10 paw-inspiring af \n(IG: puffie_the_chow) https://
         t.co/ghXBIIeQZF'],
               [792913359805018113,
                'Here is a perfect example of someone who has their priorities in o
         rder. 13/10 for both owner and Forrest https://t.co/LRyMrU7Wfq'],
               [772581559778025472,
                'Guys this is getting so out of hand. We only rate dogs. This is a
         Galapagos Speed Panda. Pls only send dogs... 10/10 https://t.co/8lpAGaZRFn
         '],
               [747885874273214464,
                'This is a mighty rare blue-tailed hammer sherk. Human almost lost
         a limb trying to take these. Be careful guys. 8/10 https://t.co/TGenMeXreW
         '],
               [747816857231626240,
                'Viewer discretion is advised. This is a terrible attack in progres
         s. Not even in water (tragic af). 4/10 bad sherk https://t.co/L3U0j14N5R'],
               [746872823977771008,
                'This is a carrot. We only rate dogs. Please only send in dogs. You
         all really should know this by now ...11/10 https://t.co/9e48aPrBm2'],
               [743222593470234624,
                'This is a very rare Great Alaskan Bush Pupper. Hard to stumble upo
         n without spooking. 12/10 would pet passionately https://t.co/xOBKCdpzaa'],
               [717537687239008257,
                'People please. This is a Deadly Mediterranean Plop T-Rex. We only
         rate dogs. Only send in dogs. Thanks you... 11/10 https://t.co/2ATDsgHD4n
         '],
               [715733265223708672,
                'This is a taco. We only rate dogs. Please only send in dogs. Dogs
         are what we rate. Not tacos. Thank you... 10/10 https://t.co/cxl6xGY8B9'],
               [704859558691414016,
                'Here is a heartbreaking scene of an incredible pupper being laid t
         o rest. 10/10 RIP pupper https://t.co/81mvJ0rGRu'],
               [704054845121142784,
                "Here is a whole flock of puppers.  60/50 I'll take the lot http
         s://t.co/9dpcw6MdWa"],
               [703079050210877440,
                "This is a Butternut Cumberfloof. It's not windy they just look lik
         e that. 11/10 back at it again with the red socks https://t.co/hMjzhdUHa
         W"],
               [702539513671897089,
                'This is a Wild Tuscan Poofwiggle. Careful not to startle. Rare ton
         gue slip. One eye magical. 12/10 would def pet https://t.co/4EnShAQjv6'],
               [700864154249383937,
                '"Pupper is a present to world. Here is a bow for pupper." 12/10 pr
         ecious as hell https://t.co/ItSsE92gCW'],
               [692187005137076224,
                'This is a rare Arctic Wubberfloof. Unamused by the happenings. No
         longer has the appetites. 12/10 would totally hug https://t.co/krvbacIX0N
         '],
               [679530280114372609,
                "Guys this really needs to stop. We've been over this way too many
         times. This is a giraffe. We only rate dogs.. 7/10 https://t.co/yavgkHYPO
         C"],
               [677644091929329666,
                'This is a dog swinging. I really enjoyed it so I hope you all do a
         s well. 11/10 https://t.co/Ozo9KHTRND'],
               [675706639471788032,
                "This is a Sizzlin Menorah spaniel from Brooklyn named Wylie. Lovab
         le eyes. Chiller as hell. 10/10 and I'm out.. poof https://t.co/7E0AiJXPm
         I"],
               [675534494439489536,
                'Seriously guys?! Only send in dogs. I only rate dogs. This is a ba
         by black bear... 11/10 https://t.co/H7kpabTfLj'],
               [675109292475830276,
                "C'mon guys. We've been over this. We only rate dogs. This is a co
         w. Please only submit dogs. Thank you...... 9/10 https://t.co/WjcELNEqN2"],
               [675047298674663426,
                'This is a fluffy albino Bacardi Columbia mix. Excellent at the twe
         ets. 11/10 would hug gently https://t.co/diboDRUuEI'],
               [674082852460433408,
                'This is a Sagitariot Baklava mix. Loves her new hat. 11/10 radiant
         pup https://t.co/Bko5kFJYUU'],
               [673715861853720576,
                'This is a heavily opinionated dog. Loves walls. Nobody knows how t
         he hair works. Always ready for a kiss. 4/10 https://t.co/dFiaKZ9cDl'],
               [673636718965334016,
                'This is a Lofted Aphrodisiac Terrier named Kip. Big fan of bed n b
         reakfasts. Fits perfectly. 10/10 would pet firmly https://t.co/gKlLpNzIl3
         '],
               [672604026190569472,
                'This is a baby Rand Paul. Curls for days. 11/10 would cuddle the h
         ell out of https://t.co/xHXNaPAYRe'],
               [671743150407421952,
                'This is a Tuscaloosa Alcatraz named Jacob (Yacōb). Loves to sit in
         swing. Stellar tongue. 11/10 look at his feet https://t.co/2IslQ8ZSc7'],
               [671147085991960577,
                "This is a Helvetica Listerine named Rufus. This time Rufus will be
         ready for the UPS guy. He'll never expect it 9/10 https://t.co/34OhVhMkV
         r"],
               [670427002554466305,
                'This is a Deciduous Trimester mix named Spork. Only 1 ear works. N
         o seat belt. Incredibly reckless. 9/10 still cute https://t.co/CtuJoLHiDo
         '],
               [670361874861563904,
                "This is a Rich Mahogany Seltzer named Cherokee. Just got destroyed
         by a snowball. Isn't very happy about it. 9/10 https://t.co/98ZBi6o4dj"],
               [670303360680108032,
                "This is a Speckled Cauliflower Yosemite named Hemry. He's terrifie
         d of intruder dog. Not one bit comfortable. 9/10 https://t.co/yV3Qgjh8iN"],
               [669923323644657664,
                "This is a spotted Lipitor Rumpelstiltskin named Alphred. He can't
         wait for the Turkey. 10/10 would pet really well https://t.co/6GUGO7azNX"],
               [669661792646373376,
                "This is a brave dog. Excellent free climber. Trying to get closer
         to God. Not very loyal though. Doesn't bark. 5/10 https://t.co/ODnILTr4Q
         M"],
               [669564461267722241,
                'This is a Coriander Baton Rouge named Alfredo. Loves to cuddle wit
         h smaller well-dressed dog. 10/10 would hug lots https://t.co/eCRdwouKCl'],
               [668955713004314625,
                'This is a Slovakian Helter Skelter Feta named Leroi. Likes to skip
         on roofs. Good traction. Much balance. 10/10 wow! https://t.co/Dmy2mY2Qj5
         '],
               [668815180734689280,
                'This is a wild Toblerone from Papua New Guinea. Mouth always open.
         Addicted to hay. Acts blind. 7/10 handsome dog https://t.co/IGmVbz07tZ'],
               [668614819948453888,
                'Here is a horned dog. Much grace. Can jump over moons (dam!). Paws
         not soft. Bad at barking. 7/10 can still pet tho https://t.co/2Su7gmsnZm'],
               [668507509523615744,
                'This is a Birmingham Quagmire named Chuk. Loves to relax and watch
         the game while sippin on that iced mocha. 10/10 https://t.co/HvNg9JWxFt'],
               [668466899341221888,
                "Here is a mother dog caring for her pups. Snazzy red mohawk. Doesn
         't wag tail. Pups look confused. Overall 4/10 https://t.co/YOHe6lf09m"],
               [668171859951755264,
                'This is a Trans Siberian Kellogg named Alfonso. Huge ass eyeballs.
         Actually Dobby from Harry Potter. 7/10 https://t.co/XpseHBlAAb'],
               [667861340749471744,
                'This is a Shotokon Macadamia mix named Cheryl. Sophisticated af. L
         ooks like a disappointed librarian. Shh (lol) 9/10 https://t.co/J4GnJ5Swba
         '],
               [667773195014021121,
                'This is a rare Hungarian Pinot named Jessiga. She is either mid-st
         roke or got stuck in the washing machine. 8/10 https://t.co/ZU0i0KJyqD'],
               [667538891197542400,
                'This is a southwest Coriander named Klint. Hat looks expensive. St
         ill on house arrest :(\n9/10 https://t.co/IQTOMqDUIe'],
               [667470559035432960,
                'This is a northern Wahoo named Kohl. He runs this town. Chases tum
         bleweeds. Draws gun wicked fast. 11/10 legendary https://t.co/J4vn2rOYFk'],
               [667177989038297088,
                "This is a Dasani Kingfisher from Maine. His name is Daryl. Daryl d
         oesn't like being swallowed by a panda. 8/10 https://t.co/jpaeu6LNmW"],
               [666983947667116034,
                'This is a curly Ticonderoga named Pepe. No feet. Loves to jet ski.
         11/10 would hug until forever https://t.co/cyDfaK8NBc'],
               [666781792255496192,
                'This is a purebred Bacardi named Octaviath. Can shoot spaghetti ou
         t of mouth. 10/10 https://t.co/uEvsGLOFHa'],
               [666701168228331520,
                'This is a golden Buckminsterfullerene named Johm. Drives trucks. L
         umberjack (?). Enjoys wall. 8/10 would hug softly https://t.co/uQbZJM2DQB
         '],
               [666407126856765440,
                'This is a southern Vesuvius bumblegruff. Can drive a truck (wow).
         Made friends with 5 other nifty dogs (neat). 7/10 https://t.co/LopTBkKa8h
         '],
               [666293911632134144,
                "This is a funny dog. Weird toes. Won't come down. Loves branch. Re
         fuses to eat his food. Hard to cuddle with. 3/10 https://t.co/IIXis0zta0"],
               [666057090499244032,
                'My oh my. This is a rare blond Canadian terrier on wheels. Only
         $8.98. Rather docile. 9/10 very rare https://t.co/yWBqbrzy8O'],
               [666055525042405380,
                'Here is a Siberian heavily armored polar bear mix. Strong owner. 1
         0/10 I would do unspeakable things to pet this dog https://t.co/rdivxLiqEt
         '],
               [666050758794694657,
                'This is a truly beautiful English Wilson Staff retriever. Has a ni
         ce phone. Privileged. 10/10 would trade lives with https://t.co/fvIbQfHjIe
         '],
               [666044226329800704,
                'This is a purebred Piers Morgan. Loves to Netflix and chill. Alway
         s looks like he forgot to unplug the iron. 6/10 https://t.co/DWnyCjf2mx'],
               [666033412701032449,
                'Here is a very happy pup. Big fan of well-maintained decks. Just l
         ook at that tongue. 9/10 would cuddle af https://t.co/y671yMhoiR'],
               [666029285002620928,
                'This is a western brown Mitsubishi terrier. Upset about leaf. Actu
         ally 2 dogs here. 7/10 would walk the shit out of https://t.co/r7mOb2m0UI
         ']],
               dtype=object)
```

Now let's check the stages:

```
In [60]: twitter_archived_enhanced_valid_df.doggo.value_counts()
```

```
Out[60]: None     2014
doggo      83
Name: doggo, dtype: int64
```

```
In [61]: twitter_archived_enhanced_valid_df.floofer.value_counts()
```

```
Out[61]: None       2087
floofer      10
Name: floofer, dtype: int64
```

```
In [62]: twitter_archived_enhanced_valid_df.pupper.value_counts()
```

```
Out[62]: None      1867
pupper     230
Name: pupper, dtype: int64
```

```
In [63]: twitter_archived_enhanced_valid_df.puppo.value_counts()
```

```
Out[63]: None     2073
puppo      24
Name: puppo, dtype: int64
```

image_predictions_df

```
In [64]: image_predictions_df.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
```

```
In [65]: image_predictions_df.head()
```

Out[65]:

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

```
In [66]: image_predictions_df.shape[0]  # There's a different number of records from
```

```
Out[66]: 2075
```

How many dog preditions are there? Are there any rows without a dog prediction?

```
In [67]: (image_predictions_df.p1_dog | image_predictions_df.p2_dog | image_predictio
```

```
Out[67]: 1751
```

```
In [68]: ((~image_predictions_df.p1_dog) & (~image_predictions_df.p2_dog) & (~image_p
```

```
Out[68]: 324
```

In [69]:
```
image_predictions_df[(~image_predictions_df.p1_dog) & (~image_predictions_df
```

Out[69]:

	tweet_id	jpg_url	img_num	p1	p1_conf
6	666051853826850816	https://pbs.twimg.com/media/CT5KoJ1WoAAJash.jpg	1	box_turtle	0.933012
17	666104133288665088	https://pbs.twimg.com/media/CT56LSZWoAAlJj2.jpg	1	hen	0.965932
18	666268910803644416	https://pbs.twimg.com/media/CT8QCd1WEAADXws.jpg	1	desktop_computer	0.086502
21	666293911632134144	https://pbs.twimg.com/media/CT8mx7KW4AEQu8N.jpg	1	three-toed_sloth	0.914671
25	666362758909284353	https://pbs.twimg.com/media/CT9lXGsUcAAyUFt.jpg	1	guinea_pig	0.996496

Are the confidence values consistent?

In [70]:
```
image_predictions_df.p1_conf.describe()
```

Out[70]:
```
count    2075.000000
mean        0.594548
std         0.271174
min         0.044333
25%         0.364412
50%         0.588230
75%         0.843855
max         1.000000
Name: p1_conf, dtype: float64
```

In [71]:
```
image_predictions_df.p2_conf.describe()
```

Out[71]:
```
count    2.075000e+03
mean     1.345886e-01
std      1.006657e-01
min      1.011300e-08
25%      5.388625e-02
50%      1.181810e-01
75%      1.955655e-01
max      4.880140e-01
Name: p2_conf, dtype: float64
```

In [72]:
```
image_predictions_df.p3_conf.describe()
```

```
Out[72]: count    2.075000e+03
         mean     6.032417e-02
         std      5.090593e-02
         min      1.740170e-10
         25%      1.622240e-02
         50%      4.944380e-02
         75%      9.180755e-02
         max      2.734190e-01
         Name: p3_conf, dtype: float64
```

Anything weird on the dog breeds?

```
In [73]: image_predictions_df[image_predictions_df.p1_dog].p1.value_counts()
```

```
Out[73]: golden_retriever      150
         Labrador_retriever    100
         Pembroke               89
         Chihuahua              83
         pug                    57
                              ...
         Japanese_spaniel        1
         Scotch_terrier          1
         standard_schnauzer      1
         EntleBucher             1
         clumber                 1
         Name: p1, Length: 111, dtype: int64
```

```
In [74]: image_predictions_df[image_predictions_df.p2_dog].p2.value_counts()
```

```
Out[74]: Labrador_retriever      104
         golden_retriever         92
         Cardigan                 73
         Chihuahua                44
         Pomeranian               42
                                ...
         affenpinscher             1
         Japanese_spaniel          1
         Kerry_blue_terrier        1
         komondor                  1
         Bernese_mountain_dog      1
         Name: p2, Length: 113, dtype: int64
```

```
In [75]: image_predictions_df[image_predictions_df.p3_dog].p3.value_counts()
```

```
Out[75]: Labrador_retriever    79
         Chihuahua             58
         golden_retriever      48
         Eskimo_dog            38
         kelpie                35
                               ..
         Irish_wolfhound        2
         affenpinscher          1
         Kerry_blue_terrier     1
         standard_schnauzer     1
         Sussex_spaniel         1
         Name: p3, Length: 116, dtype: int64
```

tweet_json_txt_df

```
In [76]: set(twitter_archived_enhanced_valid_df.tweet_id.values) - set(tweet_json_txt
```

```
Out[76]: {680055455951884288,
          754011816964026368,
          759923798737051648,
          779123168116150273,
          829374341691346946,
          837366284874571778,
          844704788403113984,
          872261713294495745}
```

Quality issues

1. There are 78 replies and 181 retweets on `twitter_archived_enhanced_df`. (Solution)
2. On tweets `820690176645140481`, `675853064436391936`, `677716515794329600`, `684222868335505415`, `697463031882764288`, `704054845121142784`, `709198395643068416`, `710658690886586372`, `713900603437621249`, `731156023742988288`, `758467244762497024` there are multiple doggos with unusual ratings. (Solution)
3. On tweets `810984652412424192`, `716439118184652801`, `716439118184652801`, `740373189193256964`, `682962037429899265`, `722974582966214656`, `666287406224695296` there are multiple expressions confused for ratings. (Solution)
4. On tweets `680494726643068929`, `778027034220126208`, `786709082849828864` there are fractional ratings. (Solution)
5. On tweet `670842764863651840` the rating is invalid as the subject is not a doggo. (Solution)
6. Although the rating on tweet `749981277374128128` is technically valid (1776), we consider it an outlier. (Solution)
7. Invalid name "a" on 55 tweets. (Solution)
8. There were missing tweets when fetching the retweet and favourite counts with Twitter's API. (Solution)
9. There are 324 records without a dog prediction on image_predictions_df. (Solution)

Tidiness issues

1. Multiple tables to represent the same observational unit: the tweet. (Solution)
2. Multiple columns for the doggo stage variable. (Solution)
3. Multiple columns to represent the breed prediction and confidence. (Solution)
4. The predictions are a string but should be a category. (Solution)
5. `timestamp` is a string, could be a datetime. (Solution)
6. Dog breed names could be made consitent and readable. (Solution)
7. The rating is a single variable represented in two columns. (Solution)

Cleaning Data

In this section, clean **all** of the issues you documented while assessing.

Note: Make a copy of the original data before cleaning. Cleaning includes merging individual pieces of data according to the rules of tidy data. The result should be a high-quality and tidy master pandas DataFrame (or DataFrames, if appropriate).

In [77]:
```
# Make copies of original pieces of data

twitter_archived_enhanced_clean_df = twitter_archived_enhanced_df.copy()
image_predictions_clean_df = image_predictions_df.copy()
tweet_json_txt_clean_df = tweet_json_txt_df.copy()
```

As suggested during the cleaning data lessons, we'll tackle the tidyness issues first as this makes the rest of the tasks simpler.

Issue #1: Multiple columns to represent the breed prediction and confidence

Define:

- Turn `p1` , `p2` and `p3` into a single `prediction` column which shows the first prediction of a dog breed or `NaN` if no dog breed prediction was made.
- Turn `p1_conf` , `p2_conf` and `p3_conf` into a single `prediction_confidence` column which shows the confidence of the first prediction of a dog breed or `NaN` if no dog breed prediction was made.

Code

In [78]:
```
image_predictions_clean_df.sample(5)
```

Out[78]:

	tweet_id	jpg_url	img_num	p1	p1_conf
2008	878057613040115712	https://pbs.twimg.com/media/DC98vABUIAA97pz.jpg	1	French_bulldog	0.839097
666	682788441537560576	https://pbs.twimg.com/media/CXnAdosWAAEMGCM.jpg	1	toyshop	0.375610
1695	816336735214911488	https://pbs.twimg.com/media/C1Q17WdWEAAjKFO.jpg	1	Labrador_retriever	0.919330
713	685325112850124800	https://pbs.twimg.com/media/CYLDikFWEAAly1y.jpg	1	golden_retriever	0.586937
1972	869596645499047938	https://pbs.twimg.com/media/DBFtiYqWAAAsjj1.jpg	1	Chihuahua	0.955156

In [79]:
```
(image_predictions_clean_df.p1_dog | image_predictions_clean_df.p2_dog | ima
```

Out[79]:
```
1751
```

In [80]:
```
image_predictions_clean_df = pd.concat([
    image_predictions_clean_df[image_predictions_clean_df.p1_dog][["tweet_id
        "p1": "prediction", "p1_conf": "prediction_confidence"
    }, axis=1),
    image_predictions_clean_df[(~image_predictions_clean_df.p1_dog) & image_
        "p2": "prediction", "p2_conf": "prediction_confidence"
    }, axis=1),
    image_predictions_clean_df[(~image_predictions_clean_df.p1_dog) & (~imag
        "p3": "prediction", "p3_conf": "prediction_confidence"
    }, axis=1),
    image_predictions_clean_df[~(image_predictions_clean_df.p1_dog | image_p
])
```

In [81]:
```
image_predictions_clean_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2075 entries, 0 to 2074
Data columns (total 4 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   tweet_id               2075 non-null   int64  
 1   jpg_url                2075 non-null   object 
 2   prediction             1751 non-null   object 
 3   prediction_confidence  1751 non-null   float64
dtypes: float64(1), int64(1), object(2)
memory usage: 81.1+ KB
```

In [82]:
```
image_predictions_clean_df.head()
```

Out[82]:

	tweet_id	jpg_url	prediction	prediction_confiden
0	666020888022790149	https://pbs.twimg.com/media/CT4udn0WwAA0aMy.jpg	Welsh_springer_spaniel	0.46507
1	666029285002620928	https://pbs.twimg.com/media/CT42GRgUYAA5iDo.jpg	redbone	0.50682
2	666033412701032449	https://pbs.twimg.com/media/CT4521TWwAEvMyu.jpg	German_shepherd	0.5964
3	666044226329800704	https://pbs.twimg.com/media/CT5Dr8HUEAA-lEu.jpg	Rhodesian_ridgeback	0.40814
4	666049248165822465	https://pbs.twimg.com/media/CT5IQmsXIAAKY4A.jpg	miniature_pinscher	0.5603

Test

In [83]:
```
for _, original_row in image_predictions_df.iterrows():
    row = image_predictions_clean_df[image_predictions_clean_df.tweet_id ==

    if original_row.p1_dog:
        assert row.prediction == original_row.p1
        assert row.prediction_confidence == original_row.p1_conf
    elif original_row.p2_dog:
        assert row.prediction == original_row.p2
        assert row.prediction_confidence == original_row.p2_conf
    elif original_row.p3_dog:
        assert row.prediction == original_row.p3
        assert row.prediction_confidence == original_row.p3_conf
    else:
        assert np.isnan(row.prediction)
        assert np.isnan(row.prediction_confidence)
```

Issue #2: Dog breed names could be made consitent and readable

Define

Replace the underscore (_) character on the `prediction` column and capitalize each word.

Code

In [84]:
```
image_predictions_clean_df["prediction"] = image_predictions_clean_df.predic
```

Test

```
In [85]: image_predictions_clean_df.head()
```

Out[85]:

	tweet_id	jpg_url	prediction	prediction_confidence
0	666020888022790149	https://pbs.twimg.com/media/CT4udn0WwAA0aMy.jpg	Welsh Springer Spaniel	0.465074
1	666029285002620928	https://pbs.twimg.com/media/CT42GRgUYAA5iDo.jpg	Redbone	0.506826
2	666033412701032449	https://pbs.twimg.com/media/CT4521TWwAEvMyu.jpg	German Shepherd	0.596461
3	666044226329800704	https://pbs.twimg.com/media/CT5Dr8HUEAA-lEu.jpg	Rhodesian Ridgeback	0.408143
4	666049248165822465	https://pbs.twimg.com/media/CT5IQmsXIAAKY4A.jpg	Miniature Pinscher	0.560311

```
In [86]: image_predictions_clean_df.prediction.str.contains("_").sum()
```

```
Out[86]: 0
```

```
In [87]: image_predictions_clean_df.prediction.value_counts()
```

```
Out[87]: Golden Retriever        173
         Labrador Retriever      113
         Pembroke                 96
         Chihuahua                95
         Pug                      65
                                ... 
         Entlebucher               1
         Japanese Spaniel          1
         Scotch Terrier            1
         Standard Schnauzer        1
         Bouvier Des Flandres      1
         Name: prediction, Length: 113, dtype: int64
```

Issue #3: The predictions are a string but should be a category

Define

`Cast prediction as category.`

Code

```
In [88]: image_predictions_clean_df["prediction"] = image_predictions_clean_df.predic
```

Test

```
In [89]: image_predictions_clean_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2075 entries, 0 to 2074
Data columns (total 4 columns):
 #   Column                 Non-Null Count  Dtype   
---  ------                 --------------  -----   
 0   tweet_id               2075 non-null   int64   
 1   jpg_url                2075 non-null   object  
 2   prediction             1751 non-null   category
 3   prediction_confidence  1751 non-null   float64 
dtypes: category(1), float64(1), int64(1), object(1)
memory usage: 71.8+ KB
```

Issue #4: Multiple columns for the doggo stage variable

Define

Convert the `doggo`, `floofer`, `pupper`, `puppo` columns onto a `stage` column.

Code

```
In [90]: stages = ["doggo", "floofer", "pupper", "puppo"]
```

We use `np.select` to assign a `stage` value depending on each condition.

```
In [91]: twitter_archived_enhanced_clean_df["stage"] = np.select(
             [
                 # A stage is defined (one condition per stage)
                 twitter_archived_enhanced_clean_df[stage] == stage
                 for stage in stages
             ], stages, default=None)
```

```
In [92]: twitter_archived_enhanced_clean_df.stage.value_counts()
```

```
Out[92]: pupper     245
         doggo       97
         puppo       29
         floofer      9
         Name: stage, dtype: int64
```

Test

In [93]:
```
for stage in stages:
    assert twitter_archived_enhanced_clean_df[
        (twitter_archived_enhanced_clean_df.stage == stage) &
        (twitter_archived_enhanced_clean_df["stage"] != stage)
    ].empty

assert twitter_archived_enhanced_clean_df[
    twitter_archived_enhanced_clean_df["doggo"].isna() &
    twitter_archived_enhanced_clean_df["floofer"].isna() &
    twitter_archived_enhanced_clean_df["pupper"].isna() &
    twitter_archived_enhanced_clean_df["puppo"].isna()
].stage.isna().all()
```

We drop the old columns stage columns

In [94]:
```
twitter_archived_enhanced_clean_df = twitter_archived_enhanced_clean_df.drop
```

Issue #5: `timestamp` is a string, could be a datetime

Define

Convert the `timestamp` column to `datetime` .

Code

In [95]:
```
twitter_archived_enhanced_clean_df["timestamp"] = pd.to_datetime(twitter_arc
```

Test

In [96]:
```
twitter_archived_enhanced_clean_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2356 entries, 0 to 2355
Data columns (total 14 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   datetime64[ns, UTC]
 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  stage                       380 non-null    object
dtypes: datetime64[ns, UTC](1), float64(4), int64(3), object(6)
memory usage: 257.8+ KB
```

Issue #6: Multiple doggo ratings on a single tweet

Define

Drop the offending tweets.

Code

In [97]:
```
twitter_archived_enhanced_clean_df[twitter_archived_enhanced_clean_df.tweet_
    820690176645140481, 675853064436391936, 677716515794329600, 684222868335
    704054845121142784, 709198395643068416, 710658690886586372, 713900603437
    758467244762497024
])][["tweet_id", "text", "rating_numerator", "rating_denominator"]]
```

Out[97]:

	tweet_id	text	rating_numerator	rating_denominator
433	820690176645140481	The floofs have been released I repeat the flo...	84	70
902	758467244762497024	Why does this never happen at my front door......	165	150
1120	731156023742988288	Say hello to this unbelievably well behaved sq...	204	170
1228	713900603437621249	Happy Saturday here's 9 puppers on a bench. 99...	99	90
1254	710658690886586372	Here's a brigade of puppers. All look very pre...	80	80
1274	709198395643068416	From left to right:\nCletus, Jerome, Alejandro...	45	50
1351	704054845121142784	Here is a whole flock of puppers. 60/50 I'll ...	60	50
1433	697463031882764288	Happy Wednesday here's a bucket of pups. 44/40...	44	40
1635	684222868335505415	Someone help the girl is being mugged. Several...	121	110
1779	677716515794329600	IT'S PUPPERGEDDON. Total of 144/120 ...I think...	144	120
1843	675853064436391936	Here we have an entire platoon of puppers. Tot...	88	80

In [98]:
```
twitter_archived_enhanced_clean_df = twitter_archived_enhanced_clean_df[~twi
    820690176645140481, 675853064436391936, 677716515794329600, 684222868335
    704054845121142784, 709198395643068416, 710658690886586372, 713900603437
    758467244762497024
])]
```

Test

In [99]:
```
assert twitter_archived_enhanced_clean_df[twitter_archived_enhanced_clean_df
    820690176645140481, 675853064436391936, 677716515794329600, 684222868335
    704054845121142784, 709198395643068416, 710658690886586372, 713900603437
    758467244762497024
])].empty
```

Issue #7: multiple expressions confused for ratings

Define

When there are multiple matches on a tweet for segments that look like a rating, pick the one with a "10" as denominator.

Code

In [100…
```
twitter_archived_enhanced_clean_df[twitter_archived_enhanced_clean_df.tweet_
    810984652412424192, 716439118184652801, 716439118184652801, 740373189193
    722974582966214656, 666287406224695296
])][["tweet_id", "text", "rating_numerator", "rating_denominator"]]
```

Out[100]:

	tweet_id	text	rating_numerator	rating_denominator
516	810984652412424192	Meet Sam. She smiles 24/7 &amp; secretly aspir...	24	7
1068	740373189193256964	After so many requests, this is Bretagne. She ...	9	11
1165	722974582966214656	Happy 4/20 from the squad! 13/10 for all https...	4	20
1202	716439118184652801	This is Bluebert. He just saw that both #Final...	50	50
1662	682962037429899265	This is Darrel. He just robbed a 7/11 and is i...	7	11
2335	666287406224695296	This is an Albanian 3 1/2 legged Episcopalian...	1	2

In [101…
```
new_ratings_df = twitter_archived_enhanced_clean_df.text.str.extract(
    r"(?P<rating_numerator>\d+)/(?P<rating_denominator>10)"
)
new_ratings_df
```

Out[101]:

	rating_numerator	rating_denominator
0	13	10
1	13	10
2	12	10
3	13	10
4	12	10
...	...	...
2351	5	10
2352	6	10
2353	9	10
2354	7	10
2355	8	10

2345 rows × 2 columns

In [102…
```
new_ratings_df.loc[
    ~new_ratings_df.isnull().any(axis=1),
    ["rating_numerator", "rating_denominator"]
] = new_ratings_df[~new_ratings_df.isnull().any(axis=1)][["rating_numerator"
```

In [103…
```
twitter_archived_enhanced_clean_df.loc[
    new_ratings_df.index,
    ["rating_numerator", "rating_denominator"]
] = new_ratings_df[["rating_numerator", "rating_denominator"]]
```

In [104…
```
twitter_archived_enhanced_clean_df = twitter_archived_enhanced_clean_df[~(
    twitter_archived_enhanced_clean_df.rating_numerator.isna() |
    twitter_archived_enhanced_clean_df.rating_denominator.isna()
)]
```

Test

In [105…
```
twitter_archived_enhanced_clean_df[twitter_archived_enhanced_clean_df.tweet_
    810984652412424192, 716439118184652801, 716439118184652801, 740373189193
    722974582966214656, 666287406224695296
])][["tweet_id", "text", "rating_numerator", "rating_denominator"]]
```

Out[105]:

	tweet_id	text	rating_numerator	rating_denominator
1068	740373189193256964	After so many requests, this is Bretagne. She ...	14	10
1165	722974582966214656	Happy 4/20 from the squad! 13/10 for all https...	13	10
1202	716439118184652801	This is Bluebert. He just saw that both #Final...	11	10
1662	682962037429899265	This is Darrel. He just robbed a 7/11 and is i...	10	10
2335	666287406224695296	This is an Albanian 3 1/2 legged Episcopalian...	9	10

Issue #8: There tweets with fractional ratings

Define

Convert the rating numerator and denominator to float. Parse the fractional ratings properly.

Code

In [106…
```
twitter_archived_enhanced_clean_df[["rating_numerator", "rating_denominator"
```

In [107…
```
new_ratings_df = twitter_archived_enhanced_clean_df.text.str.extract(
    r"(?P<rating_numerator>\d+\.\d+)/(?P<rating_denominator>10)"
).dropna()
new_ratings_df
```

Out[107]:

	rating_numerator	rating_denominator
45	13.5	10
340	9.75	10
695	9.75	10
763	11.27	10
1689	9.5	10
1712	11.26	10

In [108…
```
twitter_archived_enhanced_clean_df.loc[
    new_ratings_df.index,
    ["rating_numerator", "rating_denominator"]
] = new_ratings_df[["rating_numerator", "rating_denominator"]].astype(float)
```

Test

In [109…
```
twitter_archived_enhanced_clean_df[twitter_archived_enhanced_clean_df.tweet_
    680494726643068929, 778027034220126208, 786709082849828864
])][["tweet_id", "text", "rating_numerator", "rating_denominator"]]
```

Out[109]:

	tweet_id	text	rating_numerator	rating_denominator
695	786709082849828864	This is Logan, the Chow who lived. He solemnly...	9.75	10.0
763	778027034220126208	This is Sophie. She's a Jubilant Bush Pupper. ...	11.27	10.0
1712	680494726643068929	Here we have uncovered an entire battalion of ...	11.26	10.0

Issue #9: The rating is a single variable represented in two columns

Define

Create a new column named `rating` which is `rating_numerator` divided by `rating_denominator` .

Code

In [110…
```
twitter_archived_enhanced_clean_df["rating"] = twitter_archived_enhanced_cle
```

In [111…
```
twitter_archived_enhanced_clean_df.rating.sample(5)
```

Out[111]:
```
860     0.8
115     1.3
620     1.3
1368    1.2
1409    1.2
Name: rating, dtype: float64
```

Test

In [112…
```
for index, row in twitter_archived_enhanced_clean_df[
    ~(twitter_archived_enhanced_clean_df.rating_numerator.isna() | twitter_a
].iterrows():
    assert row.rating == row.rating_numerator / row.rating_denominator
```

Issue #10: Multiple tables to represent the same observational unit: the tweet

Define

Merge all dataframes on the `tweet_id` column to a dataframe calld `twitter_archive_master_df`.

Code

In [113…

```
twitter_archive_master_df = pd.merge(
    twitter_archived_enhanced_clean_df,
    image_predictions_clean_df,
    on=["tweet_id"],
    how="left"
)
twitter_archive_master_df = pd.merge(
    twitter_archive_master_df,
    tweet_json_txt_clean_df,
    on=["tweet_id"],
    how="left"
)
```

Test

In [114…

```
twitter_archive_master_df.head()
```

Out[114]:

	tweet_id	in_reply_to_status_id	in_reply_to_user_id	timestamp	
0	892420643555336193	NaN	NaN	2017-08-01 16:23:56+00:00	href="h /dowr
1	892177421306343426	NaN	NaN	2017-08-01 00:17:27+00:00	href="h /dowr
2	891815181378084864	NaN	NaN	2017-07-31 00:18:03+00:00	href="h /dowr
3	891689557279858688	NaN	NaN	2017-07-30 15:58:51+00:00	href="h /dowr
4	891327558926688256	NaN	NaN	2017-07-29 16:00:24+00:00	href="h /dowr

```
In [115… twitter_archive_master_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2340 entries, 0 to 2339
Data columns (total 20 columns):
 #   Column                      Non-Null Count  Dtype
---  ------                      --------------  -----
 0   tweet_id                    2340 non-null   int64
 1   in_reply_to_status_id       74 non-null     float64
 2   in_reply_to_user_id         74 non-null     float64
 3   timestamp                   2340 non-null   datetime64[ns, UTC]
 4   source                      2340 non-null   object
 5   text                        2340 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               2284 non-null   object
 10  rating_numerator            2340 non-null   float64
 11  rating_denominator          2340 non-null   float64
 12  name                        2340 non-null   object
 13  stage                       380 non-null    object
 14  rating                      2340 non-null   float64
 15  jpg_url                     2062 non-null   object
 16  prediction                  1739 non-null   category
 17  prediction_confidence       1739 non-null   float64
 18  retweet_count               2311 non-null   float64
 19  favorite_count              2311 non-null   float64
dtypes: category(1), datetime64[ns, UTC](1), float64(10), int64(1), object
(7)
memory usage: 372.9+ KB
```

Issue #11: There are 78 replies and 181 retweets on `twitter_archived_enhanced_df`

Define

Drop rows where `in_reply_to_status_id` or `retweeted_status_id` are not `NaN`. Drop the unnecessary columns.

Code

```
In [116… twitter_archive_master_df[~(twitter_archive_master_df.in_reply_to_status_id.
```

```
Out[116]: 255
```

```
In [117… twitter_archive_master_df = twitter_archive_master_df[twitter_archive_master
```

Test

We drop the unnecessary columns AFTER the test.

In [118…
```
twitter_archive_master_df[~(twitter_archive_master_df.in_reply_to_status_id.
```
Out[118]:
```
0
```

In [119…
```
twitter_archive_master_df = twitter_archive_master_df.drop(
    [
        "in_reply_to_status_id", "in_reply_to_user_id", "retweeted_status_id
        "retweeted_status_timestamp"
    ],
    axis=1
)
```

In [120…
```
twitter_archive_master_df.info()
```
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2085 entries, 0 to 2339
Data columns (total 15 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   tweet_id               2085 non-null   int64
 1   timestamp              2085 non-null   datetime64[ns, UTC]
 2   source                 2085 non-null   object
 3   text                   2085 non-null   object
 4   expanded_urls          2082 non-null   object
 5   rating_numerator       2085 non-null   float64
 6   rating_denominator     2085 non-null   float64
 7   name                   2085 non-null   object
 8   stage                  336 non-null    object
 9   rating                 2085 non-null   float64
 10  jpg_url                1959 non-null   object
 11  prediction             1655 non-null   category
 12  prediction_confidence  1655 non-null   float64
 13  retweet_count          2077 non-null   float64
 14  favorite_count         2077 non-null   float64
dtypes: category(1), datetime64[ns, UTC](1), float64(6), int64(1), object
(6)
memory usage: 251.3+ KB
```

Issue #12: There were missing tweets when fetching the retweet and favourite counts with Twitter's API

Define

Drop columns where `retweet_count` or `favorite_count` as `NaN` .

Code

In [121…
```
twitter_archive_master_df[twitter_archive_master_df.retweet_count.isna() | t
```
Out[121]:
```
8
```

In [122…
```
twitter_archive_master_df = twitter_archive_master_df[~(twitter_archive_mast
```

Test

```
In [123…  twitter_archive_master_df[twitter_archive_master_df.retweet_count.isna() | t
```

```
Out[123]: 0
```

Issue #13: There are 324 records without a dog prediction on image_predictions_df

Define

Drop rows where `prediction` is `NaN`.

Code

```
In [124…  twitter_archive_master_df.columns
```

```
Out[124]: Index(['tweet_id', 'timestamp', 'source', 'text', 'expanded_urls',
                 'rating_numerator', 'rating_denominator', 'name', 'stage', 'rating
          ',
                 'jpg_url', 'prediction', 'prediction_confidence', 'retweet_count',
                 'favorite_count'],
                dtype='object')
```

```
In [125…  twitter_archive_master_df.prediction.isna().sum()
```

```
Out[125]: 430
```

```
In [126…  twitter_archive_master_df = twitter_archive_master_df[~twitter_archive_maste
```

Test

```
In [127…  twitter_archive_master_df.prediction.isna().sum()
```

```
Out[127]: 0
```

Issue #14: On tweet `670842764863651840` the rating is invalid as the subject is not a doggo

Define

Drop the offending tweet.

Code

```
In [128…  twitter_archive_master_df[twitter_archive_master_df.tweet_id == 670842764863
```

```
Out[128]:    tweet_id   timestamp   source   text   expanded_urls   rating_numerator   rating_denominator
```

The tweet has already been taken care of by another fix.

Test

Issue #15: Remove outlier on tweet 749981277374128128

Define

Drop the offending tweet.

Code

```
In [129…  twitter_archive_master_df[twitter_archive_master_df.tweet_id == 749981277374
```

```
Out[129]:    tweet_id   timestamp   source   text   expanded_urls   rating_numerator   rating_denominator
```

Test

The tweet has already been taken care of by another fix.

Issue #16: Invalid name "a" on 55 tweets

Define

Replace `"a"` with `None` on column `name` .

Code

```
In [130…  twitter_archive_master_df.loc[twitter_archive_master_df.name == "a", "name"]
```

Test

```
In [131…  (twitter_archive_master_df.name == "a").sum()
```

```
Out[131]:  0
```

Storing Data

Save gathered, assessed, and cleaned master dataset to a CSV file named "twitter_archive_master.csv".

Saving onto a CSV file is actually quite trivial:

In [132…
```
twitter_archive_master_df.to_csv(data_dir / "twitter_archive_master.csv", in
```

However, if we load this CSV again, we loose some of the column type information:

In [133…
```
pd.read_csv(data_dir / "twitter_archive_master.csv").info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1647 entries, 0 to 1646
Data columns (total 15 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   tweet_id               1647 non-null   int64  
 1   timestamp              1647 non-null   object 
 2   source                 1647 non-null   object 
 3   text                   1647 non-null   object 
 4   expanded_urls          1647 non-null   object 
 5   rating_numerator       1647 non-null   float64
 6   rating_denominator     1647 non-null   float64
 7   name                   1602 non-null   object 
 8   stage                  256 non-null    object 
 9   rating                 1647 non-null   float64
 10  jpg_url                1647 non-null   object 
 11  prediction             1647 non-null   object 
 12  prediction_confidence  1647 non-null   float64
 13  retweet_count          1647 non-null   float64
 14  favorite_count         1647 non-null   float64
dtypes: float64(6), int64(1), object(8)
memory usage: 193.1+ KB
```

Due to this limitation, I think it's better to use a portable and type aware format like `feather`.

In [134…
```
twitter_archive_master_df.reset_index().to_feather(data_dir / "twitter_archi
```

In [135…
```
pd.read_feather(data_dir / "twitter_archive_master.feather").info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1647 entries, 0 to 1646
Data columns (total 16 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   index                  1647 non-null   int64
 1   tweet_id               1647 non-null   int64
 2   timestamp              1647 non-null   datetime64[ns, UTC]
 3   source                 1647 non-null   object
 4   text                   1647 non-null   object
 5   expanded_urls          1647 non-null   object
 6   rating_numerator       1647 non-null   float64
 7   rating_denominator     1647 non-null   float64
 8   name                   1602 non-null   object
 9   stage                  256 non-null    object
 10  rating                 1647 non-null   float64
 11  jpg_url                1647 non-null   object
 12  prediction             1647 non-null   category
 13  prediction_confidence  1647 non-null   float64
 14  retweet_count          1647 non-null   float64
 15  favorite_count         1647 non-null   float64
dtypes: category(1), datetime64[ns, UTC](1), float64(6), int64(2), object
(6)
memory usage: 199.7+ KB
```

We could have also save to a `sqlite` table as well.

```
In [136…
database = data_dir / "twitter_archive_master.sqlite"
database.unlink(missing_ok=True)
```

```
In [137…
with sqlite3.connect(database) as connection:
    twitter_archive_master_df.to_sql(name='twitter_archive_master', con=conn
```

```
In [138…
with sqlite3.connect(database) as connection:
    pd.read_sql(sql="SELECT * FROM twitter_archive_master", con=connection).
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1647 entries, 0 to 1646
Data columns (total 16 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   index                  1647 non-null   int64  
 1   tweet_id               1647 non-null   int64  
 2   timestamp              1647 non-null   object 
 3   source                 1647 non-null   object 
 4   text                   1647 non-null   object 
 5   expanded_urls          1647 non-null   object 
 6   rating_numerator       1647 non-null   float64
 7   rating_denominator     1647 non-null   float64
 8   name                   1602 non-null   object 
 9   stage                  256 non-null    object 
 10  rating                 1647 non-null   float64
 11  jpg_url                1647 non-null   object 
 12  prediction             1647 non-null   object 
 13  prediction_confidence  1647 non-null   float64
 14  retweet_count          1647 non-null   float64
 15  favorite_count         1647 non-null   float64
dtypes: float64(6), int64(2), object(8)
memory usage: 206.0+ KB
```

But once again we lose the type information.

Analyzing and Visualizing Data

In this section, analyze and visualize your wrangled data. You must produce at least **three (3) insights and one (1) visualization.**

The following cells contain the exploratory work that led to the insights.

In [139…
```
twitter_archive_master_df.name.value_counts(dropna=False)[:10]
```

Out[139]:
```
None       390
None        45
Cooper      10
Charlie      9
Lucy         9
Tucker       9
Oliver       9
Penny        8
Sadie        7
the          7
Name: name, dtype: int64
```

In [140…
```
twitter_archive_master_df.rating.mean()
```

Out[140]:
```
1.0820752884031573
```

In [141…
```
twitter_archive_master_df.rating.std()
```

```
Out[141]: 0.17777543390270223
```

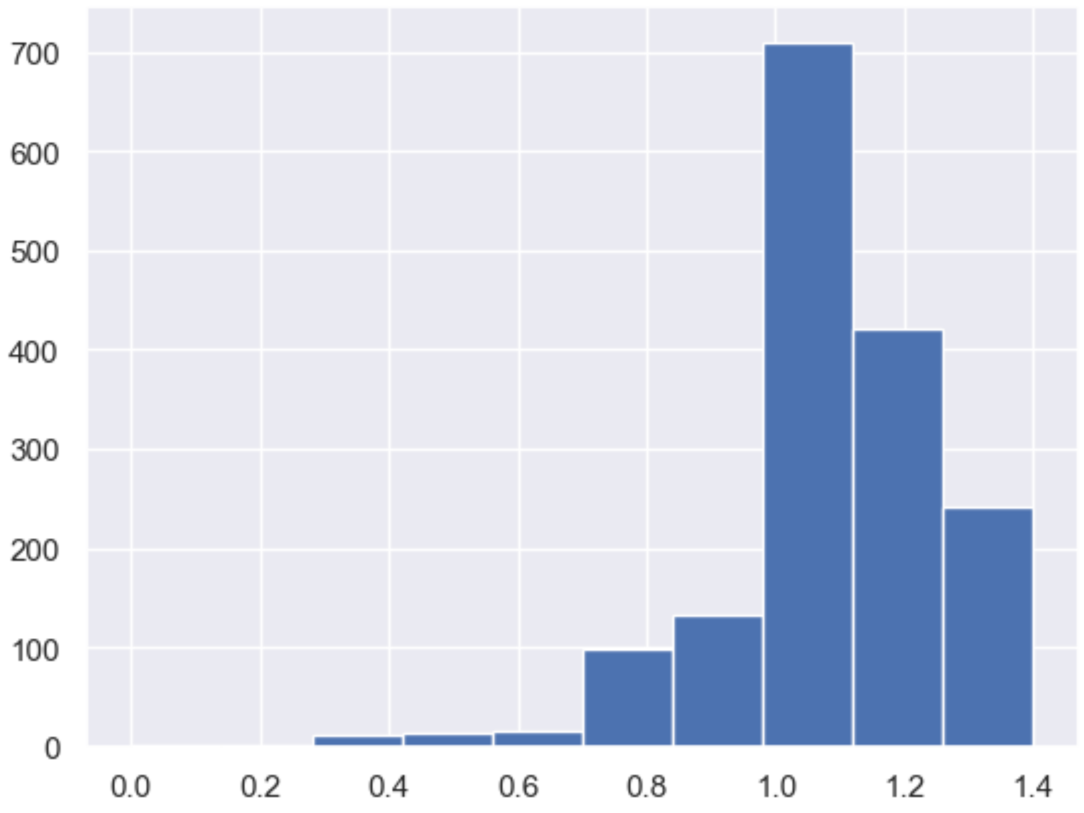
```
In [142…  np.percentile(twitter_archive_master_df.rating, [25, 50, 75])
```

```
Out[142]: array([1. , 1.1, 1.2])
```

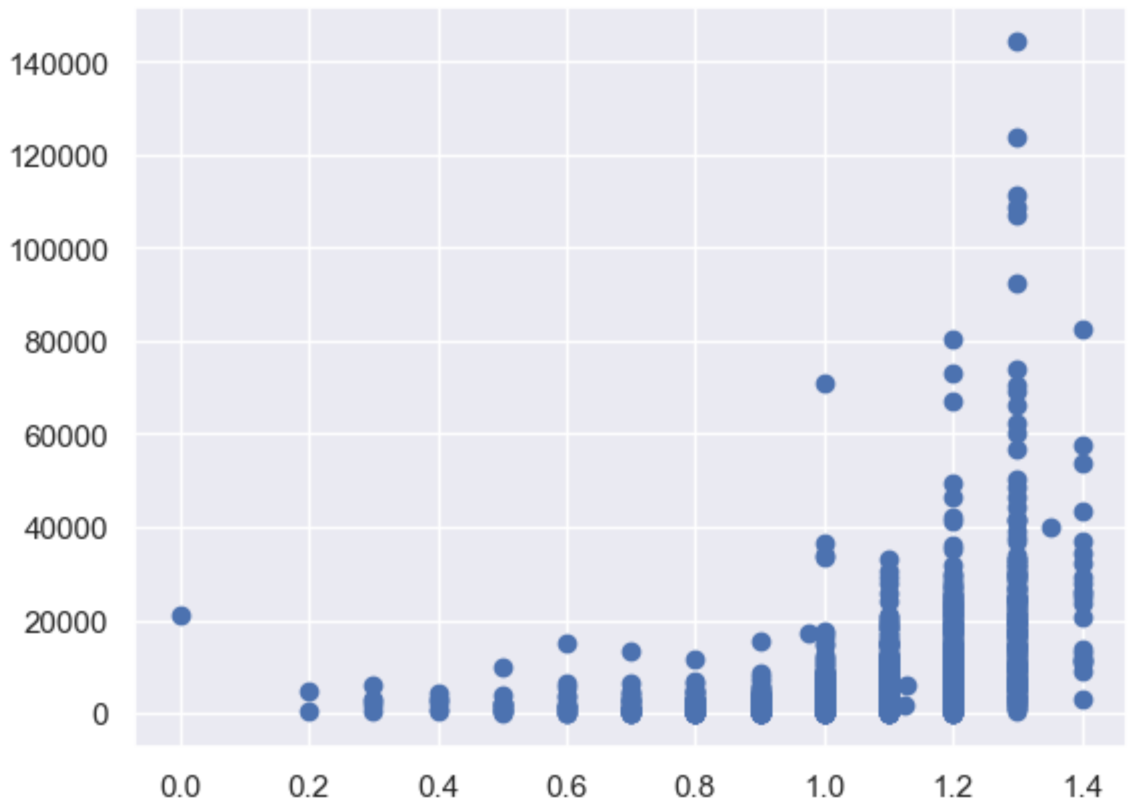
```
In [143…  twitter_archive_master_df.rating.min(), twitter_archive_master_df.rating.max
```

```
Out[143]: (0.0, 1.4)
```

```
In [144…  twitter_archive_master_df.rating.hist();
```



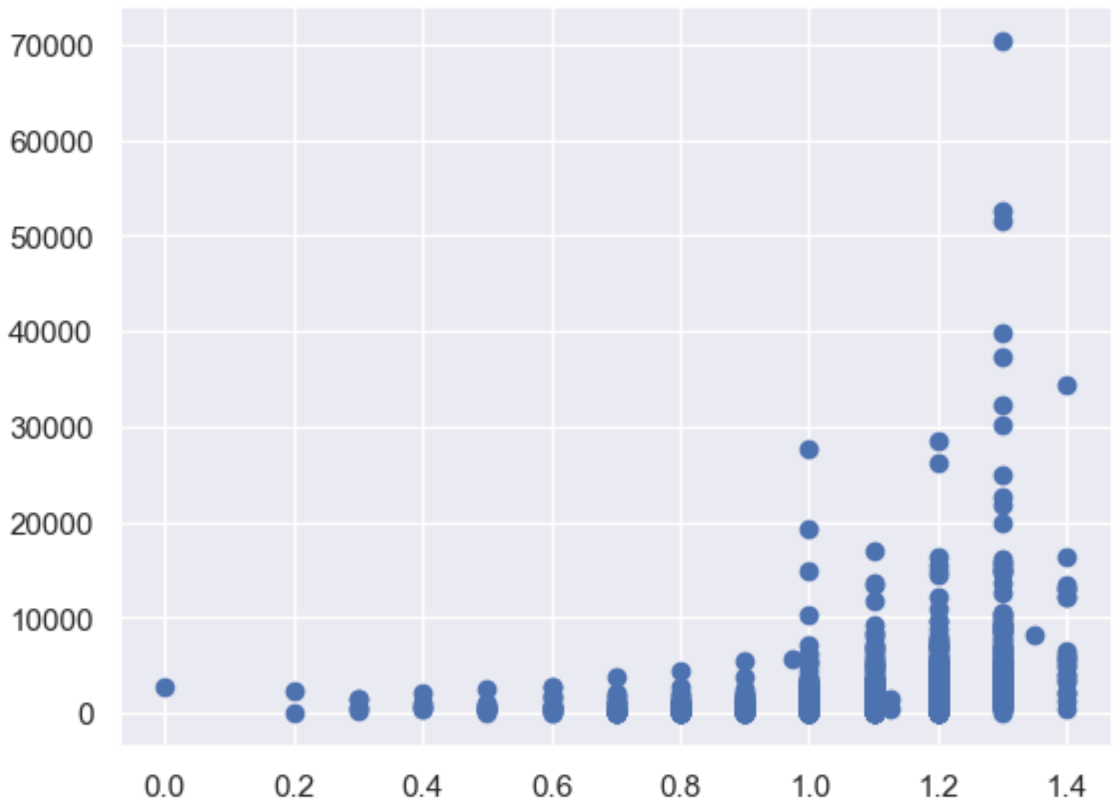
```
In [145…  plt.scatter(
              twitter_archive_master_df.rating,
              twitter_archive_master_df.favorite_count
          );
```



```
In [146…  twitter_archive_master_df.rating.corr(twitter_archive_master_df.favorite_cou
```

```
Out[146]:  0.4112524328126853
```

```
In [147…  plt.scatter(
              twitter_archive_master_df.rating,
              twitter_archive_master_df.retweet_count
          );
```



```
In [148… twitter_archive_master_df.rating.corr(twitter_archive_master_df.favorite_cou
```

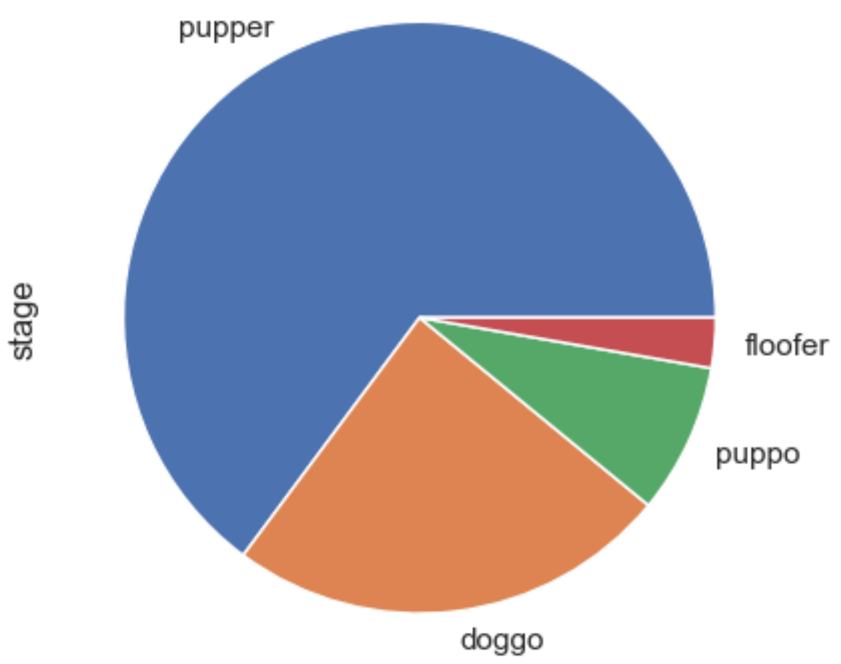
```
Out[148]: 0.4112524328126853
```

```
In [149… twitter_archive_master_df.prediction.value_counts()[:10]
```

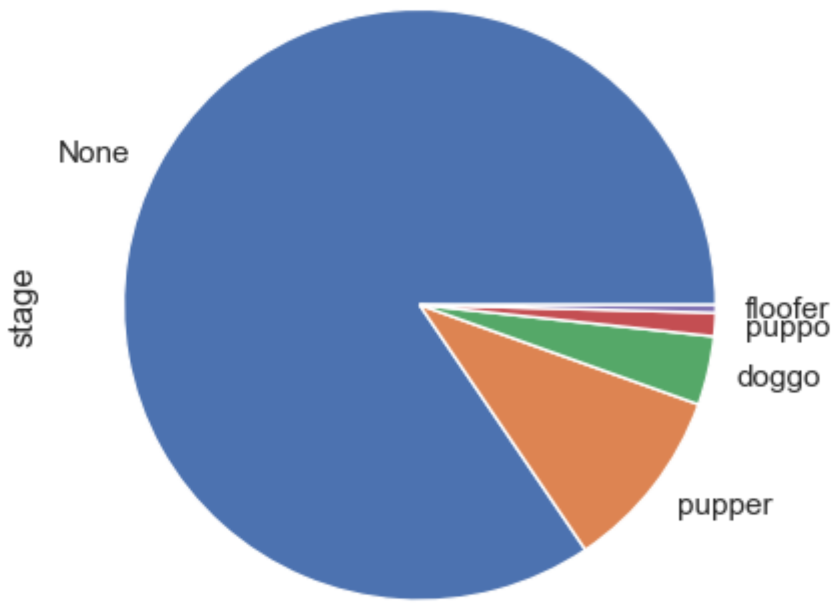
```
Out[149]: Golden Retriever      154
          Labrador Retriever    100
          Pembroke               94
          Chihuahua              90
          Pug                    62
          Toy Poodle             49
          Chow                   47
          Pomeranian             41
          Samoyed                41
          Malamute               33
          Name: prediction, dtype: int64
```

```
In [150… twitter_archive_master_df.groupby("prediction").rating.mean().sort_values(as
Out[150]: prediction
          Bouvier Des Flandres    1.300000
          Saluki                  1.250000
          Briard                  1.233333
          Tibetan Mastiff         1.225000
          Border Terrier          1.214286
          Silky Terrier           1.200000
          Standard Schnauzer      1.200000
          Irish Setter            1.175000
          Gordon Setter           1.175000
          Samoyed                 1.173171
          Name: rating, dtype: float64
```

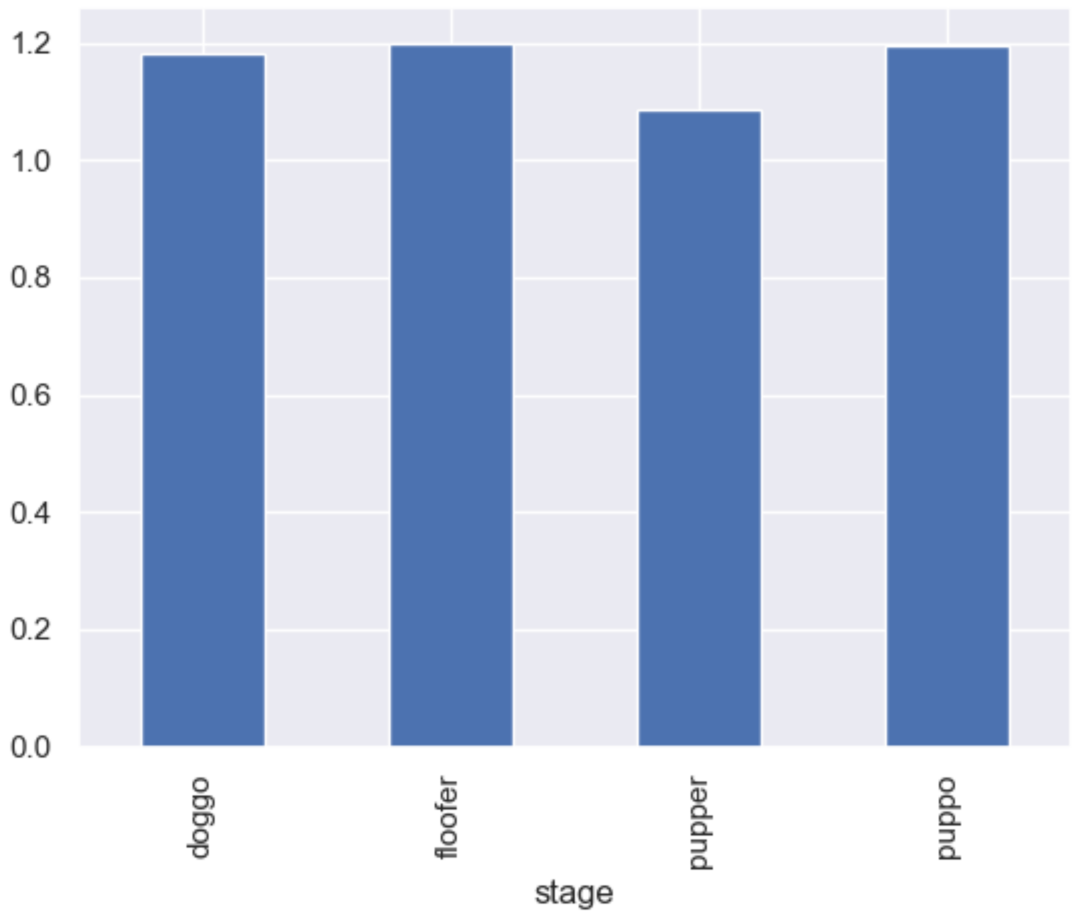
```
In [151… twitter_archive_master_df.stage.value_counts().plot(kind="pie");
```



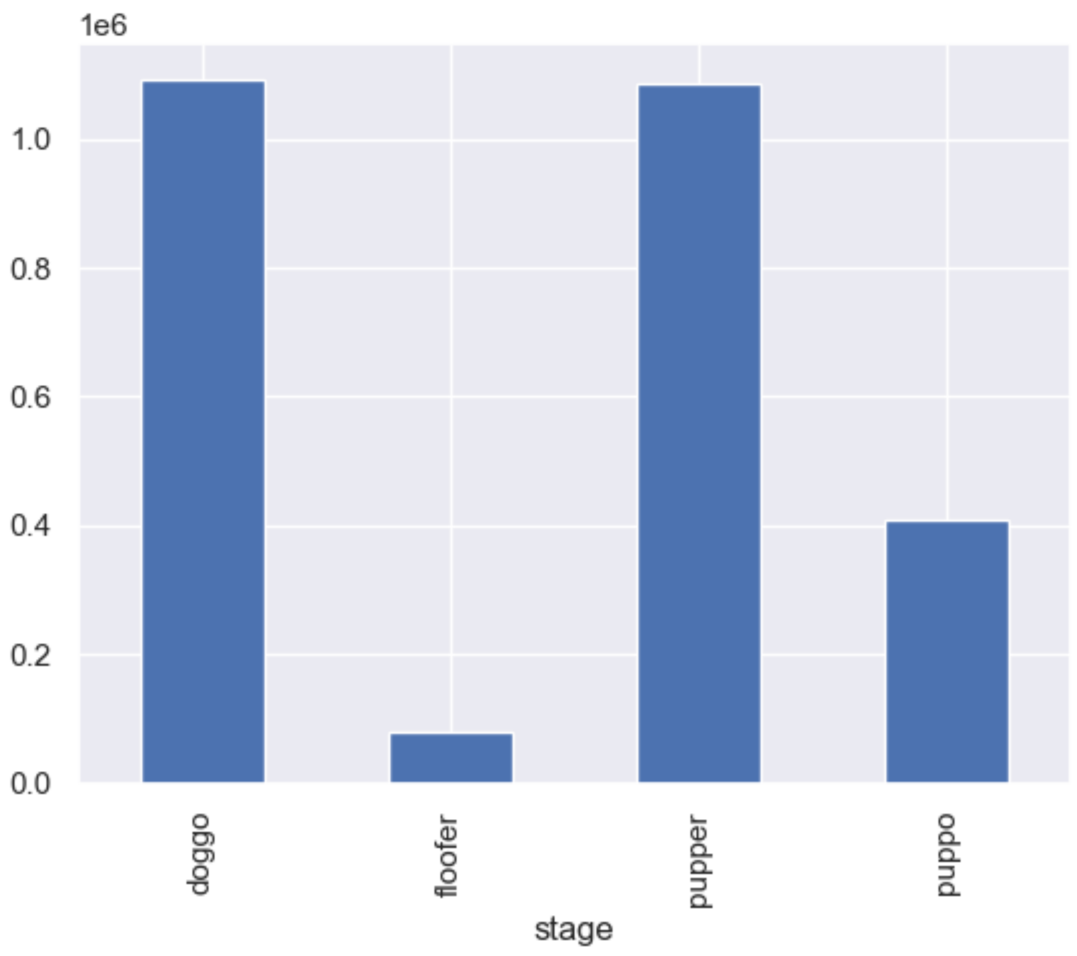
```
In [152… twitter_archive_master_df.stage.value_counts(dropna=False).plot(kind="pie");
```



In [153…
```
twitter_archive_master_df.groupby("stage").rating.mean().plot(kind="bar");
```



In [154…
```
twitter_archive_master_df.groupby("stage").favorite_count.sum().plot(kind="b
```



Insights:

1. Most ratings are over 10/10 (1.0)
2. Golden retrievers are the most popular breed
3. There's a slight correlation between rating and favorite and retweet counts
4. All stages are evenly rated.
5. All doggos are good doggos.

Insight: Most ratings are over 10/10 (1.0)

The "Average Rating" histogram, as well as the 5 number summary clearly shows that most ratings are over 1.0, which means (assuming that all valid ratings have a 10 as denominator) that most ratings are over 10/10. We used `twitter_archive_master_df.rating` for this insight, which was computed dividing the `rating_numerator` column over the `rating_denominator` column. In turn, this columns, which were originally provided, required some cleaning as they were invalid ratings (due to pattern matching) as well as some outliers.

```
In [155…  twitter_archive_master_df.rating.mean()  # mean

Out[155]: 1.0820752884031573
```

```
In [156…  twitter_archive_master_df.rating.std()  # standard deviation

Out[156]: 0.17777543390270223
```

```
In [157…  np.percentile(twitter_archive_master_df.rating, [25, 50, 75])  # quartiles

Out[157]: array([1. , 1.1, 1.2])
```

```
In [158…  twitter_archive_master_df.rating.min(), twitter_archive_master_df.rating.max

Out[158]: (0.0, 1.4)
```

Insight: Golden retrievers are the most popular breed

The following ranking (as well as the chart "Popular Breed Predition" included in the visualizations section) shows the 10 most propular (predicted) breeds amongst the rated tweets. The chart ""

```
In [159…  twitter_archive_master_df.prediction.value_counts()[:10]

Out[159]: Golden Retriever      154
          Labrador Retriever    100
          Pembroke               94
          Chihuahua              90
          Pug                    62
          Toy Poodle             49
          Chow                   47
          Pomeranian             41
          Samoyed                41
          Malamute               33
          Name: prediction, dtype: int64
```

The `prediction` column came from a consolidation of the `p1`, `p2`, and `p3` columns from the `image_predictions.tsv` file. I select the first column that predicted a dog breed for the `prediction` column. Afterwards we cleaned up the strings to make them readable, and turned them into a category. If you need a reason for why this breed is so popular, just check the visualization section.

Insight: There's a slight correlation between rating and favorite and retweet counts

The following correlation factors, shows there's a slight correlation between `rating` and `favorite_count` and `retweet_count` columns. These last two were missing from the original CSV file and had to be fetched from Twitter's API. Not much cleaning was needed, but there were a handful of deleted tweets for which we couldn't get these values and were dropped eventually.

In [160…
```
twitter_archive_master_df.rating.corr(twitter_archive_master_df.favorite_cou
```

Out[160]:
```
0.4112524328126853
```

In [161…
```
twitter_archive_master_df.rating.corr(twitter_archive_master_df.retweet_coun
```

Out[161]:
```
0.3117353235682869
```

The "Rating vs. Favorite Count" and "Rating vs. Retweet Count" scatter plots are consistent with these correlation factors.

Insight: All stages are evenly rated

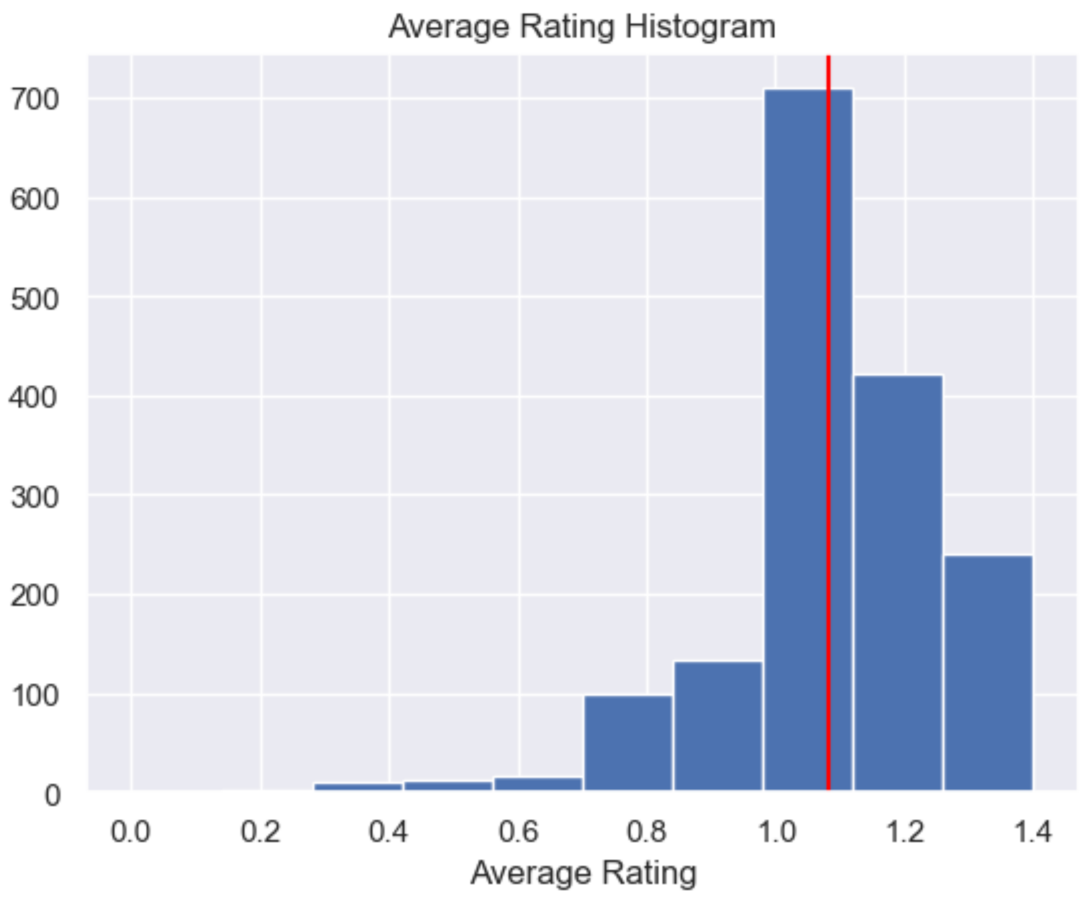
The "Stage Rating Avergage" clearly shows that all stages are similarily rated (on average). The `stage` column is a combination of the columns `doggo` , `pupper` , `puppo` and `fluffer` from `twitter-archive-enhanced.csv` . When each column had a value (with the same string as the name of the column) we took that as the `stage` of the individual.

Insight: All doggos are good doggos

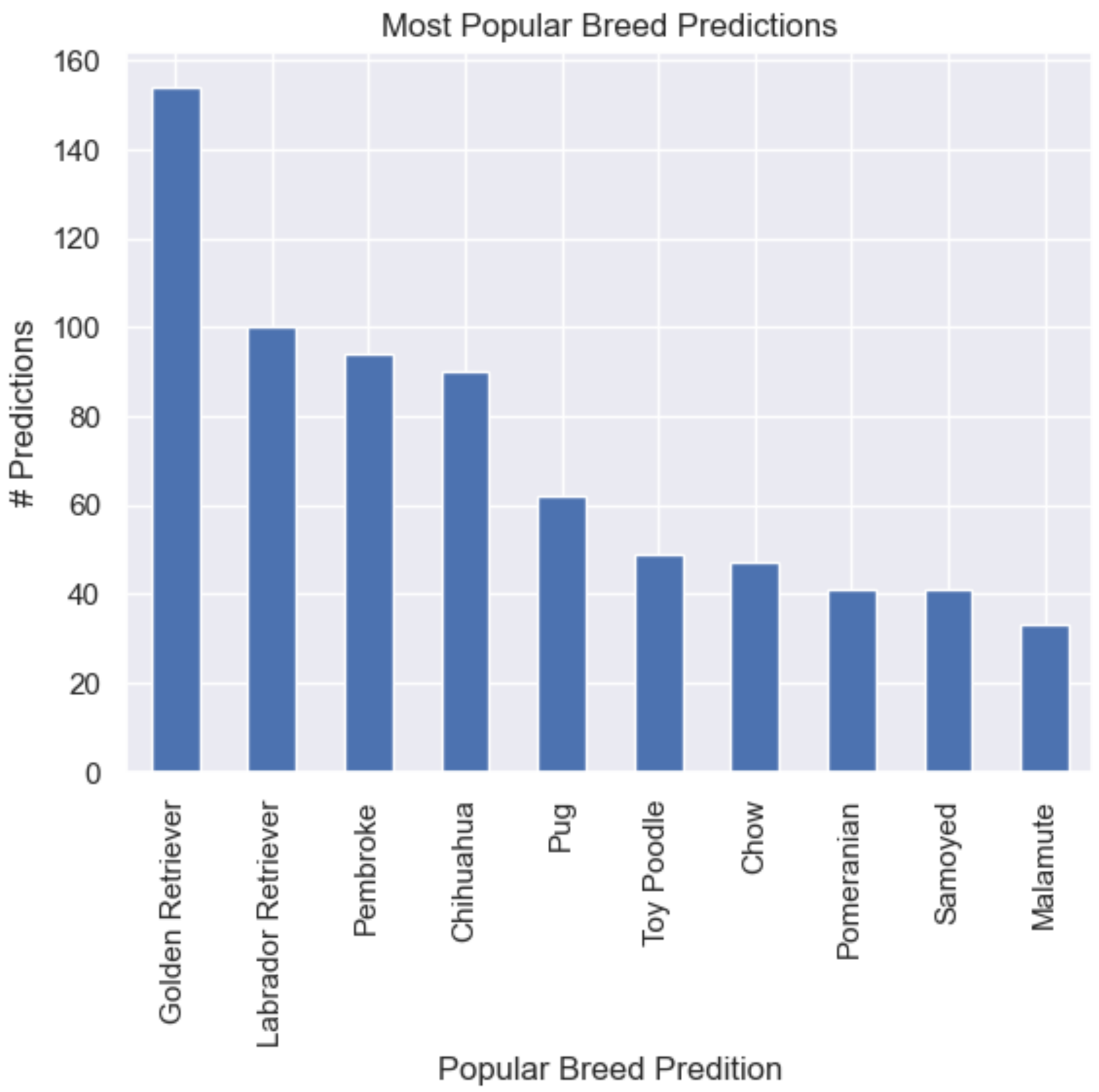
Juss a fact of life.

Visualization

In [162…
```
plt.hist(twitter_archive_master_df.rating);
plt.xlabel('Average Rating')
plt.title('Average Rating Histogram')
plt.axvline(twitter_archive_master_df.rating.mean(), color="red");
```



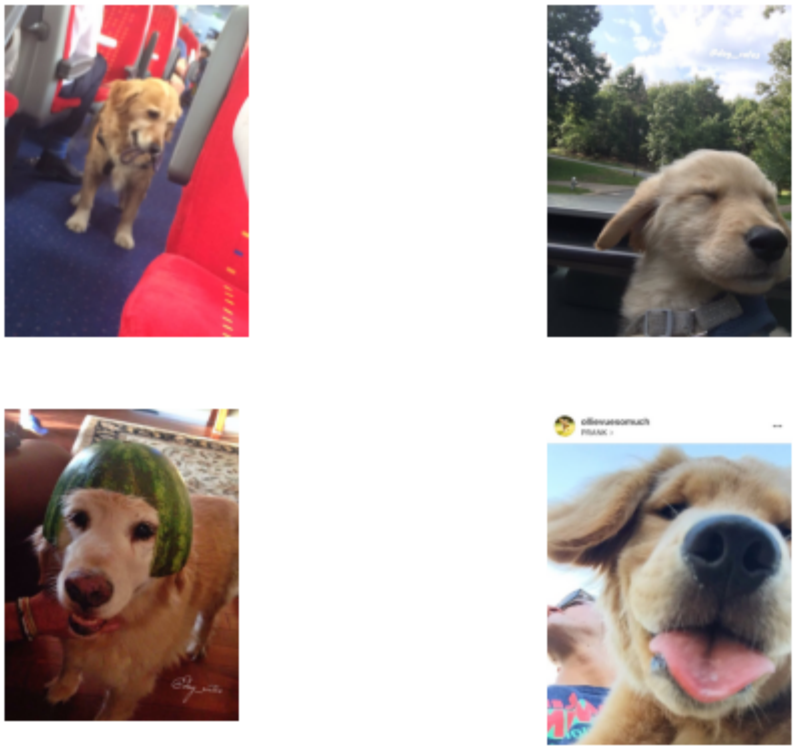
```
In [163…  twitter_archive_master_df.prediction.value_counts()[:10].plot(kind="bar");
          plt.xlabel('Popular Breed Predition');
          plt.ylabel('# Predictions');
          plt.title('Most Popular Breed Predictions');
```



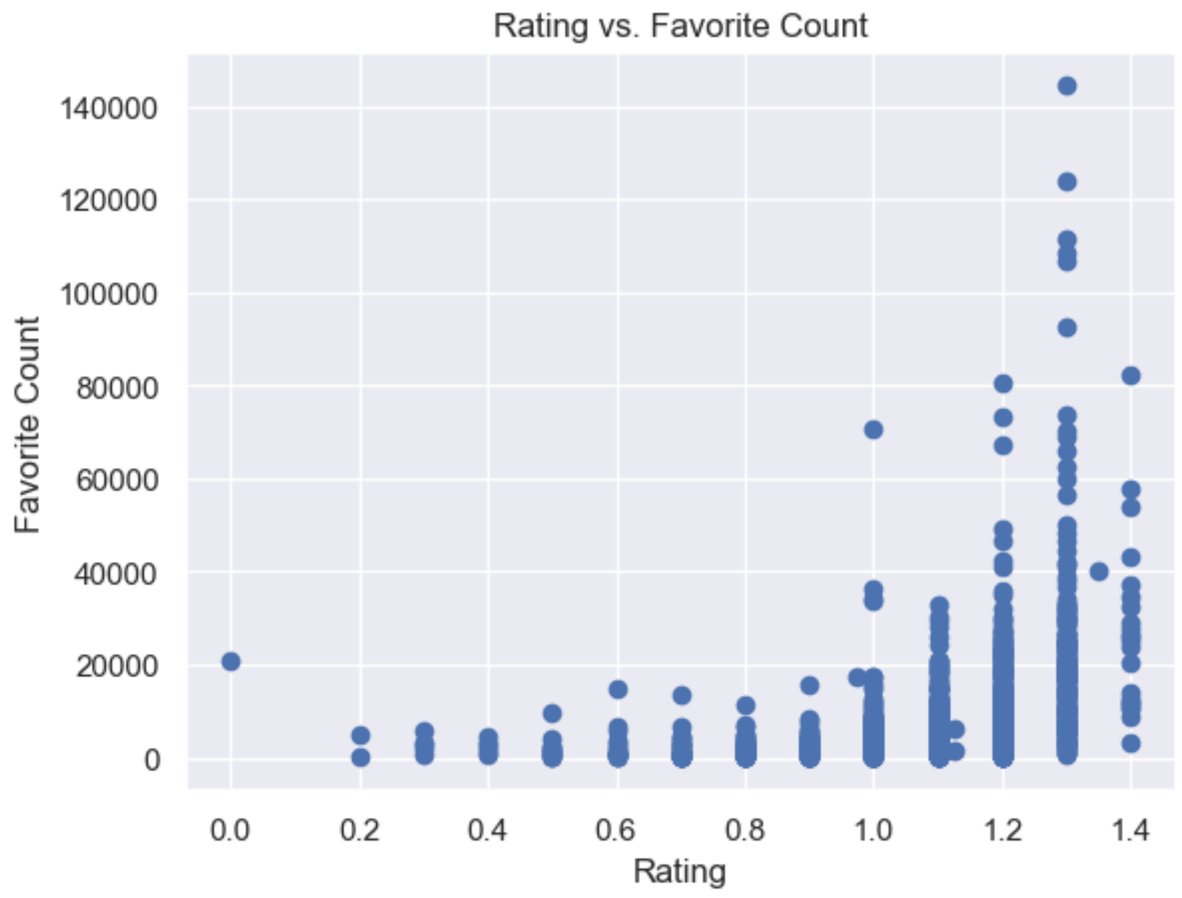
```
In [164… twitter_archive_master_df[twitter_archive_master_df.prediction == "Golden Re
```

```
Out[164]: 824     https://pbs.twimg.com/media/CqzKfQgXEAAWIY-.jpg
          276     https://pbs.twimg.com/media/C6qGphPV4AEKrdc.jpg
          1177    https://pbs.twimg.com/media/CfpNGTHUIAAA8XC.jpg
          1392    https://pbs.twimg.com/media/CbTj--1XEAIZjc_.jpg
          Name: jpg_url, dtype: object
```

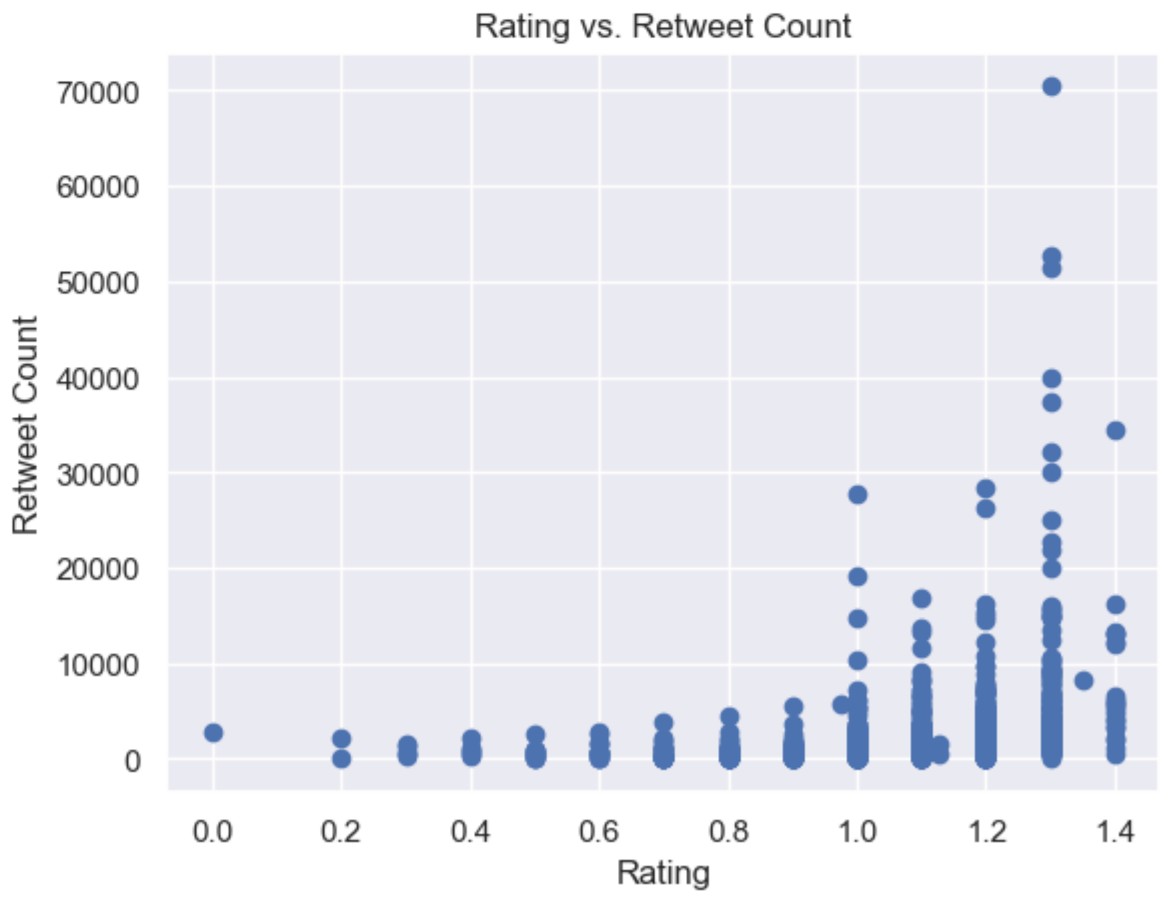
```
In [165… urls = twitter_archive_master_df[twitter_archive_master_df.prediction == "Go
         images = [
             plt.imread(urllib.request.urlopen(url), format="jpg")
             for url in urls
         ]
         fig, ((ax1, ax2), (ax3, ax4)) = plt.subplots(2, 2, sharex=True, sharey=True)
         ax1.imshow(images[0]);
         ax1.axis('off');
         ax2.imshow(images[1]);
         ax2.axis('off');
         ax3.imshow(images[2]);
         ax3.axis('off');
         ax4.imshow(images[3]);
         ax4.axis('off');
```



```
In [166… plt.scatter(
             twitter_archive_master_df.rating,
             twitter_archive_master_df.favorite_count
         );
         plt.xlabel('Rating');
         plt.ylabel('Favorite Count');
         plt.title('Rating vs. Favorite Count');
```

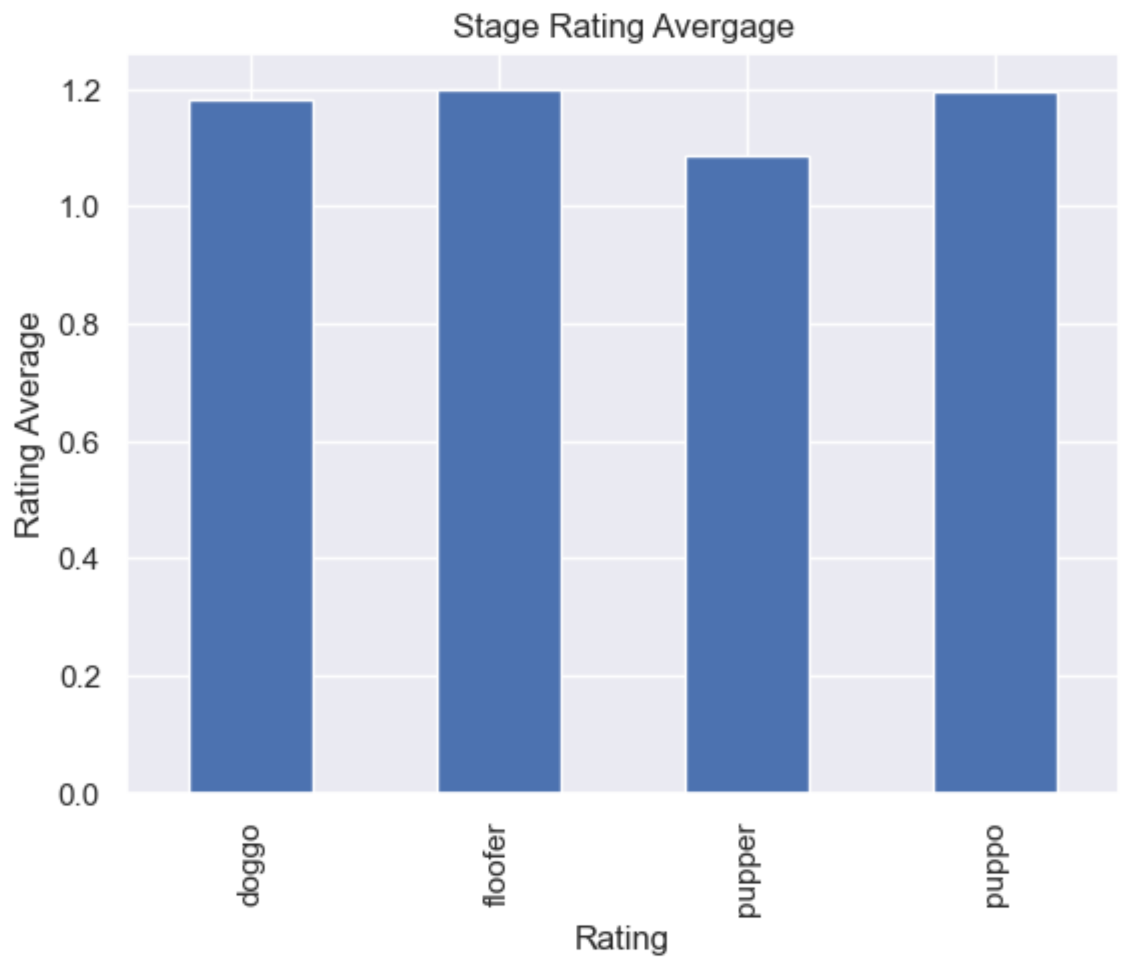


```
In [167…  plt.scatter(
              twitter_archive_master_df.rating,
              twitter_archive_master_df.retweet_count
          );
          plt.xlabel('Rating');
          plt.ylabel('Retweet Count');
          plt.title('Rating vs. Retweet Count');
```



In [168…

```
twitter_archive_master_df.groupby("stage").rating.mean().plot(kind="bar");
plt.xlabel('Rating');
plt.ylabel('Rating Average');
plt.title('Stage Rating Avergage');
```


Stage Rating Avergage
Rating Average
Rating
1.2
1.0
0.8
0.6
0.4
0.2
0.0
doggo
floofer
pupper
puppo

```
In [ ]:
```