01-data-analysis

December 17, 2021

1 Imports

[1]:
```
%load_ext autoreload
%autoreload 2

import pandas as pd
import random, time, io
from itertools import product
from utils import get_dataset_files, extract_first_entries,␣
 ↪extract_random_entries, extract_best_entries, render_single,␣
 ↪render_multiple, complexity_score
from IPython.display import display, Image as IPImage
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
from ipyplot import plot_images
from PIL import Image as pilimg
```

2 Load data, generate complexity score

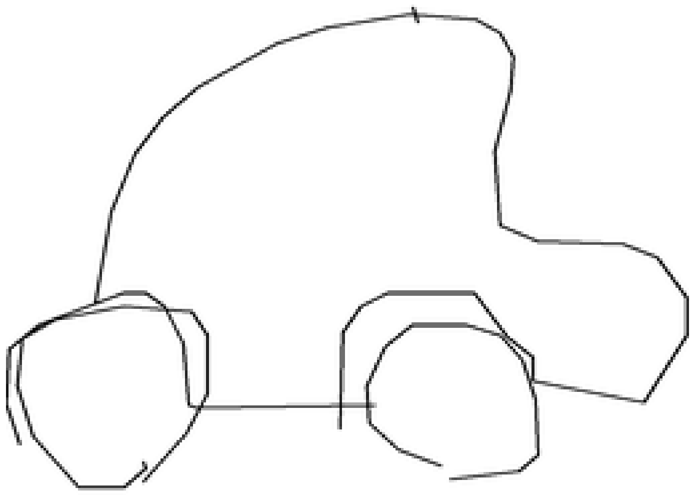
[2]:
```
names = ['snowman', 'pig', 'car', 'fish', 'power outlet']
files = list(map(lambda n: f'./dataset/{n}.ndjson', names))

df = extract_first_entries(files, 50000)
print(f'Loaded {len(df)} entries from {files}')

df['complexity'] = df.apply(lambda row: complexity_score(row['drawing']),␣
 ↪axis=1)

df
```

```
Loaded 250000 entries from ['./dataset/snowman.ndjson', './dataset/pig.ndjson',
'./dataset/car.ndjson', './dataset/fish.ndjson', './dataset/power
outlet.ndjson']
```

[2]:
```
                word countrycode                    timestamp  recognized  \
0            snowman          SG  2017-03-19 13:09:20.41026 UTC        True
1            snowman          GB  2017-04-01 00:23:56.92064 UTC        True
```

```
2             snowman          US  2017-01-28 22:52:14.74002 UTC        True
3             snowman          US  2017-03-02 19:02:04.75534 UTC       False
4             snowman          US  2017-03-21 21:59:23.44407 UTC        True
…                 …         …                          …         …
249995   power outlet          US  2017-03-26 16:46:22.04101 UTC        True
249996   power outlet          KW  2017-03-03 12:05:28.65947 UTC       False
249997   power outlet          US  2017-03-19 23:24:45.17094 UTC        True
249998   power outlet          HU  2017-03-12 16:52:14.40216 UTC        True
249999   power outlet          JP  2017-01-28 13:09:40.52908 UTC        True

                   key_id                                             drawing  \
0        5040959249186816  [[[51, 37, 31, 33, 39, 56, 74, 88, 101, 106, 1…
1        5057709479034880  [[[128, 102, 73, 42, 36, 40, 55, 81, 112, 131,…
2        4649154502459392  [[[95, 74, 56, 40, 36, 40, 53, 75, 89, 119, 13…
3        5668944822140928  [[[17, 17], [36, 36]], [[14, 14, 26, 51, 58, 8…
4        5670608501211136  [[[129, 116, 95, 79, 76, 79, 87, 111, 130, 139…
…                       …                                                 …
249995   5349398601007104  [[[36, 33, 27, 23, 19, 19, 12, 12, 17, 39, 113…
249996   4692501355036672  [[[107, 98, 98, 104, 102, 106, 121], [29, 76, …
249997   5740946509529088  [[[2, 2, 14, 20, 125, 147, 147, 27, 0], [253, …
249998   5450473727328256  [[[20, 9, 3, 0, 4, 81, 180, 184, 187, 187, 178…
249999   5180105942892544  [[[1, 3], [7, 218]], [[7, 41, 143, 167, 180, 1…

        complexity
0               39
1               41
2               34
3               55
4               36
…             …
249995          45
249996          76
249997          42
249998          35
249999          33

[250000 rows x 7 columns]
```

[94]:
```python
img = df.sample().iloc[0]
display(IPImage(render_single(img['drawing'])))
print(img['word'])
```

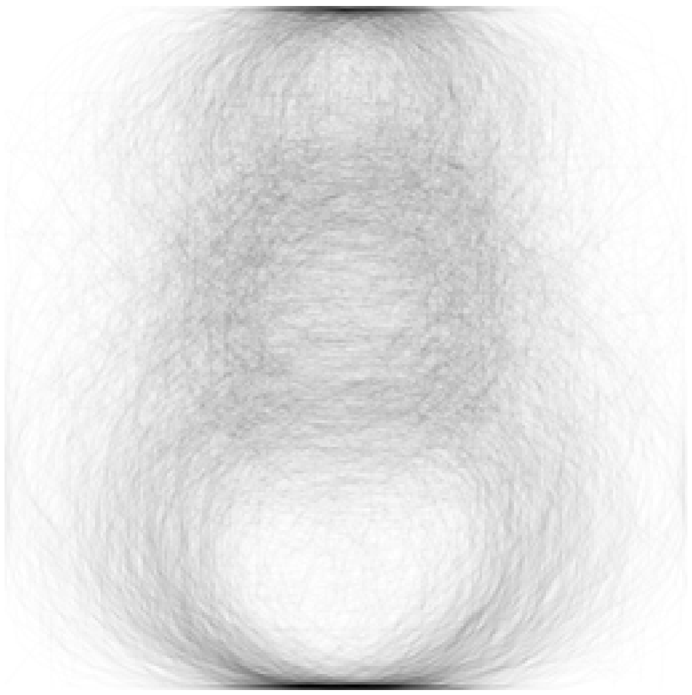


```
car
```

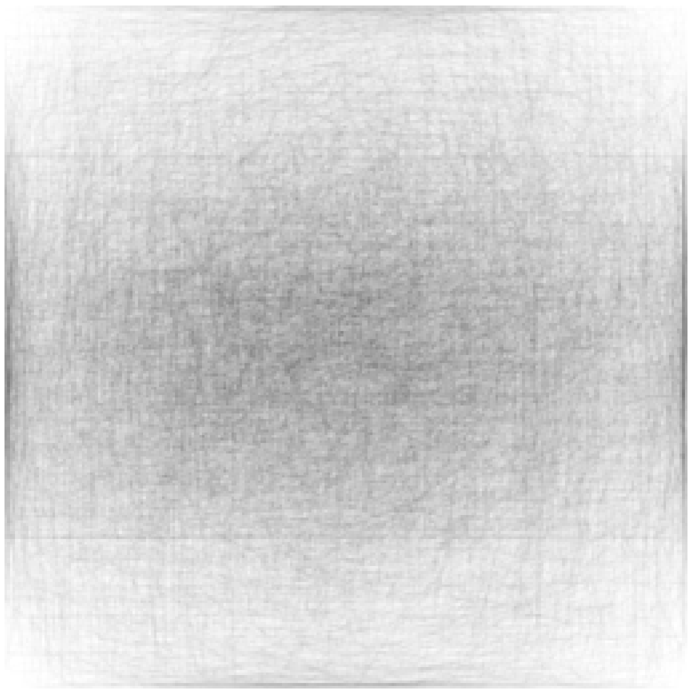
[4]:
```python
print(df['word'].value_counts())
```

```
snowman         50000
pig             50000
car             50000
fish            50000
power outlet    50000
Name: word, dtype: int64
```

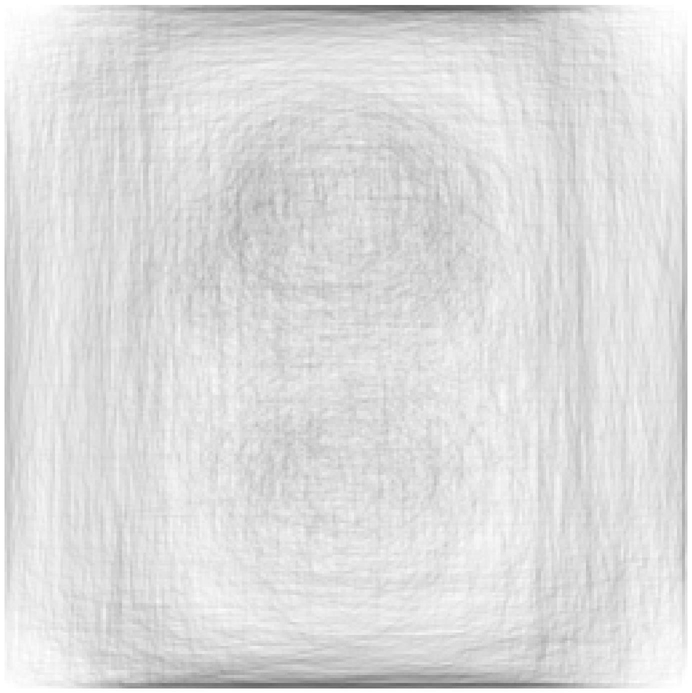
[5]:
```python
word = 'snowman'

imgs = df[df['word'] == 'snowman'].sample(1000)['drawing']
display(IPImage(render_multiple(imgs)))
```



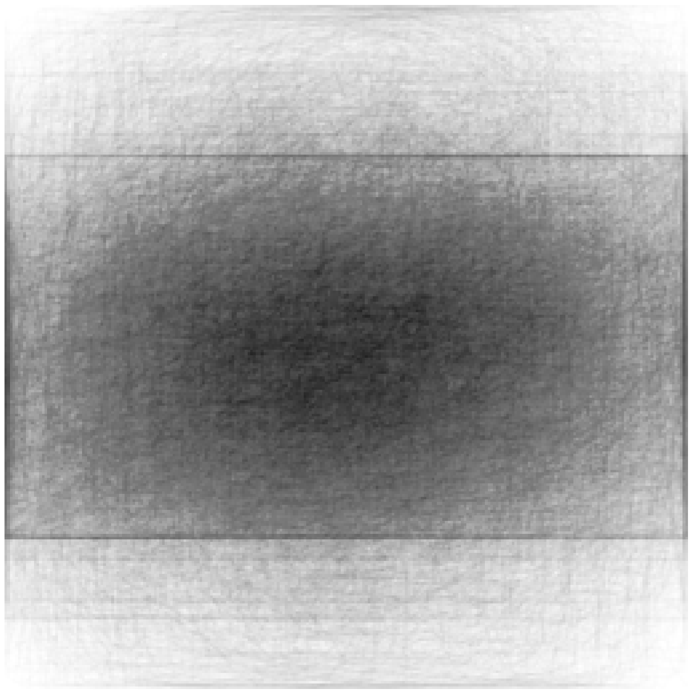
```
[6]: word = 'power outlet'

     imgs = df[(df['word'] == word) & (df['recognized'] == False)].
      ↪sample(1000)['drawing']
     display(IPImage(render_multiple(imgs)))
```



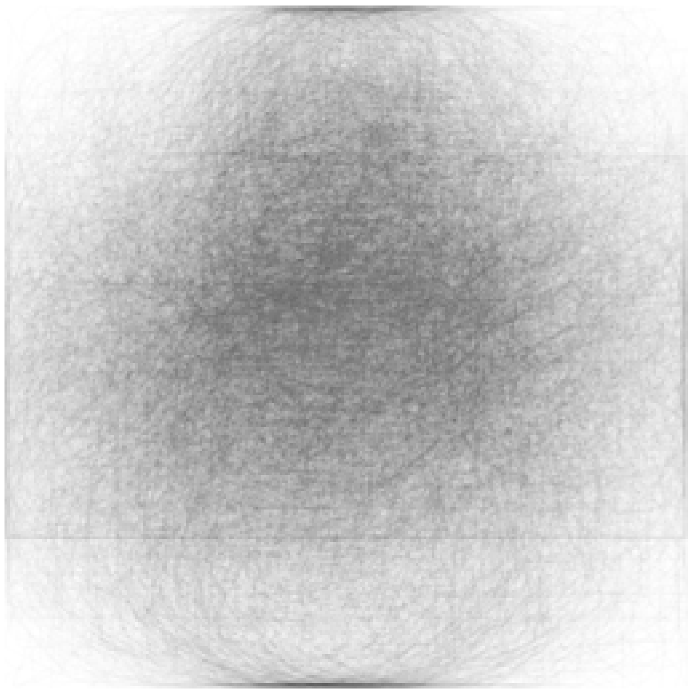
[7]:
```
word = 'power outlet'

imgs = df[(df['word'] == word) & (df['recognized'] == True)].
↪sample(1000)['drawing']
display(IPImage(render_multiple(imgs)))
```



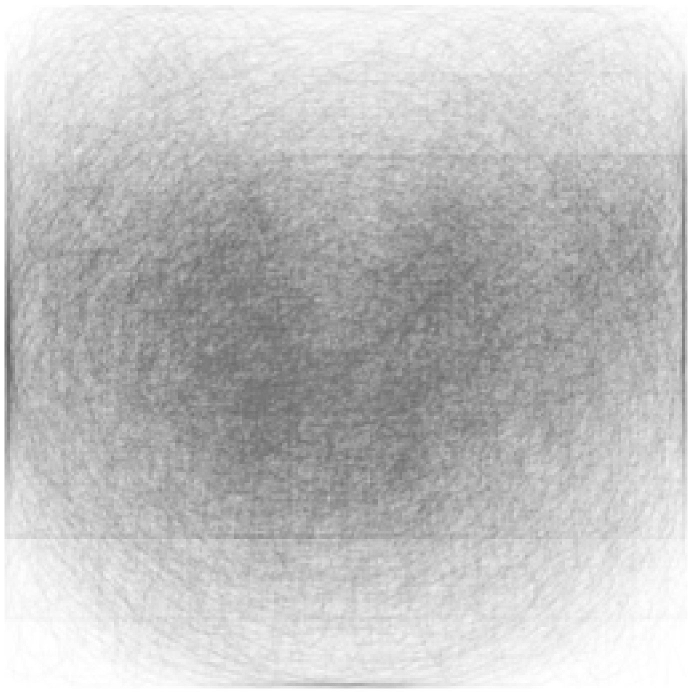
[8]:
```
df2 = df.sort_values(by=['complexity'], ascending=False)

for word in set(df2['word'].values):
    imgs = df2[(df2['word'] == word)][:1000]['drawing']
    display(IPImage(render_multiple(imgs)))
    print(word)
```



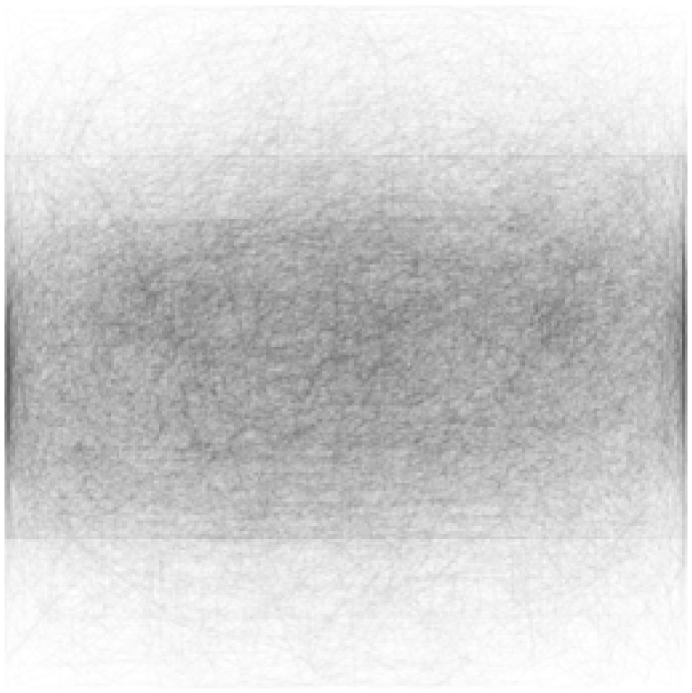
power outlet



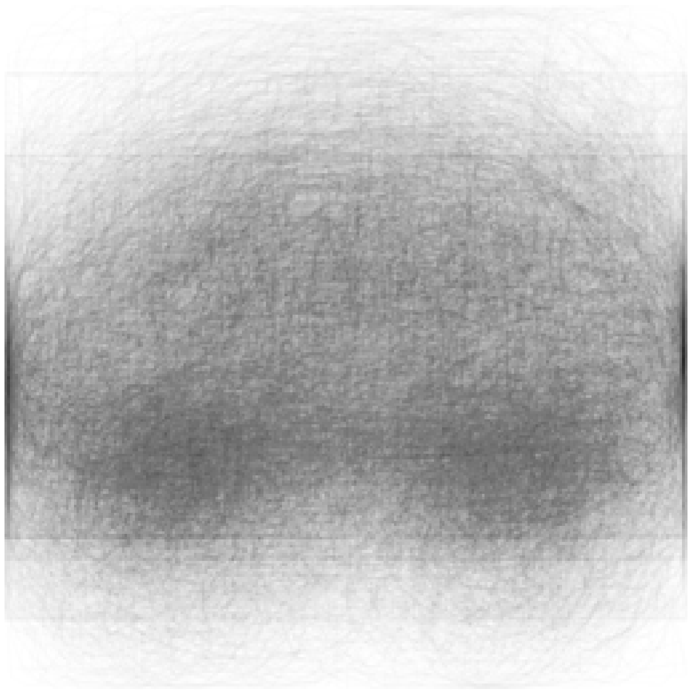
snowman



pig



fish



```
car
```

[9]:
```
word = 'power outlet'
images = []
for i in range(300):
    images.append(pilimg.open(io.BytesIO(render_single(df2[df2['word'] ==␣
↪word]['drawing'].iloc[i], stroke_width_scale=2))))

plot_images(images)
```

```
/home/chris/.local/lib/python3.9/site-packages/numpy/core/_asarray.py:102:
FutureWarning: The input object of type 'PngImageFile' is an array-like
implementing one of the corresponding protocols (`__array__`,
`__array_interface__` or `__array_struct__`); but not a sequence (or 0-D). In
the future, this object will be coerced as if it was first converted using
`np.array(obj)`. To retain the old behaviour, you have to either modify the type
'PngImageFile', or assign to an empty array created with
`np.empty(correct_shape, dtype=object)`.
  return array(a, dtype, copy=False, order=order)
```

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

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

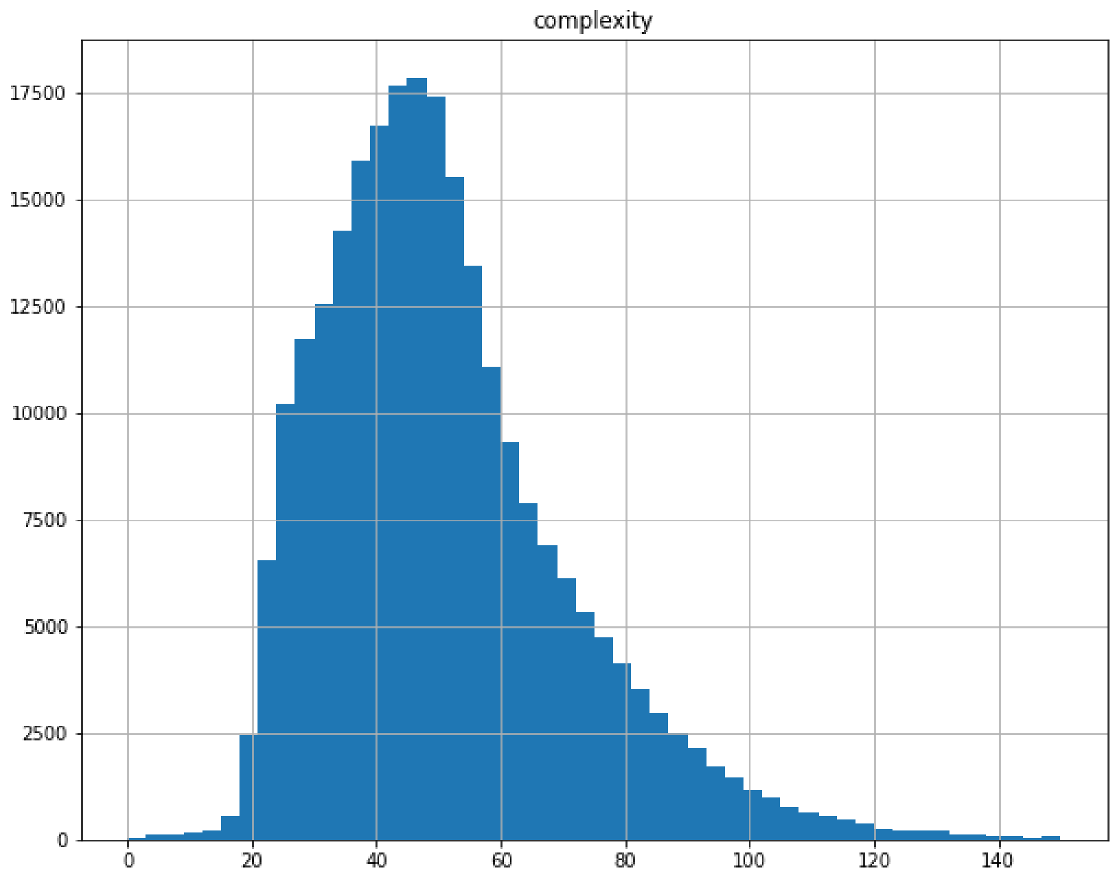
[97]:
```
df2['complexity'].describe()
display(df2.hist(column='complexity', bins=50, range=[0, 150], figsize=(10, 8)))
display(df2[df2['recognized'] == True].hist(column='complexity', bins=50,␣
 ↪range=[0, 150], figsize=(10, 8)))
display(df2[df2['recognized'] == False].hist(column='complexity', bins=50,␣
 ↪range=[0, 150], figsize=(10, 8)))
```

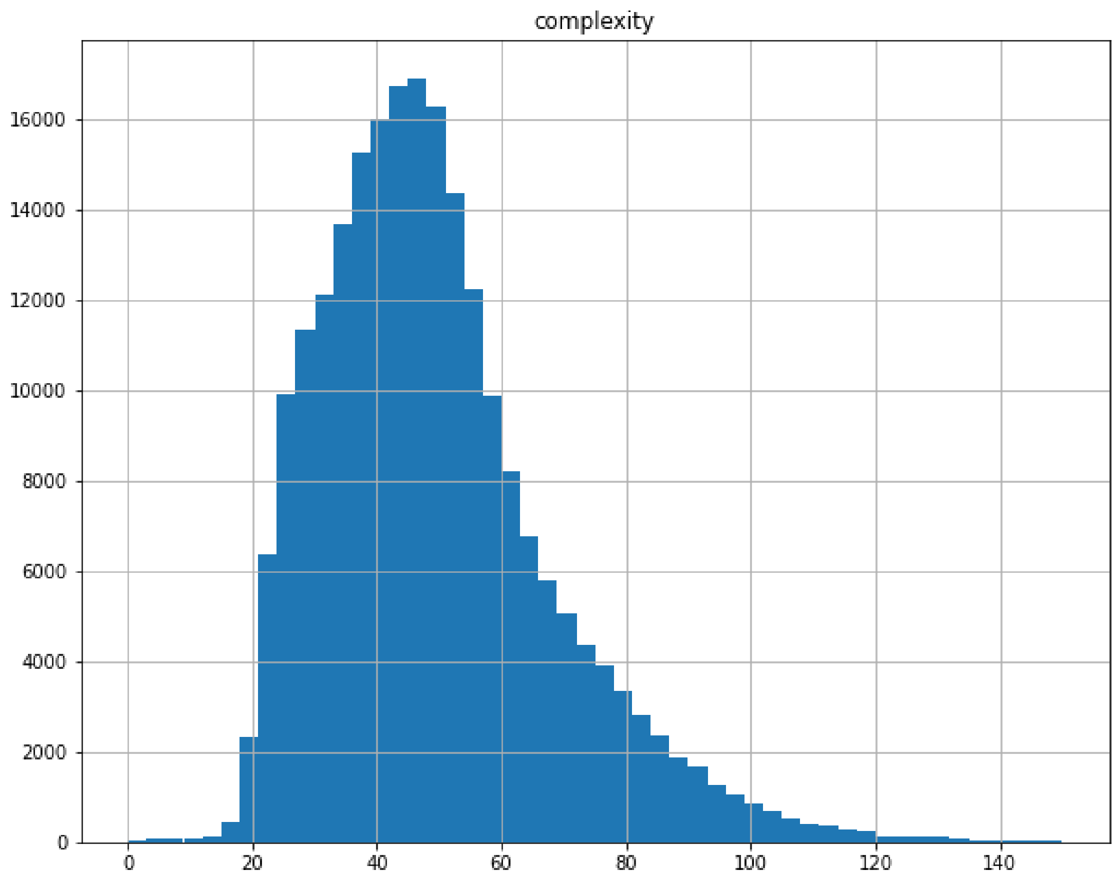
[97]:
```
count    250000.000000
mean         50.728364
std          22.461515
min           2.000000
25%          36.000000
50%          47.000000
75%          60.000000
max         916.000000
Name: complexity, dtype: float64
```

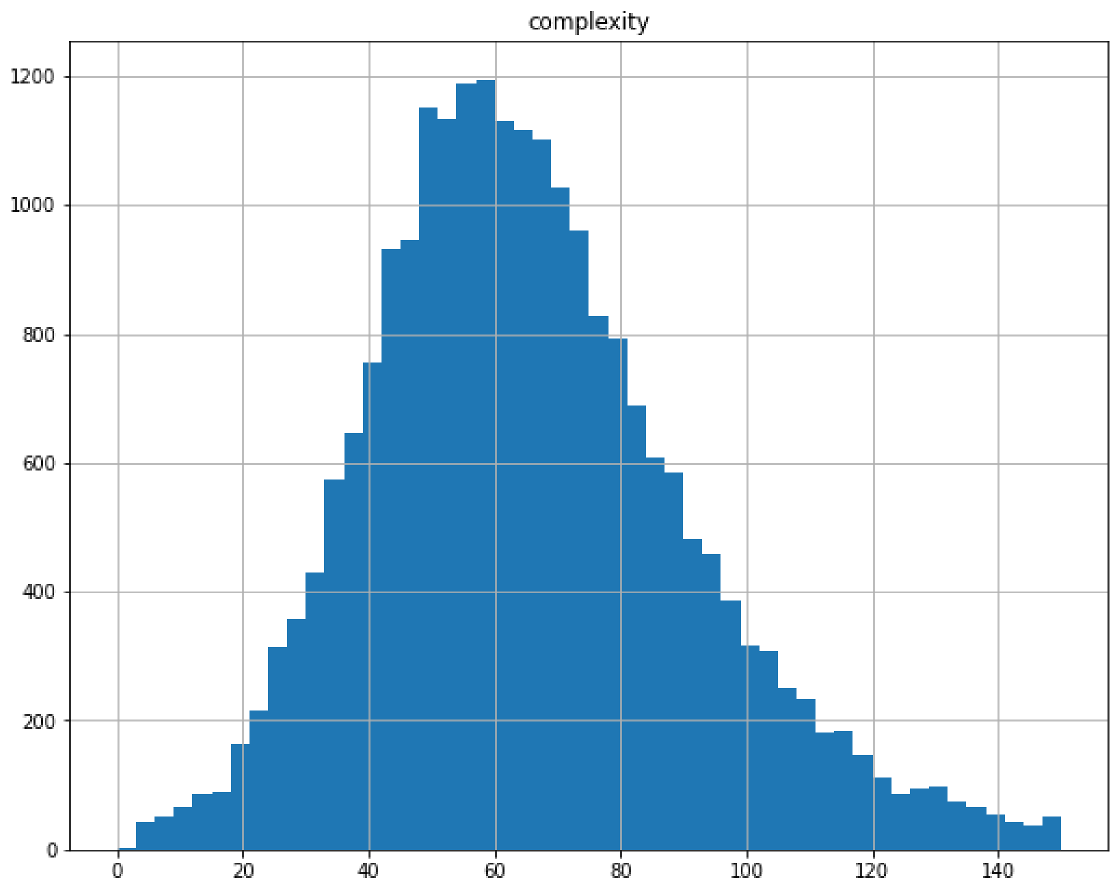
```
array([[<AxesSubplot:title={'center':'complexity'}>]], dtype=object)
```

```
array([[<AxesSubplot:title={'center':'complexity'}>]], dtype=object)
```

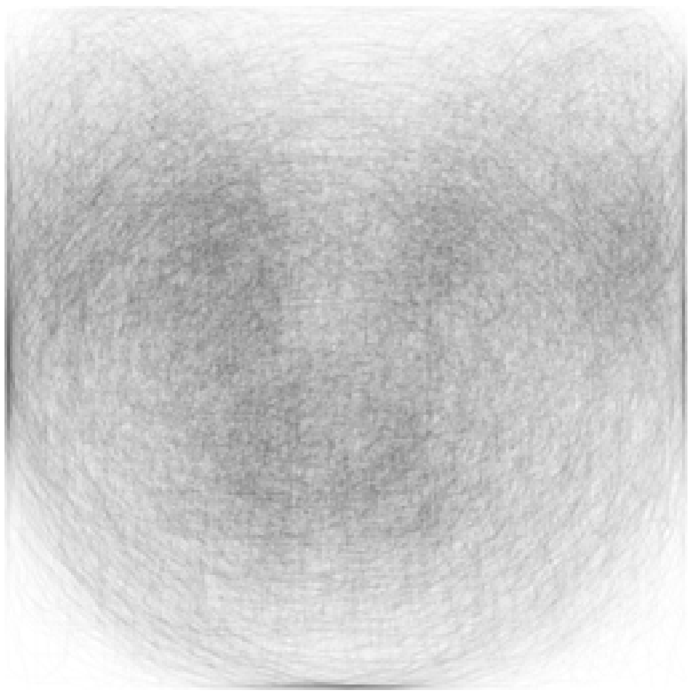
```
array([[<AxesSubplot:title={'center':'complexity'}>]], dtype=object)
```



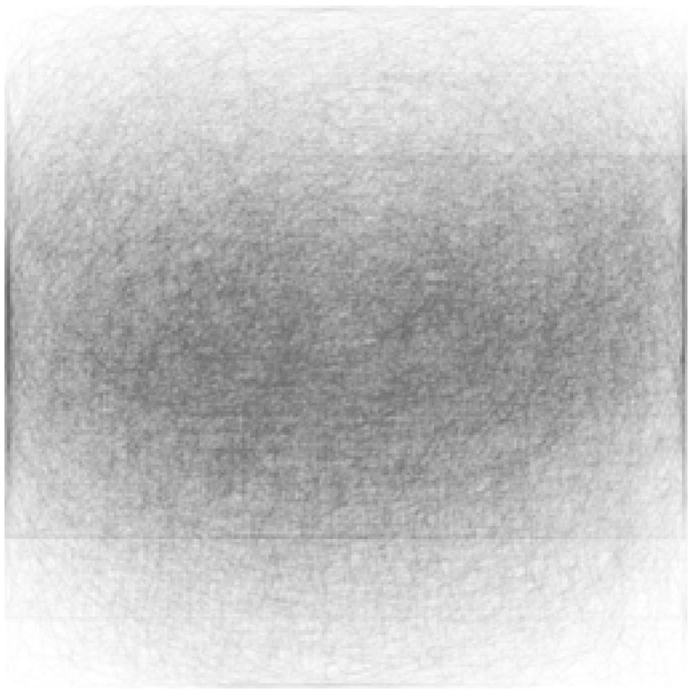

complexity
16000
14000
12000
10000
8000
6000
4000
2000
0
0
20
40
60
80
100
120
140



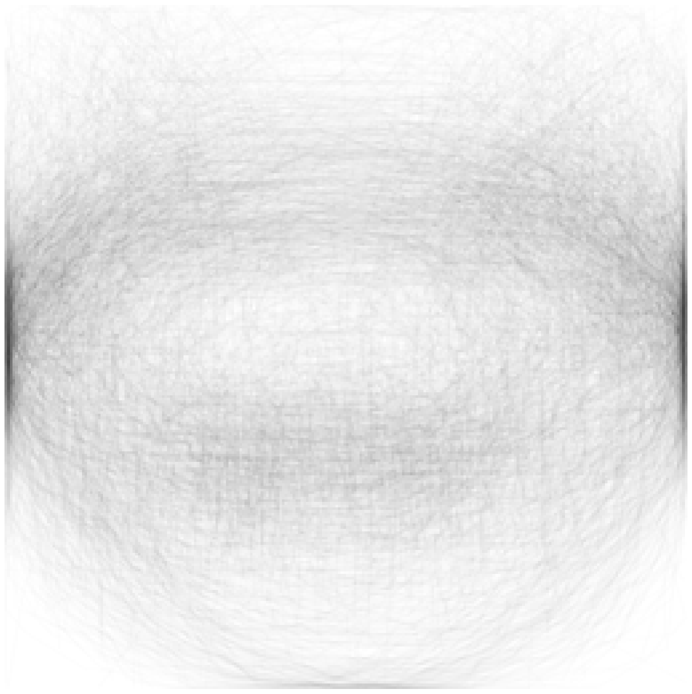
```
[11]: word = random.choice(list(set(df2['word'].values)))
      slices = [slice(None, 1000), slice(-1000, None)]
      for n in product(slices, [True, False]):
          imgs = df2[(df2['word'] == word) & (df2['recognized'] ==␣
       ↪n[1])][n[0]]['drawing']
          display(IPImage(render_multiple(imgs)))
          print(word + (", recognized" if n[1] else ", not recognized"))
```



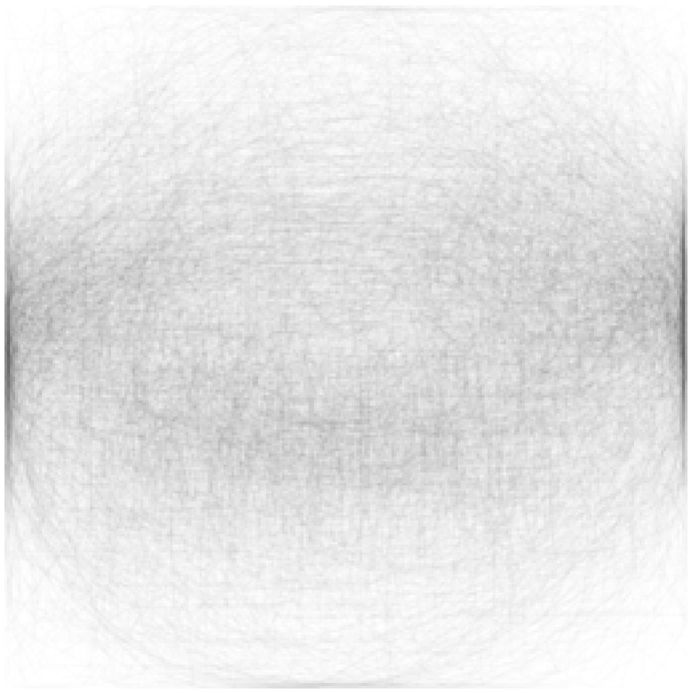
pig, recognized



pig, not recognized



pig, recognized



pig, not recognized