data_mining_programming_Assignment

October 5, 2024

[57]:

```
# ALL THE REQUIRED LIBRARIES
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.image as implt


#KERAS
from PIL import Image
import keras,shutil,keras_preprocessing,requests,math,glob, datetime
import tensorflow as tf
from keras import layers
from keras.models import Sequential, Model
from keras.layers import Lambda, Input, Dense, Dropout, Flatten, Conv2D,␣
 ↪MaxPooling2D, Activation, SpatialDropout2D, GlobalAveragePooling2D
from keras.callbacks import EarlyStopping
from keras_preprocessing import image
from keras_preprocessing.image import ImageDataGenerator
from keras.applications.inception_v3 import InceptionV3, preprocess_input as␣
 ↪inception_preprocessor
from keras.applications.xception import Xception, preprocess_input as␣
 ↪xception_preprocessor
from keras.applications.inception_resnet_v2 import InceptionResNetV2,␣
 ↪preprocess_input as inc_resnet_preprocessor
from keras.applications.nasnet import NASNetLarge, preprocess_input as␣
 ↪nasnet_preprocessor

# SKLEARN
from sklearn.utils import shuffle
from sklearn import metrics
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix, classification_report
from sklearn.datasets import load_files
from io import BytesIO
import seaborn as sns
import xml.etree.ElementTree as ET
```

```
from pathlib import Path
%load_ext tensorboard
shutil.rmtree('./logs', ignore_errors=True)

#SKIMAGE
from skimage import data, exposure, img_as_float
from skimage.filters import sobel
from skimage.color import rgb2gray
from skimage import io
from skimage import filters
```

```
The tensorboard extension is already loaded. To reload it, use:
  %reload_ext tensorboard
```

[59]:
```
%matplotlib inline
%config InlineBackend.figure_format = 'svg'
dog_images = glob.glob('/Users/angel/Data_Mining/Images/*/*')
```

[61]:
```
%matplotlib inline
%config InlineBackend.figure_format = 'svg'
dog_images = glob.glob("/Users/angel/Data_Mining/Images/*/*")
annotations = glob.glob("/Users/angel/Data_Mining/Annotation/*/*")
```

[63]:
```
def get_bounding_boxes(annot):
    xml = annot
    tree = ET.parse(xml)
    root = tree.getroot()
    objects = root.findall('object')
    bbox = []
    for o in objects:
        bndbox = o.find('bndbox')
        xmin = int(bndbox.find('xmin').text)
        ymin = int(bndbox.find('ymin').text)
        xmax = int(bndbox.find('xmax').text)
        ymax = int(bndbox.find('ymax').text)
        bbox.append((xmin,ymin,xmax,ymax))
    return bbox
```

[65]:
```
def get_image(annot):
    img_path = '/Users/angel/Data_Mining/Images/'
    file = annot.split('/')
    img_filename = img_path + file[-2]+'/'+file[-1]

    return img_filename
```

[67]:
```
for i in range(len(dog_images)):
    bbox = get_bounding_boxes(annotations[i])
    dog = get_image(dog_images[i])

    im = Image.open(dog)
    for j in range(len(bbox)):
        im2 = im.crop(bbox[j])
        im2 = im2.resize((128,128), Image.Resampling.LANCZOS)
        new_path = dog.replace('/Users/angel/Data_Mining/','./Cropped/')
        new_path = new_path.replace('.jpg', f'-{j}.jpg')
        im2=im2.convert('RGB')
        head, tail = os.path.split(new_path)
        Path(head).mkdir(parents=True, exist_ok=True)
        im2.save(new_path)
```

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[70]:

```
for i in range(len(dog_images)):
    print(len(dog_images))
    print(annotations[i])
    bbox = get_bounding_boxes(annotations[i])
    dog = get_image(dog_images[i])
    print(dog)
    print(bbox)

    im = Image.open(dog)
    for j in range(len(bbox)):
        im2 = im.crop(bbox[j])
        im2 = im2.resize((331,331), Image.Resampling.LANCZOS)
        new_path = dog.replace('/Users/angel/Data_Mining/','./Cropped/')
        new_path = new_path.replace('.jpg','-' + str(j) + '.jpg')
        im2=im2.convert('RGB')
        head, tail = os.path.split(new_path)
        Path(head).mkdir(parents=True, exist_ok=True)
        im2.save(new_path)
```

```
8
/Users/angel/Data_Mining/Annotation/n02102318-cocker_spaniel/n02102318_89
/Users/angel/Data_Mining/Images/n02102318-cocker_spaniel/n02102318_89.jpg
[(52, 26, 211, 280)]
8
/Users/angel/Data_Mining/Annotation/n02102318-cocker_spaniel/n02102318_20
/Users/angel/Data_Mining/Images/n02102318-cocker_spaniel/n02102318_20.jpg
[(152, 247, 471, 404), (242, 145, 395, 307)]
8
/Users/angel/Data_Mining/Annotation/n02093256-
Staffordshire_bullterrier/n02093256_225
/Users/angel/Data_Mining/Images/n02093256-
Staffordshire_bullterrier/n02093256_264.jpg
```

```
[(44, 90, 109, 199)]
8
/Users/angel/Data_Mining/Annotation/n02093256-
Staffordshire_bullterrier/n02093256_264
/Users/angel/Data_Mining/Images/n02093256-
Staffordshire_bullterrier/n02093256_225.jpg
[(220, 90, 498, 258), (39, 54, 363, 275)]
8
/Users/angel/Data_Mining/Annotation/n02097209-standard_schnauzer/n02097209_8
/Users/angel/Data_Mining/Images/n02097209-standard_schnauzer/n02097209_1.jpg
[(77, 0, 422, 333)]
8
/Users/angel/Data_Mining/Annotation/n02097209-standard_schnauzer/n02097209_1
/Users/angel/Data_Mining/Images/n02097209-standard_schnauzer/n02097209_8.jpg
[(15, 31, 296, 275)]
8
/Users/angel/Data_Mining/Annotation/n02087394-Rhodesian_ridgeback/n02087394_36
/Users/angel/Data_Mining/Images/n02087394-Rhodesian_ridgeback/n02087394_101.jpg
[(127, 131, 255, 438)]
8
/Users/angel/Data_Mining/Annotation/n02087394-Rhodesian_ridgeback/n02087394_101
/Users/angel/Data_Mining/Images/n02087394-Rhodesian_ridgeback/n02087394_36.jpg
[(253, 179, 373, 337), (157, 180, 190, 239)]
```

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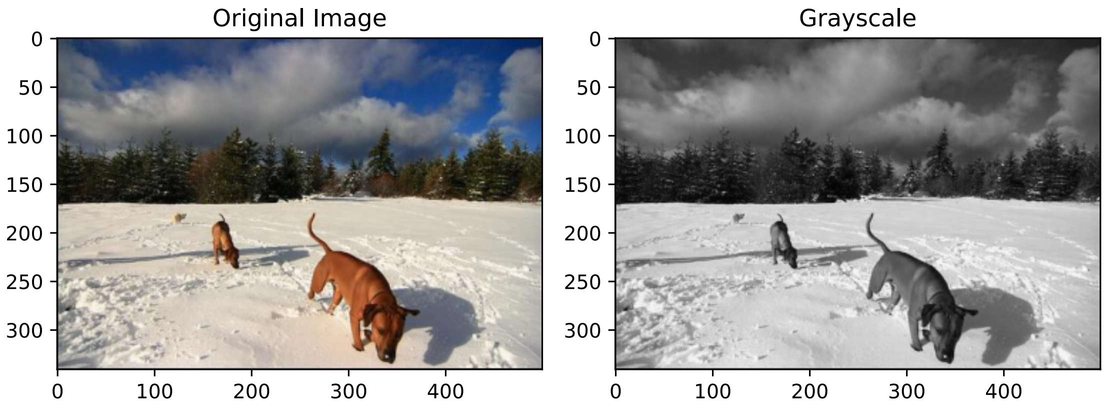
[74]:

```python
# 1) Rhodesian_ridgeback

# Load the image from the file path
img_path1 = "/Users/angel/Data_Mining/Images/n02087394-Rhodesian_ridgeback/
 ↪n02087394_101.jpg"
image1 = io.imread(img_path1)
grayscale = rgb2gray(image1)

# Create subplots
fig, axes = plt.subplots(1, 2, figsize=(8, 4))
ax = axes.ravel()

# Show grayscale image
ax[0].imshow(image1)
ax[0].set_title("Original Image")
ax[0].axis('on')

# Show original image
ax[1].imshow(grayscale, cmap=plt.cm.gray)
```

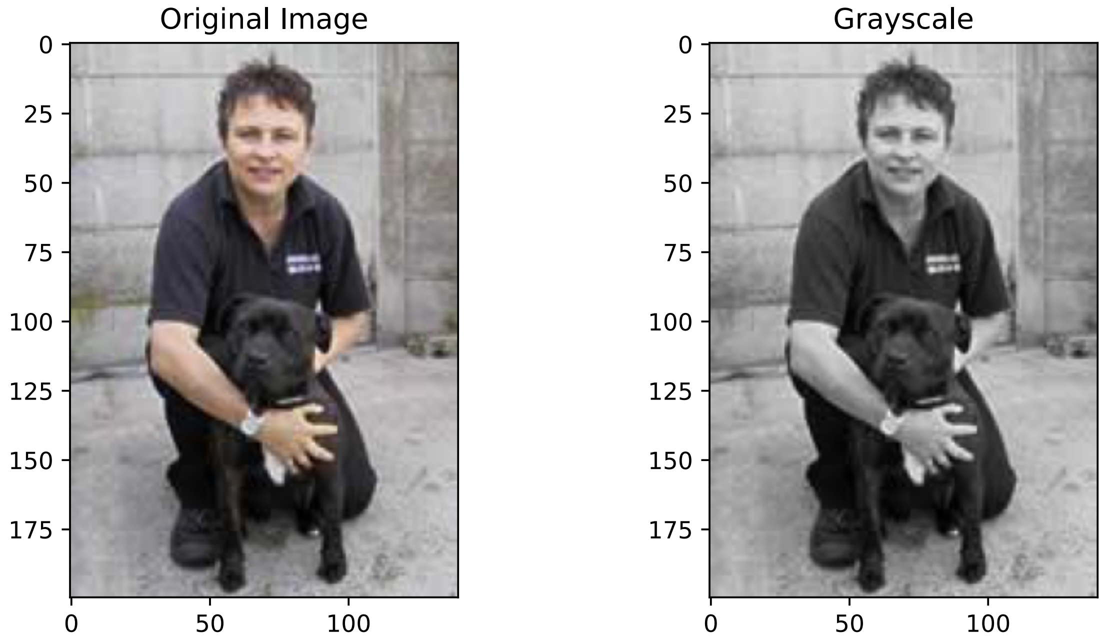
```python
ax[1].set_title("Grayscale")
ax[1].axis('on')

# Adjust layout and display
fig.tight_layout()
plt.show()



# 2) Staffordshire
# Load the image from the file path
img_path2 = '/Users/angel/Data_Mining/Images/
 ↪n02093256-Staffordshire_bullterrier/n02093256_225.jpg'
image2 = io.imread(img_path2)
grayscale = rgb2gray(image2)

# Create subplots
fig, axes = plt.subplots(1, 2, figsize=(8, 4))
ax = axes.ravel()

# Show grayscale image
ax[0].imshow(image2)
ax[0].set_title("Original Image")
ax[0].axis('on')

# Show original image
ax[1].imshow(grayscale, cmap=plt.cm.gray)
ax[1].set_title("Grayscale")
ax[1].axis('on')

# Adjust layout and display
fig.tight_layout()
plt.show()


# 3) Standard
# Load the image from the file path
img_path3 = '/Users/angel/Data_Mining/Images/n02097209-standard_schnauzer/
 ↪n02097209_1.jpg'
image3 = io.imread(img_path3)
grayscale = rgb2gray(image3)

# Create subplots
fig, axes = plt.subplots(1, 2, figsize=(8, 4))
ax = axes.ravel()

# Show grayscale image
```

```
ax[0].imshow(image3)
ax[0].set_title("Original Image")
ax[0].axis('on')

# Show original image
ax[1].imshow(grayscale, cmap=plt.cm.gray)
ax[1].set_title("Grayscale")
ax[1].axis('on')

# Adjust layout and display
fig.tight_layout()
plt.show()

#4 cocker
# Load the image from the file path
img_path4 = '/Users/angel/Data_Mining/Images/n02102318-cocker_spaniel/
 ↪n02102318_20.jpg'
image4 = io.imread(img_path4)
grayscale = rgb2gray(image4)

# Create subplots
fig, axes = plt.subplots(1, 2, figsize=(8, 4))
ax = axes.ravel()

# Show grayscale image
ax[0].imshow(image4)
ax[0].set_title("Original Image")
ax[0].axis('on')

# Show original image
ax[1].imshow(grayscale, cmap=plt.cm.gray)
ax[1].set_title("Grayscale")
ax[1].axis('on')

# Adjust layout and display
fig.tight_layout()
plt.show()
```



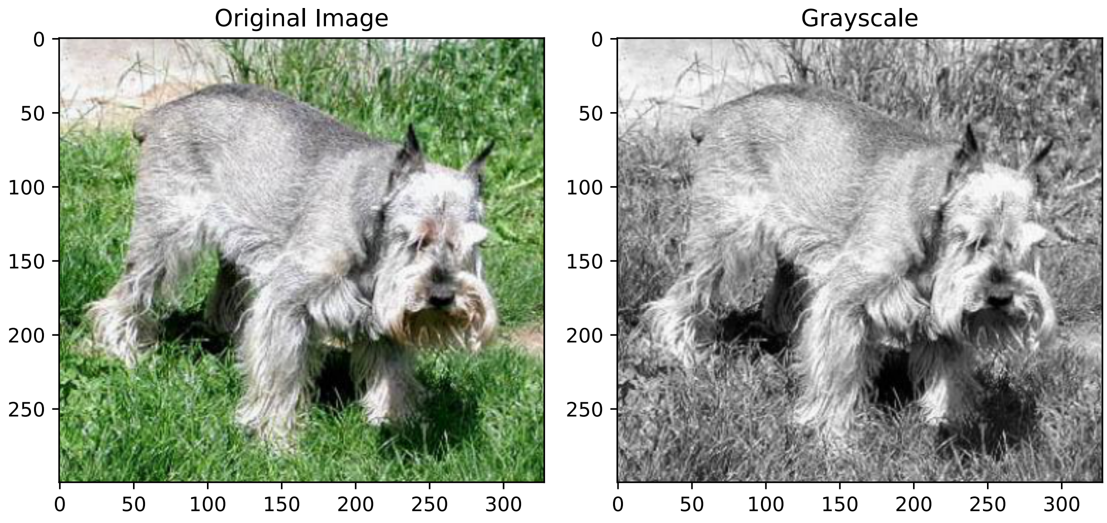
Original Image

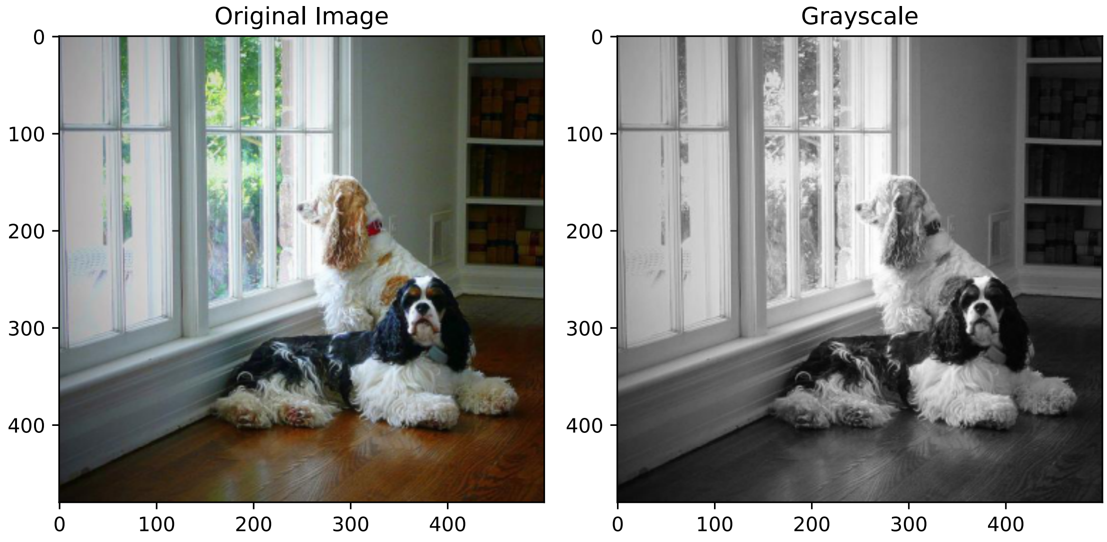
Grayscale



Original Image

Grayscale





[76]:

```
def angle(dx, dy):
    return np.mod(np.arctan2(dy, dx), np.pi)
    angle_sobel = angle(filters.sobel_h(I),
    filters.sobel_v(I))
```

[ ]:

```

```

[79]:

```
#1
image1 = img_as_float(image1)
np.histogram(image1, bins=2)
exposure.histogram(image1, nbins=36)
```

```
/opt/anaconda3/lib/python3.12/site-packages/skimage/_shared/utils.py:438:
UserWarning: This might be a color image. The histogram will be computed on the
flattened image. You can instead apply this function to each color channel, or
set channel_axis.
  return func(*args, **kwargs)
```

```
[79]: (array([ 8963,  9383, 11491, 13184, 12776, 11314, 10573, 10747, 11307,
              11284, 11708, 11527, 14062, 15527, 17398, 18367, 19520, 18144,
              18459, 17693, 13207,  9056,  7130,  6482,  8977, 14077, 24618,
              26125, 27806, 30557, 25953, 18252, 10807,  6725,  4394,  3907]),
       array([0.01388889, 0.04166667, 0.06944444, 0.09722222, 0.125     ,
              0.15277778, 0.18055556, 0.20833333, 0.23611111, 0.26388889,
              0.29166667, 0.31944444, 0.34722222, 0.375     , 0.40277778,
              0.43055556, 0.45833333, 0.48611111, 0.51388889, 0.54166667,
              0.56944444, 0.59722222, 0.625     , 0.65277778, 0.68055556,
              0.70833333, 0.73611111, 0.76388889, 0.79166667, 0.81944444,
              0.84722222, 0.875     , 0.90277778, 0.93055556, 0.95833333,
              0.98611111]))
```

```
[81]: # 2
      image2 = img_as_float(image2)
      np.histogram(image2, bins=2)
      exposure.histogram(image2, nbins=36)
```

```
[81]: (array([ 775, 1940, 1978, 2090, 2207, 2546, 2703, 2475, 2127, 1761, 1435,
              1114, 1084,  864,  909, 1031, 1242, 1744, 2560, 3361, 3876, 3806,
              4471, 4655, 5505, 5673, 6706, 6474, 4307, 1594,  378,  256,  199,
                93,   40,   21]),
       array([0.01388889, 0.04166667, 0.06944444, 0.09722222, 0.125     ,
              0.15277778, 0.18055556, 0.20833333, 0.23611111, 0.26388889,
              0.29166667, 0.31944444, 0.34722222, 0.375     , 0.40277778,
              0.43055556, 0.45833333, 0.48611111, 0.51388889, 0.54166667,
              0.56944444, 0.59722222, 0.625     , 0.65277778, 0.68055556,
              0.70833333, 0.73611111, 0.76388889, 0.79166667, 0.81944444,
              0.84722222, 0.875     , 0.90277778, 0.93055556, 0.95833333,
              0.98611111]))
```

```
[83]: # 3
      image3 = img_as_float(image3)
      np.histogram(image3, bins=2)
      exposure.histogram(image3, nbins=36)
```

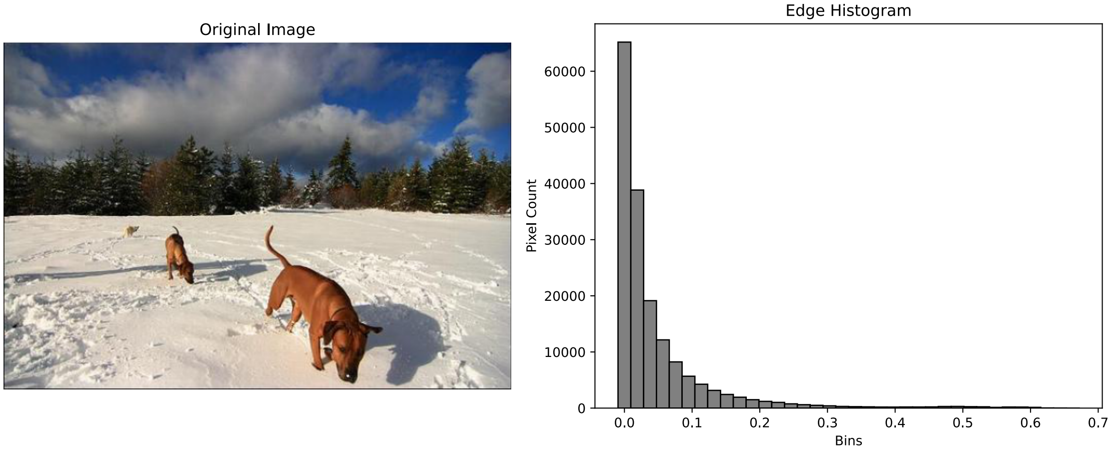
```
[83]: (array([ 6962,  3255,  3552,  3765,  4408,  5264,  5657,  6250,  6983,
               7266,  7975,  8446, 10106,  9314,  9534,  9645,  9945, 10114,
              10155, 10087, 10015,  9933,  9560,  9633, 10998,  9726,  9635,
               9720, 10268, 10482, 10480,  9578,  8239,  7370,  6185,  4695]),
       array([0.01388889, 0.04166667, 0.06944444, 0.09722222, 0.125     ,
              0.15277778, 0.18055556, 0.20833333, 0.23611111, 0.26388889,
              0.29166667, 0.31944444, 0.34722222, 0.375     , 0.40277778,
              0.43055556, 0.45833333, 0.48611111, 0.51388889, 0.54166667,
              0.56944444, 0.59722222, 0.625     , 0.65277778, 0.68055556,
              0.70833333, 0.73611111, 0.76388889, 0.79166667, 0.81944444,
              0.84722222, 0.875     , 0.90277778, 0.93055556, 0.95833333,
              0.98611111]))
```

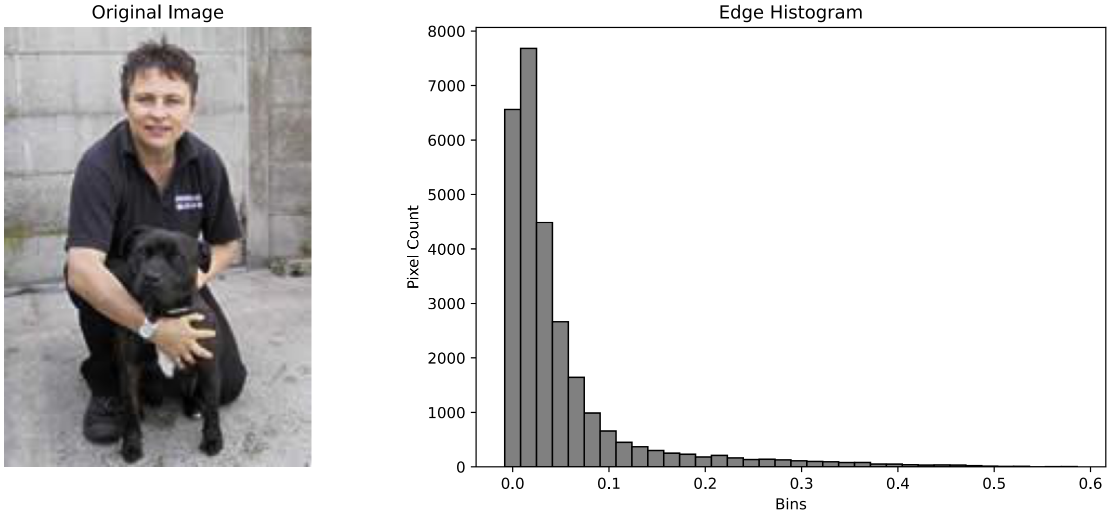
```
[85]: # 4
      image4 = img_as_float(image4)
      np.histogram(image4, bins=2)
      exposure.histogram(image4, nbins=36)
```

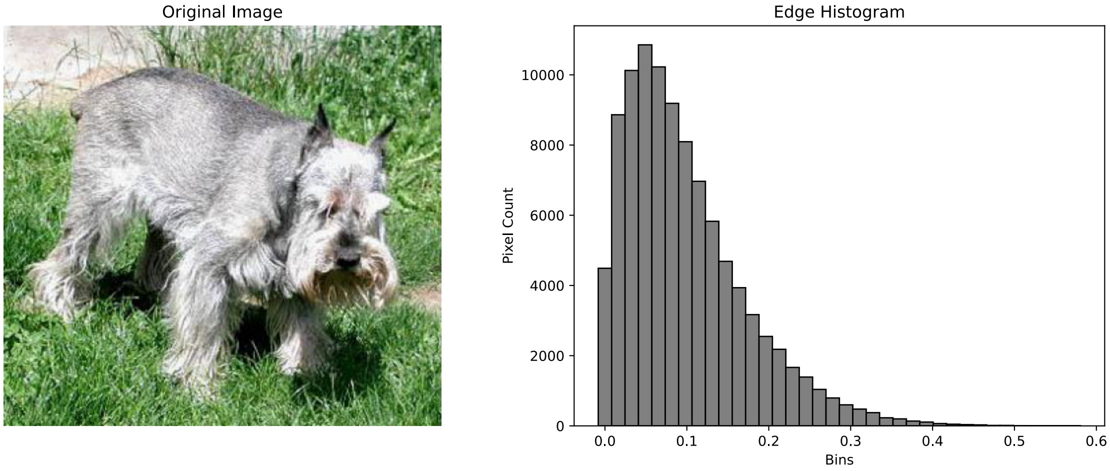
```
[85]: (array([27957, 25059, 26858, 25757, 20035, 19843, 18387, 18295, 18786,
              20825, 23770, 28061, 36135, 31274, 28725, 22104, 19242, 18102,
              16966, 18170, 16732, 15663, 17026, 19334, 25671, 23404, 20407,
              18576, 18978, 17263, 14245, 11564,  9818,  9002,  8134,  9832]),
       array([0.01388889, 0.04166667, 0.06944444, 0.09722222, 0.125     ,
              0.15277778, 0.18055556, 0.20833333, 0.23611111, 0.26388889,
              0.29166667, 0.31944444, 0.34722222, 0.375     , 0.40277778,
              0.43055556, 0.45833333, 0.48611111, 0.51388889, 0.54166667,
              0.56944444, 0.59722222, 0.625     , 0.65277778, 0.68055556,
              0.70833333, 0.73611111, 0.76388889, 0.79166667, 0.81944444,
              0.84722222, 0.875     , 0.90277778, 0.93055556, 0.95833333,
              0.98611111]))
```

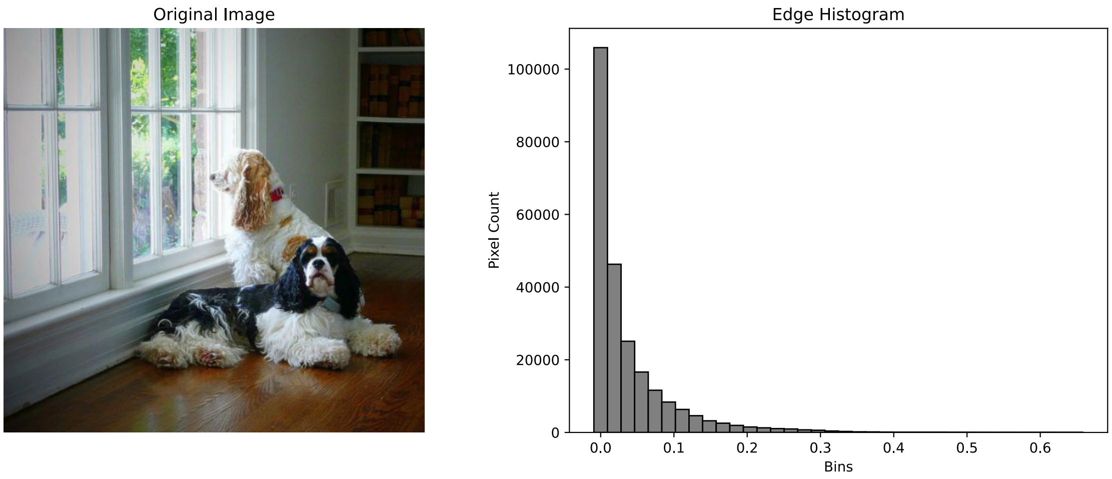
```
[87]: #1
      edges = sobel(image1[:, :, 0])
      hist1, bins = np.histogram(edges, bins=36)
      fig, axes = plt.subplots(1, 2, figsize=(12, 5))
      axes[0].imshow(image1)
      axes[0].axis('off')  # Turn off axis
      axes[0].set_title("Original Image")
      axes[1].bar(bins[:-1], hist1, width=np.diff(bins), color='gray',␣
        ↪edgecolor='black')
      axes[1].set_title("Edge Histogram")
      axes[1].set_xlabel("Bins")
      axes[1].set_ylabel("Pixel Count")

      plt.tight_layout()
      plt.show()

      #2
      edges = sobel(image2[:, :, 0])
      hist2, bins = np.histogram(edges, bins=36)
      fig, axes = plt.subplots(1, 2, figsize=(12, 5))
      axes[0].imshow(image2)
```

```
axes[0].axis('off')  # Turn off axis
axes[0].set_title("Original Image")
axes[1].bar(bins[:-1], hist2, width=np.diff(bins), color='gray', edgecolor='black')
axes[1].set_title("Edge Histogram")
axes[1].set_xlabel("Bins")
axes[1].set_ylabel("Pixel Count")

plt.tight_layout()
plt.show()

#3
edges = sobel(image3[:, :, 0])
hist, bins = np.histogram(edges, bins=36)
fig, axes = plt.subplots(1, 2, figsize=(12, 5))
axes[0].imshow(image3)
axes[0].axis('off')  # Turn off axis
axes[0].set_title("Original Image")
axes[1].bar(bins[:-1], hist, width=np.diff(bins), color='gray', edgecolor='black')
axes[1].set_title("Edge Histogram")
axes[1].set_xlabel("Bins")
axes[1].set_ylabel("Pixel Count")

plt.tight_layout()
plt.show()

#4
edges = sobel(image4[:, :, 0])
hist, bins = np.histogram(edges, bins=36)
fig, axes = plt.subplots(1, 2, figsize=(12, 5))
axes[0].imshow(image4)
axes[0].axis('off')  # Turn off axis
axes[0].set_title("Original Image")
axes[1].bar(bins[:-1], hist, width=np.diff(bins), color='gray', edgecolor='black')
axes[1].set_title("Edge Histogram")
axes[1].set_xlabel("Bins")
axes[1].set_ylabel("Pixel Count")

plt.tight_layout()
plt.show()
```


Original Image
Edge Histogram
Pixel Count
60000
50000
40000
30000
20000
10000
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Bins


Original Image
Edge Histogram
Pixel Count
8000
7000
6000
5000
4000
3000
2000
1000
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Bins


Original Image
Edge Histogram
Pixel Count
10000
8000
6000
4000
2000
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Bins

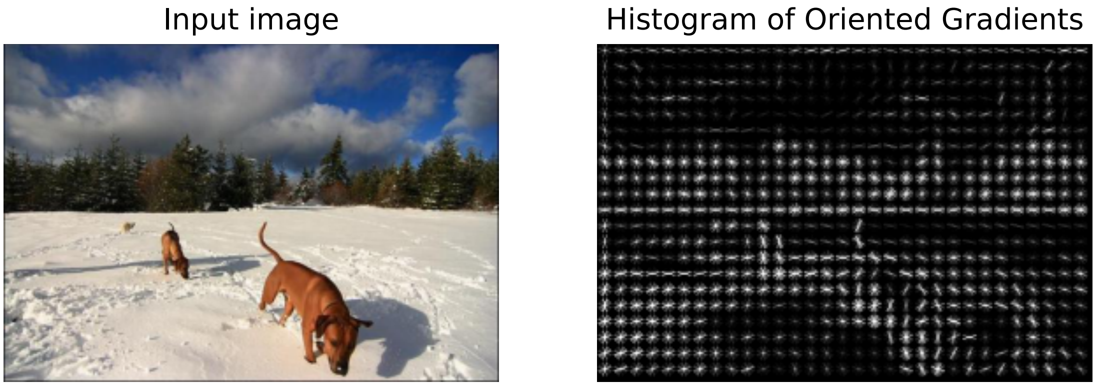


[89]:
```
import numpy as np
from sklearn.metrics import pairwise

euclidean_distance = pairwise.euclidean_distances(hist1.reshape(1, -1), hist2.
  ↪reshape(1, -1))[0][0]
print(f"Euclidean Distance: {euclidean_distance}")
```

```
Euclidean Distance: 69352.09608944779
```

[91]:
```
import matplotlib.pyplot as plt

from skimage.feature import hog
from skimage import data, exposure


img_path1 = "/Users/angel/Data_Mining/Images/n02087394-Rhodesian_ridgeback/
  ↪n02087394_101.jpg"
image = io.imread(img_path1)

fd, hog_image = hog(
    image,
    orientations=8,
    pixels_per_cell=(16, 16),
    cells_per_block=(1, 1),
    visualize=True,
    channel_axis=-1,
)
```

```python
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(8, 4), sharex=True, sharey=True)

ax1.axis('off')
ax1.imshow(image, cmap=plt.cm.gray)
ax1.set_title('Input image')

# Rescale histogram for better display
hog_image_rescaled = exposure.rescale_intensity(hog_image, in_range=(0, 10))

ax2.axis('off')
ax2.imshow(hog_image_rescaled, cmap=plt.cm.gray)
ax2.set_title('Histogram of Oriented Gradients')
plt.show()
```



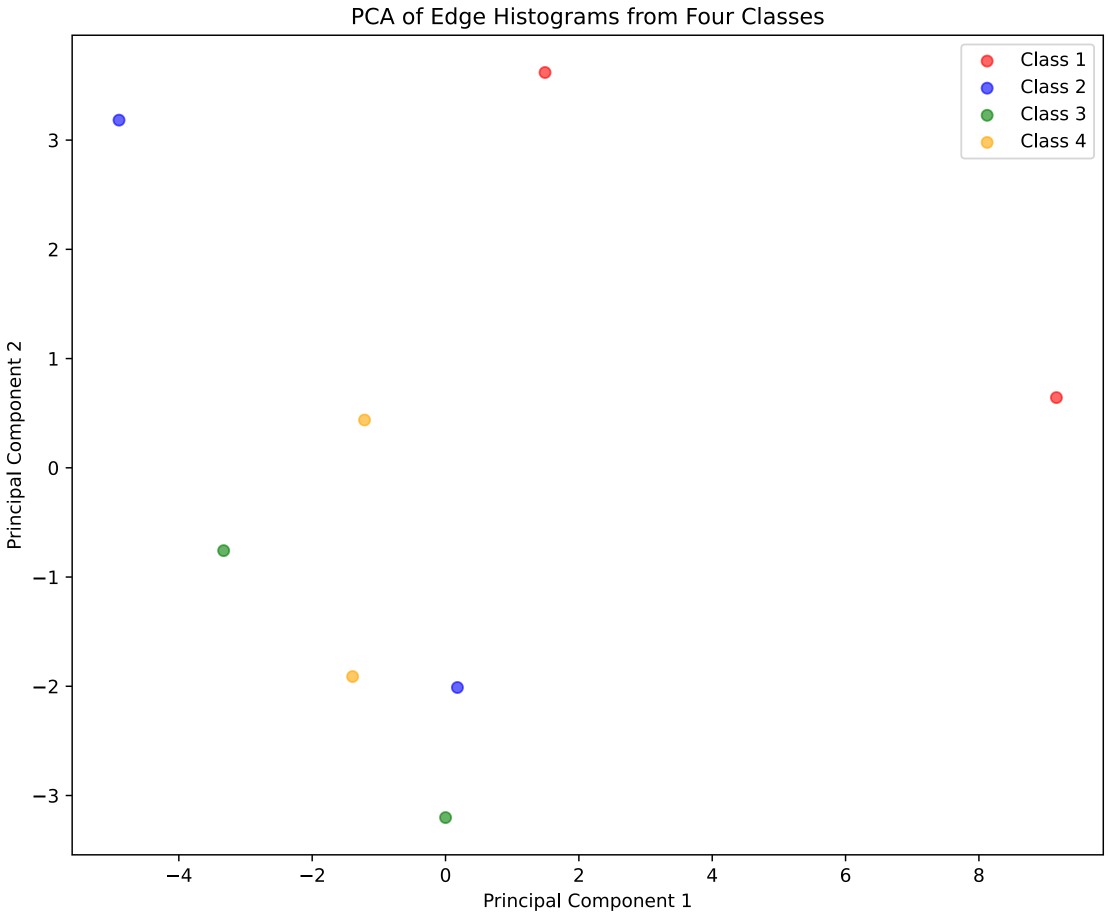
Input image

Histogram of Oriented Gradients

[93]:

```python
import os
import numpy as np
import matplotlib.pyplot as plt
from skimage import io, color, exposure
from skimage.filters import sobel
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler

# Step 1: Load Images from Four Classes
def load_images_from_folder(folder):
    images = []
    for filename in os.listdir(folder):
        # Ensure the file is an image
        if filename.endswith(('.jpg', '.jpeg', '.png')):
            img_path = os.path.join(folder, filename)
            try:
                img = io.imread(img_path)
                if img is not None:
                    images.append(img)
            except Exception as e:
                print(f"Error loading image {img_path}: {e}")
    return images

# Define folders for the four classes
folders = [
    '/Users/angel/Data_Mining/Images/n02087394-Rhodesian_ridgeback/',
    '/Users/angel/Data_Mining/Images/n02093256-Staffordshire_bullterrier/',
    '/Users/angel/Data_Mining/Images/n02097209-standard_schnauzer/',
    '/Users/angel/Data_Mining/Images/n02102318-cocker_spaniel/'
]

# Load all images from the four classes
all_images = []
for folder in folders:
    images = load_images_from_folder(folder)
    all_images.append(images)

# Step 2: Convert Images to Edge Histograms
def compute_edge_histogram(image, bins=36):
    # Convert to grayscale
    gray_image = color.rgb2gray(image)
    # Apply edge detection (Sobel)
    edges = sobel(gray_image)
    # Compute histogram of edge intensities
    hist, _ = np.histogram(edges, bins=bins, range=(0, 1))
    return hist

# Compute histograms for all images
edge_histograms = []
for images in all_images:
    for img in images:
        hist = compute_edge_histogram(img)
        edge_histograms.append(hist)

# Convert to numpy array
edge_histograms = np.array(edge_histograms)

# Step 3: Perform PCA on the Histograms
# Standardize the data before PCA
scaler = StandardScaler()
edge_histograms_scaled = scaler.fit_transform(edge_histograms)

# Apply PCA to reduce to 2 dimensions
pca = PCA(n_components=2)
pca_result = pca.fit_transform(edge_histograms_scaled)
```

```
# Step 4: Plot the 2D Points with Different Colors for the Four Classes
# Assign colors to each class
colors = ['red', 'blue', 'green', 'orange']

# Create labels for each class (for coloring)
labels = []
for i, images in enumerate(all_images):
    labels += [i] * len(images)

# Convert labels to numpy array for easier handling
labels = np.array(labels)

# Plot PCA results
plt.figure(figsize=(10, 8))
for i, color in enumerate(colors):
    plt.scatter(pca_result[labels == i, 0], pca_result[labels == i, 1],␣
  ↪c=color, label=f'Class {i+1}', alpha=0.6)

plt.title('PCA of Edge Histograms from Four Classes')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.show()
```



```
[95]: from sklearn.feature_extraction.text import CountVectorizer
      corpus = [
          "And all the bullshit in your live ends and nothing will bother you ever␣
        ↪again.",
          "@COFFEECOWal Really Sad News, it's been a pleasure over the years, all the␣
        ↪best for the future.",
          "It's #NationalFrenchFryDay and I'm working at McDonald's.",
          "And the angel said unto them, Fear not: for, behold, I bring you good␣
        ↪tidings of great joy, which shall be to all people",
      ]
      vectorizer = CountVectorizer()
      X = vectorizer.fit_transform(corpus)
      print(vectorizer.get_feature_names_out())
```

```
['again' 'all' 'and' 'angel' 'at' 'be' 'been' 'behold' 'best' 'bother'
 'bring' 'bullshit' 'coffeecowal' 'ends' 'ever' 'fear' 'for' 'future'
 'good' 'great' 'in' 'it' 'joy' 'live' 'mcdonald' 'nationalfrenchfryday'
 'news' 'not' 'nothing' 'of' 'over' 'people' 'pleasure' 'really' 'sad'
 'said' 'shall' 'the' 'them' 'tidings' 'to' 'unto' 'which' 'will'
 'working' 'years' 'you' 'your']
```

[97]:

```
print(X.toarray())
print(X.shape)
```

```
[[1 1 2 0 0 0 0 0 0 1 0 1 0 1 1 0 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0
  0 1 0 0 0 0 0 1 0 0 1 1]
 [0 1 0 0 0 0 1 0 1 0 0 0 1 0 0 0 1 1 0 0 0 1 0 0 0 0 1 0 0 0 1 0 1 1 1 0
  0 3 0 0 0 0 0 0 0 1 0 0]
 [0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 1 0 0 0]
 [0 1 1 1 0 1 0 1 0 0 1 0 0 0 0 1 1 0 1 1 0 0 1 0 0 0 0 1 0 1 0 1 0 0 0 1
  1 1 1 1 1 1 1 0 0 0 1 0]]
(4, 48)
```

[99]:

```
from sklearn.feature_extraction.text import TfidfVectorizer
corpus = [
    "And all the bullshit in your live ends and nothing will bother you ever␣
 ↪again.",
    "@COFFEECOWal Really Sad News, it's been a pleasure over the years, all the␣
 ↪best for the future.",
    "It's #NationalFrenchFryDay and I'm working at McDonald's.",
    "And the angel said unto them, Fear not: for, behold, I bring you good␣
 ↪tidings of great joy, which shall be to all people",

]
vectorizer = TfidfVectorizer()
X = vectorizer.fit_transform(corpus)
print(vectorizer.get_feature_names_out())
```

```
['again' 'all' 'and' 'angel' 'at' 'be' 'been' 'behold' 'best' 'bother'
 'bring' 'bullshit' 'coffeecowal' 'ends' 'ever' 'fear' 'for' 'future'
 'good' 'great' 'in' 'it' 'joy' 'live' 'mcdonald' 'nationalfrenchfryday'
 'news' 'not' 'nothing' 'of' 'over' 'people' 'pleasure' 'really' 'sad'
 'said' 'shall' 'the' 'them' 'tidings' 'to' 'unto' 'which' 'will'
 'working' 'years' 'you' 'your']
```

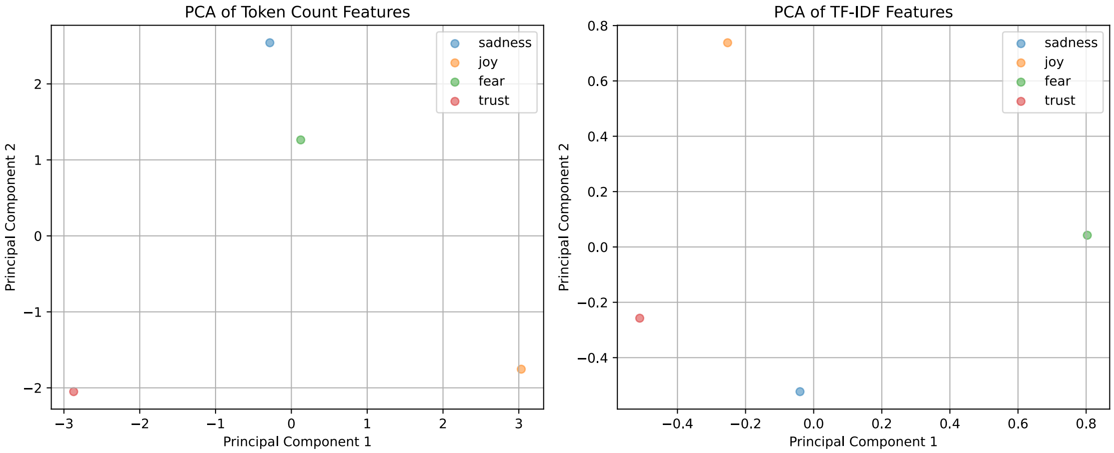
[101]:

```
print(X.shape)
```

```
(4, 48)
```

[103]:

```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer

# Step 1: Simulate processed text data
# Let's say we have the following classes (for example):
classes = ['sadness', 'joy', 'fear', 'trust']

# Simulated documents belonging to each class
documents = {
    'sadness': ["And all the bullshit in your live ends and nothing will bother␣
  ↪you ever again."],
    'joy': ["@COFFEECOWal Really Sad News, it's been a pleasure over the years,␣
  ↪all the best for the future."],
    'fear': ["It's #NationalFrenchFryDay and I'm working at McDonald's."],
    'trust': ["And the angel said unto them, Fear not: for, behold, I bring you␣
  ↪good tidings of great joy, which shall be to all people"]
}

# Flatten the document list and create corresponding labels
text_data = []
labels = []
for class_label in classes:
    text_data.extend(documents[class_label])
    labels.extend([class_label] * len(documents[class_label]))

# Step 2: Create token count features
count_vectorizer = CountVectorizer()
token_count_features = count_vectorizer.fit_transform(text_data).toarray()

# Step 3: Create TF-IDF features
tfidf_vectorizer = TfidfVectorizer()
tfidf_features = tfidf_vectorizer.fit_transform(text_data).toarray()


pca_count = PCA(n_components=2)
pca_result_count = pca_count.fit_transform(token_count_features)

# Step 5: Perform PCA for TF-IDF Features
pca_tfidf = PCA(n_components=2)
pca_result_tfidf = pca_tfidf.fit_transform(tfidf_features)

# Step 6: Plot the PCA results for Token Count Features
plt.figure(figsize=(12, 5))

plt.subplot(1, 2, 1)
for i, class_label in enumerate(classes):
    plt.scatter(pca_result_count[np.array(labels) == class_label, 0],
                pca_result_count[np.array(labels) == class_label, 1],
                label=class_label, alpha=0.5)

plt.title('PCA of Token Count Features')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.grid()

# Step 7: Plot the PCA results for TF-IDF Features
plt.subplot(1, 2, 2)
for i, class_label in enumerate(classes):
    plt.scatter(pca_result_tfidf[np.array(labels) == class_label, 0],
                pca_result_tfidf[np.array(labels) == class_label, 1],
                label=class_label, alpha=0.5)

plt.title('PCA of TF-IDF Features')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.grid()

plt.tight_layout()
plt.show()
```



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