

# CaseStudy2

December 8, 2024

## 1 Module 10: Unsupervised Learning

### 1.1 Case Study – 2

```
[22]: from PIL import Image
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans

# Load the image
image_path = 'dogs.jpeg'
image = Image.open(image_path)

# Display the image
plt.imshow(image)
plt.axis('off')
plt.title("Original Image")
plt.show()

# Convert image to numpy array
image_array = np.array(image)
print(f"Image dimensions: {image_array.shape}")
#image_array
```

Original Image



Image dimensions: (185, 272, 3)

```
[20]: # Reshape the image array into a 2D array
pixels = image_array.reshape(-1, 3)
print(f"Reshaped array dimensions: {pixels.shape}") # Each row is a pixel, and
↳ columns are RGB values.
pixels
```

Reshaped array dimensions: (50320, 3)

```
[20]: array([[240, 240, 240],
           [255, 255, 255],
           [255, 255, 255],
           ...,
           [254, 254, 254],
           [254, 254, 254],
           [254, 254, 254]], dtype=uint8)
```

```
[19]: # Perform K-Means clustering with k=3
kmeans = KMeans(n_clusters=3, random_state=42)
kmeans.fit(pixels)

# Get the cluster labels for each pixel
cluster_labels = kmeans.predict(pixels)
```

```

# Get the RGB values of the cluster centers (dominant colors)
dominant_colors = kmeans.cluster_centers_
print(f"Dominant Colors (RGB):\n{dominant_colors}")

cluster_labels

```

```

Dominant Colors (RGB):
[[210.76015962 175.26924017 144.33292613]
 [ 29.6021852   21.64834745  20.49647637]
 [251.68144507 247.85554317 243.32088569]]

```

```
[19]: array([2, 2, 2, ..., 2, 2, 2], dtype=int32)
```

```

[13]: # Replace each pixel's color with its cluster center (dominant color)
segmented_image = dominant_colors[cluster_labels].reshape(image_array.shape)

# Convert the segmented image array to uint8 (image format)
segmented_image = segmented_image.astype('uint8')

# Display the segmented image
plt.figure(figsize=(10, 6))
plt.imshow(segmented_image)
plt.axis('off')
plt.title("Segmented Image with 3 Dominant Colors")
plt.show()

#print(segmented_image)

```

Segmented Image with 3 Dominant Colors



Dominant Colors: RGB (210, 175, 144): corresponds to the beige fur of the light-colored dog. RGB (29, 21, 20): corresponds to the black fur of the dark-colored dog. RGB (251, 247, 243): represents the background or lighter parts of the image.

Segmented Image: The segmentation groups the pixels into the 3 dominant color regions, simplifying the image into distinct areas based on the clustering. Key Steps Recap: The image was converted into a 2D pixel array for processing. K-Means clustering was used with  $k=3$  to identify 3 clusters, corresponding to the dominant colors. Each pixel was assigned to its cluster's representative color, resulting in the segmented image.

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