

Image Compression Albums

1. Architecture (23)

Stylistic Traits

- Main subject (building/structure) centered or symmetrically framed
- Background commonly a clear blue sky
- Typically 3–7 dominant colors (sky, building material, shadows, accents)
- Strong straight edges, high contrast boundaries
- Color regions often large and uniform

Why It's Good for K-Means Analysis:

Easy to see how color quantization handles flat backgrounds and structural patterns.

2. Landscapes (Forests, Mountains, Fields) (23)

Stylistic Traits

- Gradual transitions in color (ex: greens → browns, distant haze)
- High texture variation (leaves, grass, rocks)
- Often wide color palettes (15–30 visible tones)
- Light changes across depth create subtle gradients
- No single main subject—broad scenes

Why It's Good for K-Means Analysis:

Lets you evaluate how k-means handles color gradients and high-texture variation.

3. Urban Street Scenes (23)

Stylistic Traits

- Multiple objects: cars, people, signs, buildings
- High contrast, sharp edges, many small color patches
- Often busy scenes with complex geometry
- Large color diversity (20+ distinct visible colors)
- Non-uniform lighting (shadows, reflections)

Why It's Good for K-Means Analysis:

Tests k-means on fragmented color regions and mixed lighting, which are usually difficult cases.

4. Portraits (25)

Stylistic Traits

- Clear main subject: human face/body
- Background often blurred or uniform
- Skin tones dominate; low color diversity (5–10 key colors)
- Smooth gradients in skin, hair, and shadows
- Strong focus on fine features (eyes, hair texture)

Why It's Good for K-Means Analysis:

- Shows how k-means performs on smooth gradients and delicate textures (hair, skin tones).
- Good for seeing where compression creates artificial banding.

5. Still Life / Product Photography (25)

Stylistic Traits

- Clean composition with a few objects
- Uniform or lightly shaded background (ex: white, beige, black)
- Usually 3–8 dominant colors
- High clarity, strong shadows, crisp edges
- Controlled lighting

Why It's Good for K-Means Analysis:

Easy to evaluate color fidelity and edge preservation, making it ideal for measuring quantization error.

Project Main Idea: Classifying image compression difficulty using K-Means + supervised learning.

Aside from compressing images using k-means clustering, we will turn compression into a prediction problem. We are using k-means clustering to compress images, measure how much quality is lost, and then use a supervised model to predict which images are easy or hard to compress.

Unsupervised Method: K-means

We will apply K-means to each image with different values of k (example: 4, 8, 16, 32).

Then, for each image, we compute metrics such as compression error (MSE/MAE between original and compressed) and number of unique colors before compression.

Supervised Method: Classification or Regression

After we compute metrics for our images, we will create some kind of dataset like:

image_id	category	entropy	num_colors	edge_density	mse_k8	mse_k16	label_easy_or_hard
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From this dataset, we can either:

- Predict whether an image is easy or hard to compress (binary classification).
or
- Predict the expected compression error (MSE) for a given image based on its complexity features.

Potential add-ons:

Train a supervised model that predicts the best k (4, 8, 16, or 32) for a given image based on its features.