Daulet Baimukashev

Project 1. Photographic mosaic

Phase 1. Dataset Generation

1. Creating the Dataset from videos.
   Initially, multiple videos were downloaded from the Youtube. The two main theme of the videos are natural scene and animation films. The reason is that they contain more colourful content of different scenes. The typical search keywords are “animation films hd”, “beautiful nature scene” and so on. Only short videos in HD were selected because they have more dynamic capture.
2. Then, using the software ImageGrab, the images from the videos were created at some interval. The time interval were adjusted depending on video, usually of 3-4 seconds. After this step, **2667** images were generated.
3. As videos were selected automatically, there were many images that capture similar scene. For selecting the images, histogram analysis is used. Histogram represents the distribution of the pixels for intensity range. Therefore, every two consecutive images were selected and their histogram graphs were compared, and depending on the value of the adjusted threshold, the images that have not similar histogram were selected for the dataset. Using only two consecutive images and shifting the choice every time reduces the calculation, and is applicable as similar scene are usually captured in sequence. After this step, **1775** images left.
4. Later, for mosaic creation, as average mean value is used, the next step was to pre calculate the average color of the images from the dataset. This step had major two benefits. First, This reduces the calculation further, as it is not required to calculate the average color of the image. The average color i.e average of R,G,B intensity is pre calculated and saved as the “name” of the image. Secondly, it reduced the dataset to around **1400**, as only one image from set of images with equal average values is selected. For example, there was several dark images with nearly the same average value.
5. In this method of using the average value, the tiles (images from the dataset) are reduced to the single color and replaced to the part of the original image. This means it is preferable to have the image with more uniform color than that of random. This has two negative impacts. First, the image with not uniform color gives the false average value and it distorts the main image. For example, the image covered with green in 70 percent and 30 percent with black, even if from the average value it is considered as green, and put to the main image, the black part may distort the image. But having more uniform images can improve the results (Appendix 1). After this step, only **671** images left.
6. The dataset with 671 images were generated and each image saved with its average mean color.

Phase 2. Mosaic creation

a) Rectangular

1. Initially, the rectangular patch is used. Given the size of the patch, the main image is divided into patches of this size.
2. For each patch average color is calculated. For that, for each channel of RGB, the intensity of the pixels were summed together and divided by the size of the patch.
3. The tile images have their name in the following manner: “002_005_162.jpg”. Here, values 2, 5 and 162 corresponds to the average value of the R, G, and B channel.
4. Then, for each patch, the average value of RGB channels were compared to that of tile images, by taking the square root of the sum of the differences.

   Error = $\sqrt{(Rmain - Rtile)^2 + (Gmain - Gtile)^2 + (Bmain - Btile)^2}$

   At every step of the loop, the error was replaced with minimum error and the image with less error was tracked.
5. After that, tile image with less error was replaced to the patch of the main image.
6. These steps (2-5) are repeated for all patches.

b) Parallelogram

1. For parallelogram, similar approach is used as for rectangular. Only the shape is different.
2. Average value calculation, the error tracking and tile image selection is similar to that of the rectangular
3. The difference is that when creating the main image, first the new image with a larger size than the original image, i.e. the length is larger. This is due to the fact that when using the parallelogram, to cover the whole image the some part of the parallelogram will be outside of the original image size. Then, these parts will be cropped.

Phase 3. Results

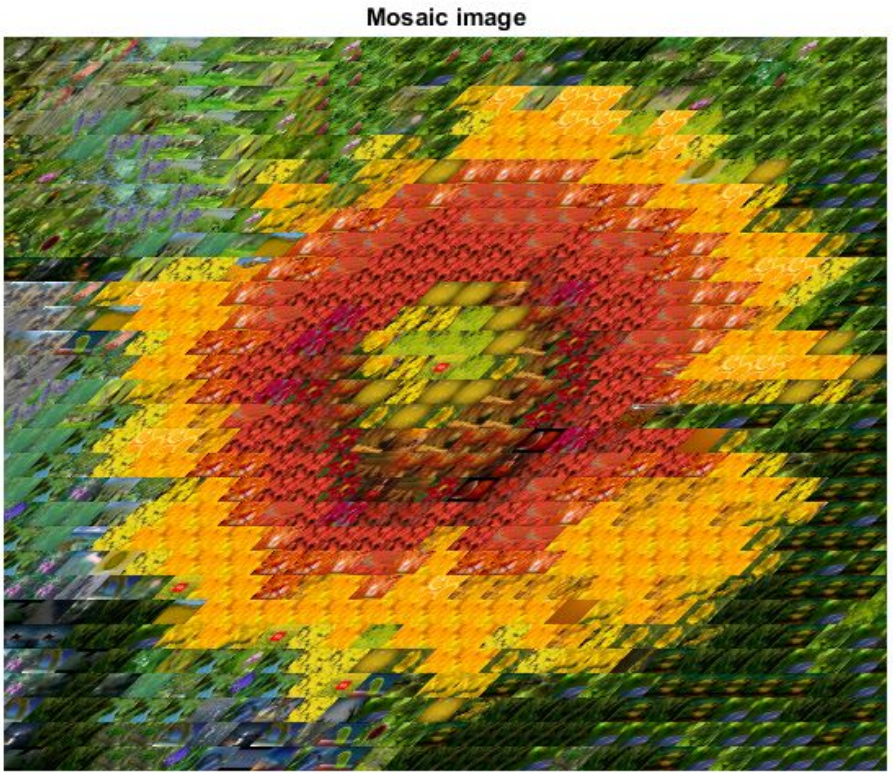
The results are presented below for a patch 15*20. The average time for execution is 3.8 minues. Three images were tested for rectangular and parallelogram patches. The latter one has better performance.

1. Flower

Main image

Mosaic image

Rectangular patch

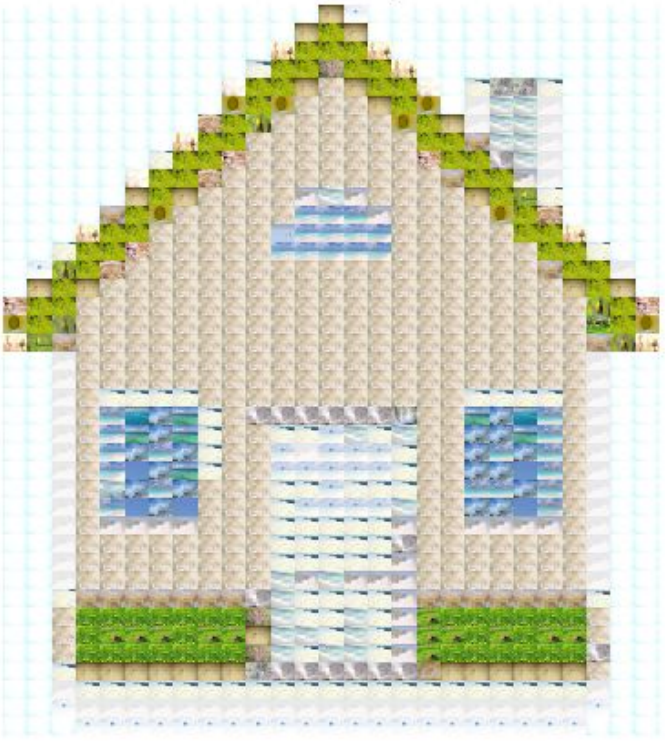


Parallelogram patch

2. House

Main image

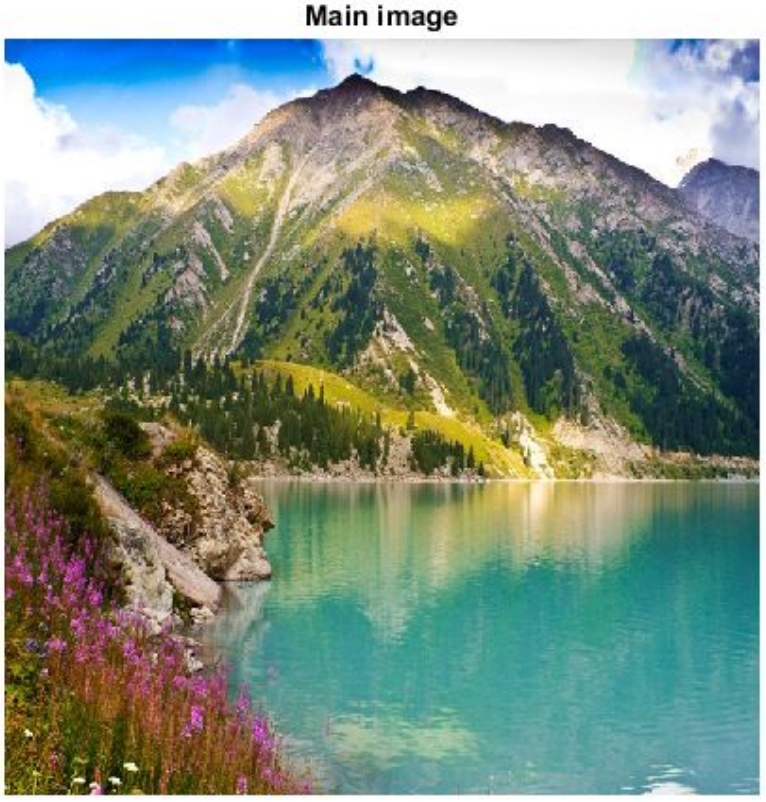
Mosaic image

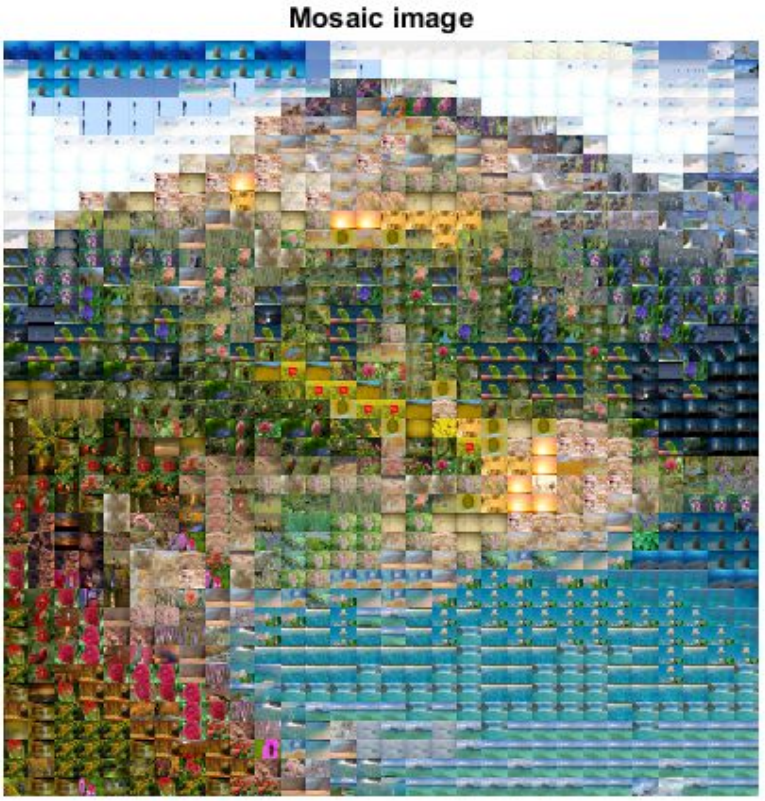


Rectangular patch

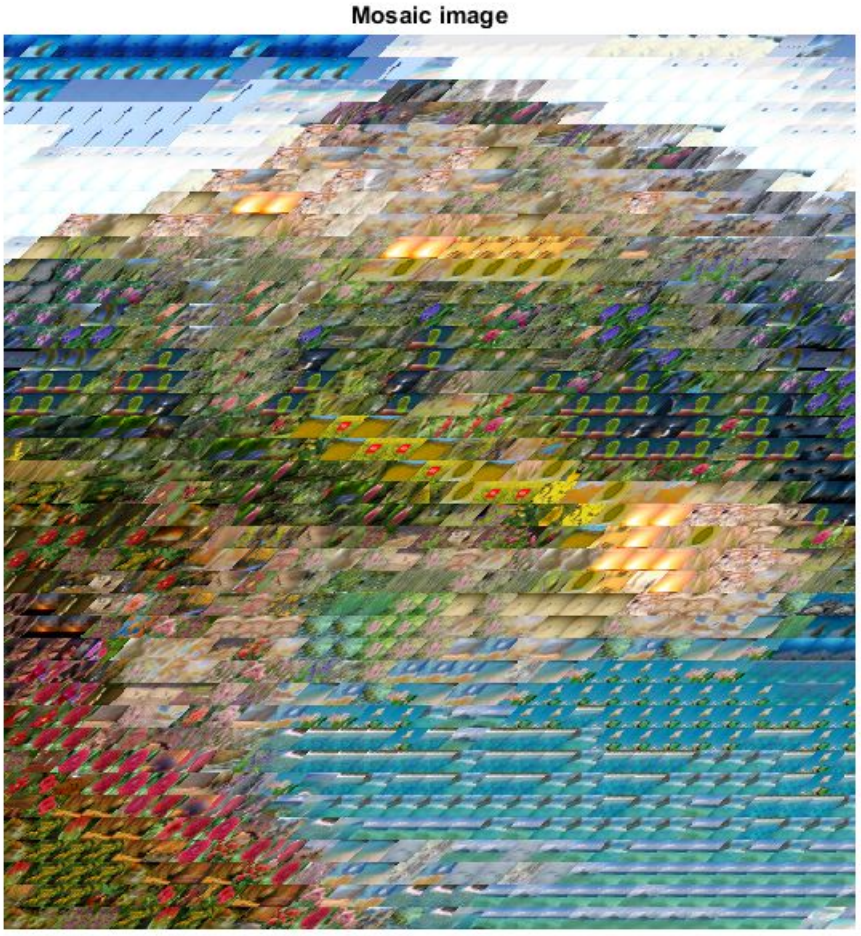
Parallelogram patch

3. Almaty





Rectangular patch



Parallelogram patch

Appendix 1.
The difference of two datasets with and without implementation of standard deviation filtering. With filtering, the figure is more smooth as shown below

Without filtering.

With filtering.