

Generating Low-Poly Representations of Images Using K-Means Clustering

Yifan Ruan and David Young

Motivation

Our goal is to create an accessible tool for generating high-quality, low-poly representations of images.

The typical approach when compute is limited is to perform edge detection and then triangulate based on a random selection of edge points.

- We want a tool that:
- Runs quickly (efficient)
 - Produces high-quality, low-poly representations (performant)
 - Requires little compute (accessible)

The Problem

Consider the typical approach (edge detection + triangulation):

Pros

- Efficient
- Lightweight

Cons

- Significant information loss (many feature points that aren't meaningful)



Observe how the smaller buildings are lost in the low-poly version

Goal

Our goal is to extend the typical implementation such that:

- Computational costs are still low
- Polygonization still runs quickly
- More information from the original image is preserved in the triangulation



The Solution

In our implementation, we use k-means clustering to improve semantic encoding prior to triangulation.

We cluster based on six attributes per pixel:

- x position
- y position
- value of first color channel
- value of second color channel
- value of third color channel
- intensity of pixel

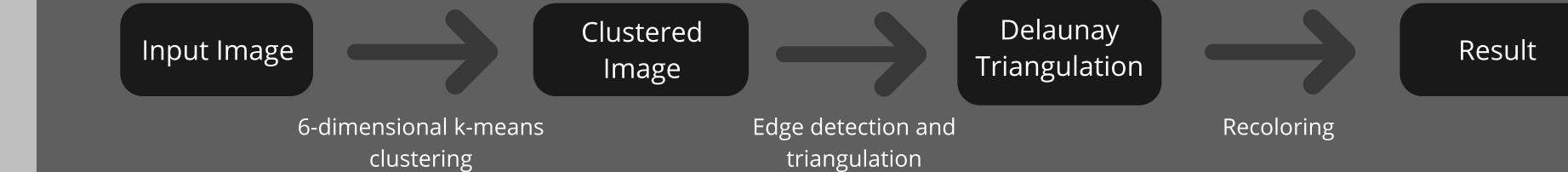
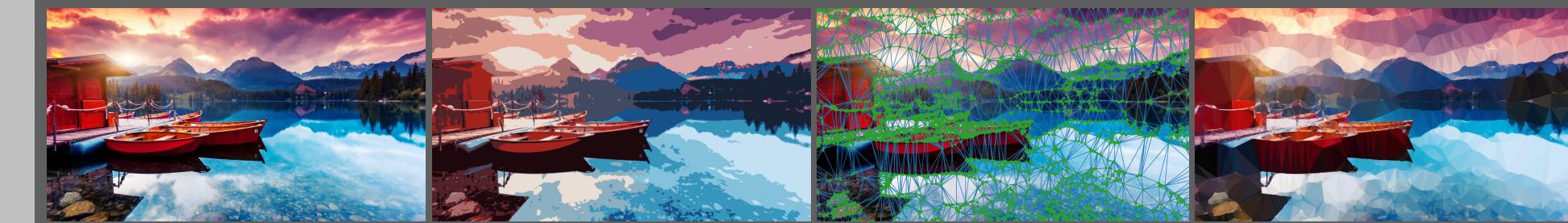


We then perform edge detection on the segmented image, giving us cleaner and more meaningful segmentations when we finally perform triangulation due to the homogeneity of each cluster that our K-Means algorithm generated.

Notice how there are no edges within buildings in the figure to the right.



Overview of Pipeline



Results



References

- [1] Rohit Mohan and Abhinav Valada. Efficientps: Efficient panoptic segmentation. CoRR, abs/2004.02307, 2020.
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- [3] Wenli Zhang, Shuangjiu Xiao, and Xin Shi. Low-poly style image and video processing. In 2015 International Conference on Systems, Signals and Image Processing (IWSSIP), pages 97–100, 2015.
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