

A HYBRID APPROACH FOR IMAGE VECTORIZATION FOR SEMI-GEOMETRIC IMAGES

Jonathan Lam, Derek Lee, Victor Zhang

Prof. Sam Keene
The Cooper Union for the Advancement of Science and Art

Abstract

Vector (shape-based) images are a useful image representation that may be more efficient than traditional raster (pixel-based) formats. Our project aims to develop an image vectorization method (a tool to convert from raster to vector format) specialized towards geometric images, combining the benefits of edge tracing and sampling methods.

Proposed Methods

A raster image is first sampled using blue noise sampling (BNS) [4], which generates a point cloud with variable density. This point cloud is simplified using the quadric error metric (QEM) [2]. We also run the image through multiple color scans using the Potrace edge tracing algorithm [3]. We improve edges in the mesh using the Potrace paths and edge detection methods, and then triangulate the point cloud. We evaluate the accuracy of the generated image using MSE, file size, and content loss [1].

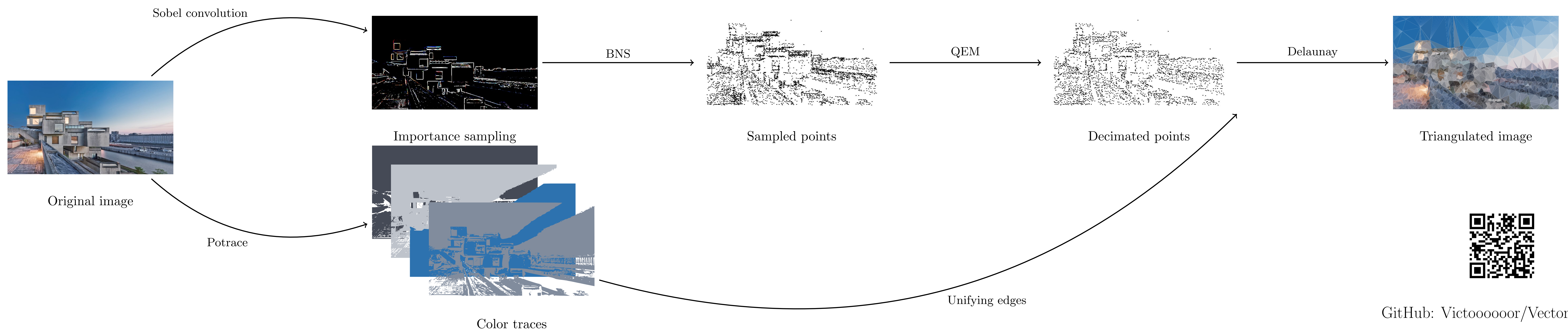
Conclusions

We have implemented a basic framework for vectorizing raster images, primarily based on blue-noise sampling [4] and Potrace [3]. Our proposed framework involves performing blue-noise sampling on an image, merging sampled points with the Potrace output, triangulation, and exporting to an SVG file. While this method currently does not generate a highly efficient representation, it performs better than BNS and Potrace on some metrics, particularly accuracy. Our method is able to both handle gradient patches better than Potrace, and represent edges better than blue-noise sampling. There is much future work remaining to further tune this model for efficiency.

References

- [1] Vincent Dumoulin, Jonathon Shlens, and Manjunath Kudlur. *A Learned Representation For Artistic Style*. 2017. arXiv: [1610.07629 \[cs.CV\]](#).
- [2] Hugues Hoppe. “New quadric metric for simplifying meshes with appearance attributes”. In: *Proceedings Visualization’99 (Cat. No. 99CB37067)*. IEEE. 1999, pp. 59–510.
- [3] Peter Selinger. “Potrace: a polygon-based tracing algorithm”. In: *Potrace (online)*, <http://potrace.sourceforge.net/potrace.pdf> (2009-07-01) 2 (2003).
- [4] Jiaojiao Zhao, Jie Feng, and Bingfeng Zhou. “Image vectorization using blue-noise sampling”. In: *Imaging and Printing in a Web 2.0 World IV*. Vol. 8664. International Society for Optics and Photonics. 2013, 86640H.

Diagram of Proposed Methods



Results

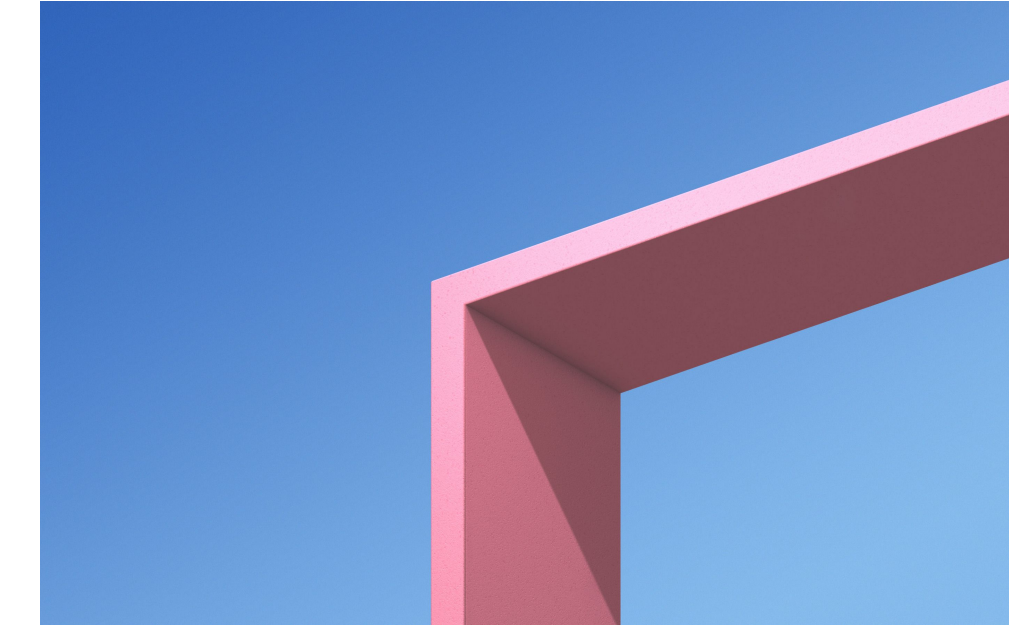


Figure 1: Original image



Figure 2: BNS image

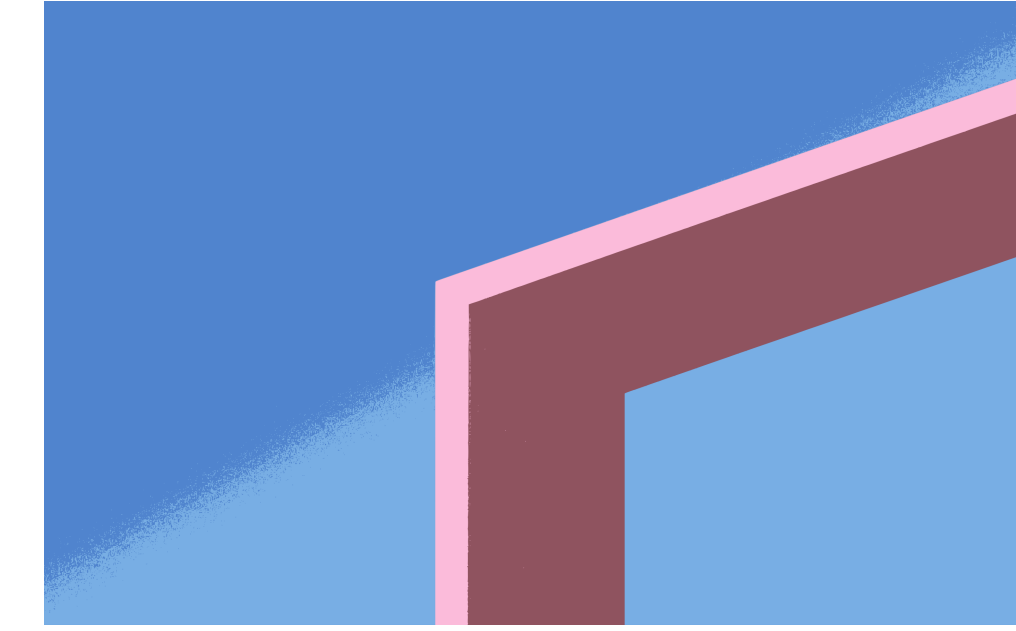


Figure 3: Potrace image

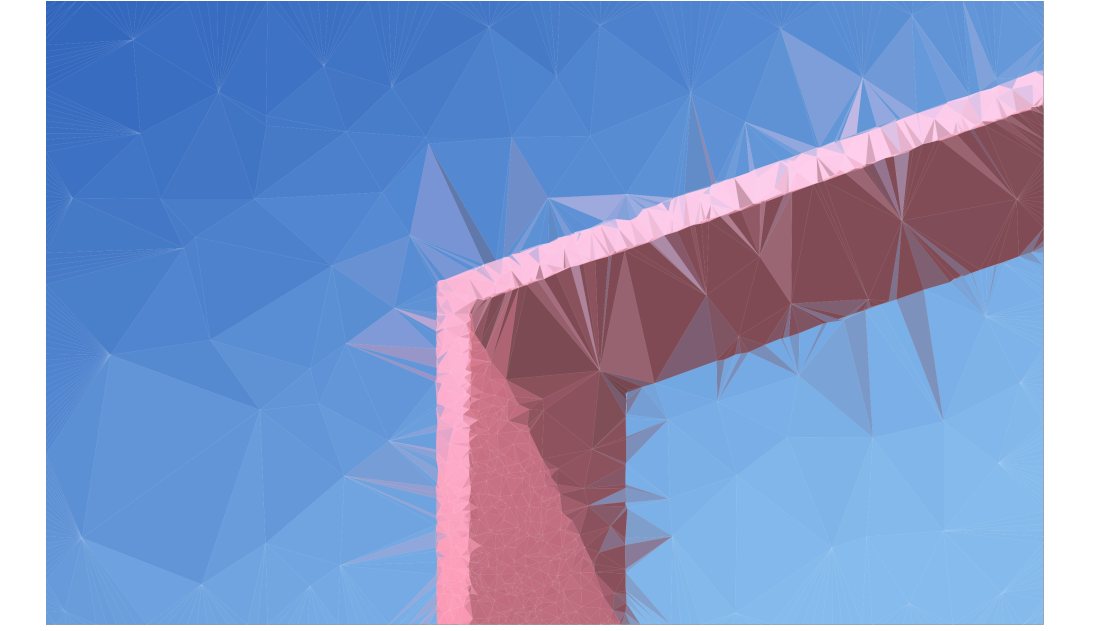


Figure 4: Hybrid image



Figure 5: Original image

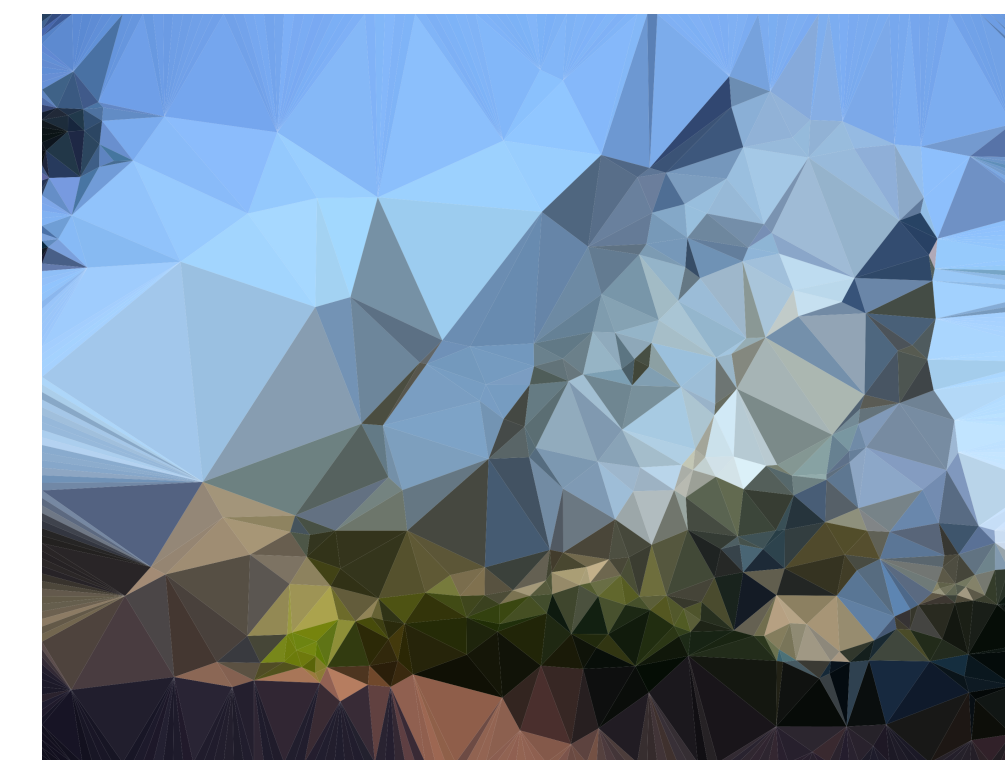


Figure 6: BNS image

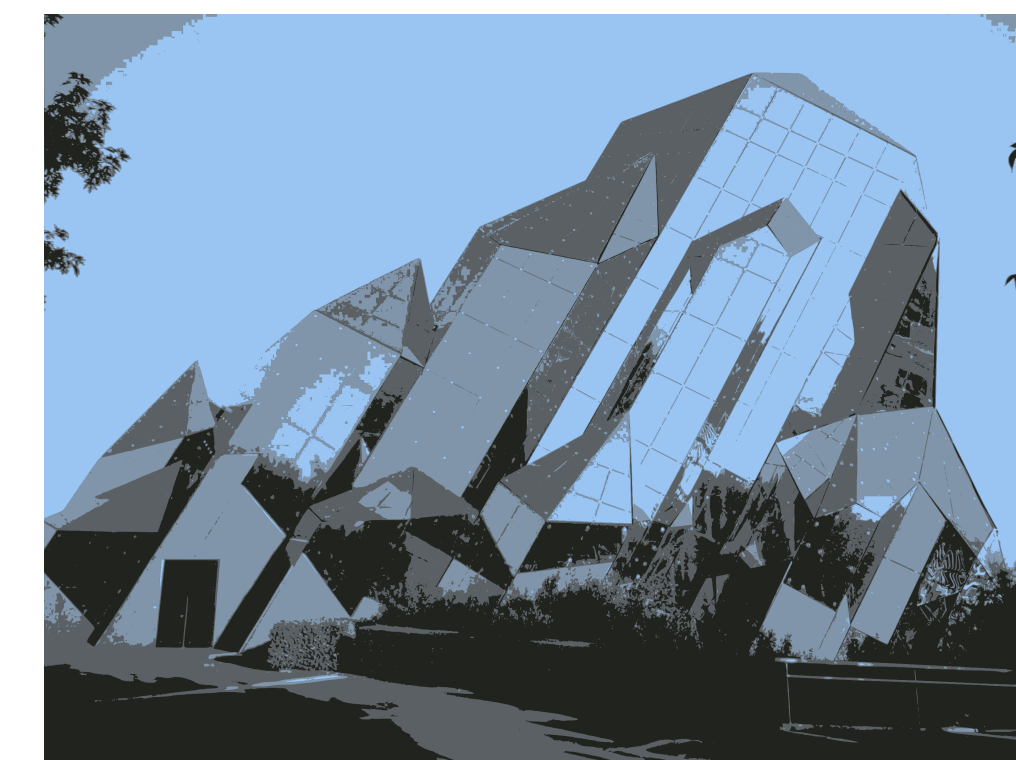


Figure 7: Potrace image

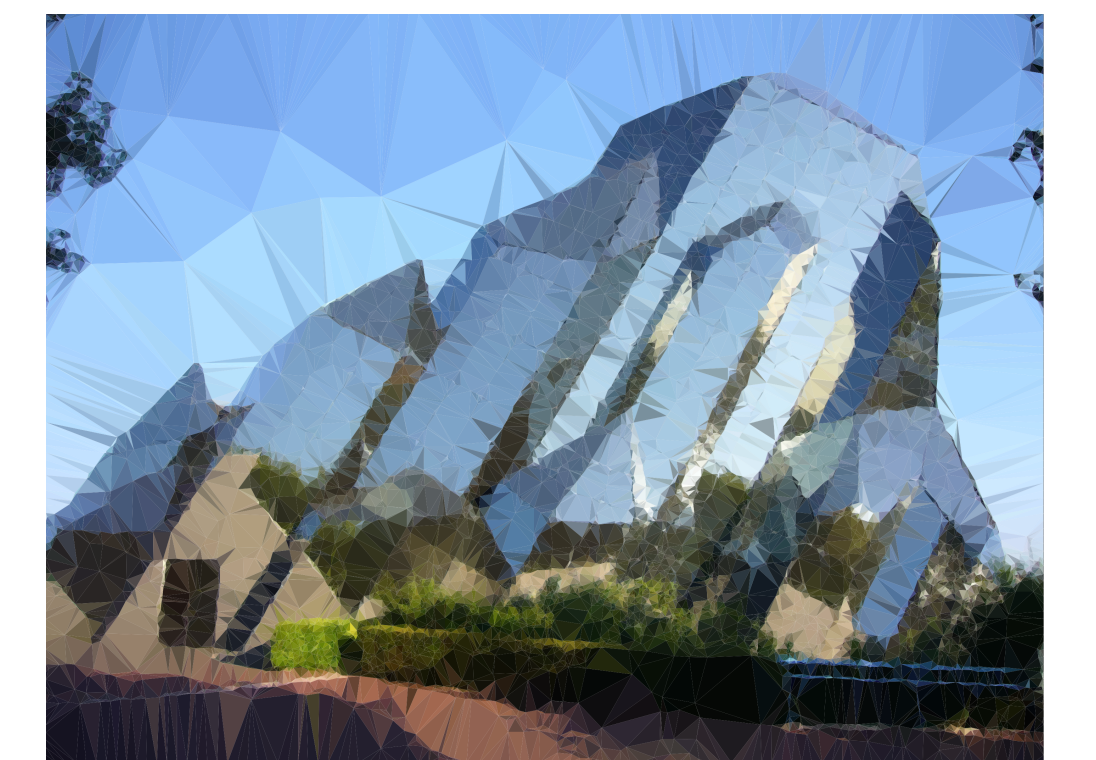


Figure 8: Hybrid image



Figure 9: Original image

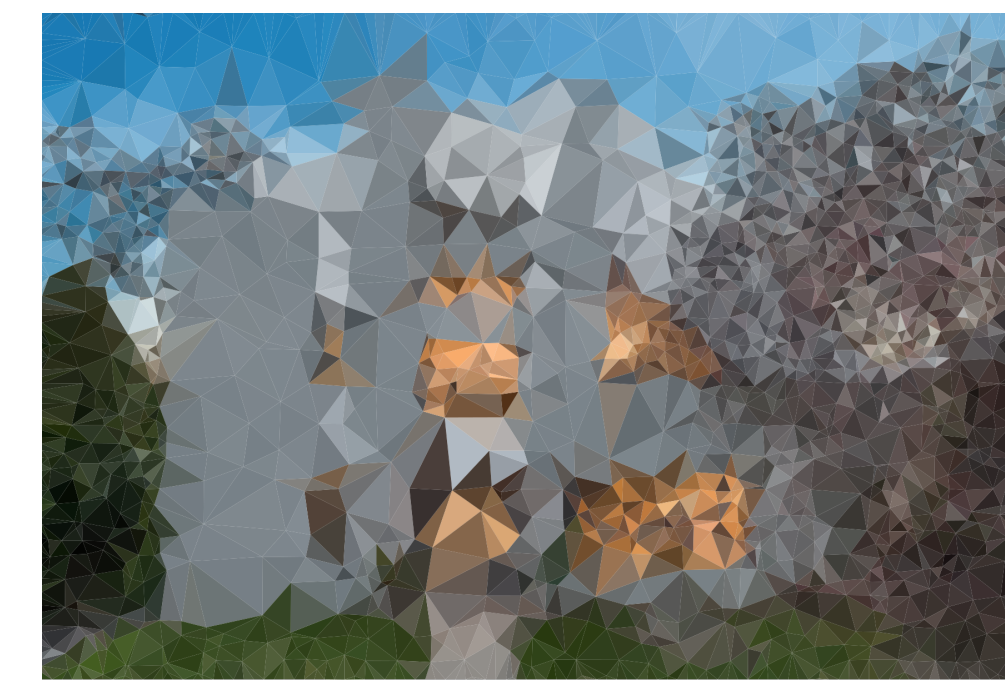


Figure 10: BNS image



Figure 11: Potrace image



Figure 12: Hybrid image

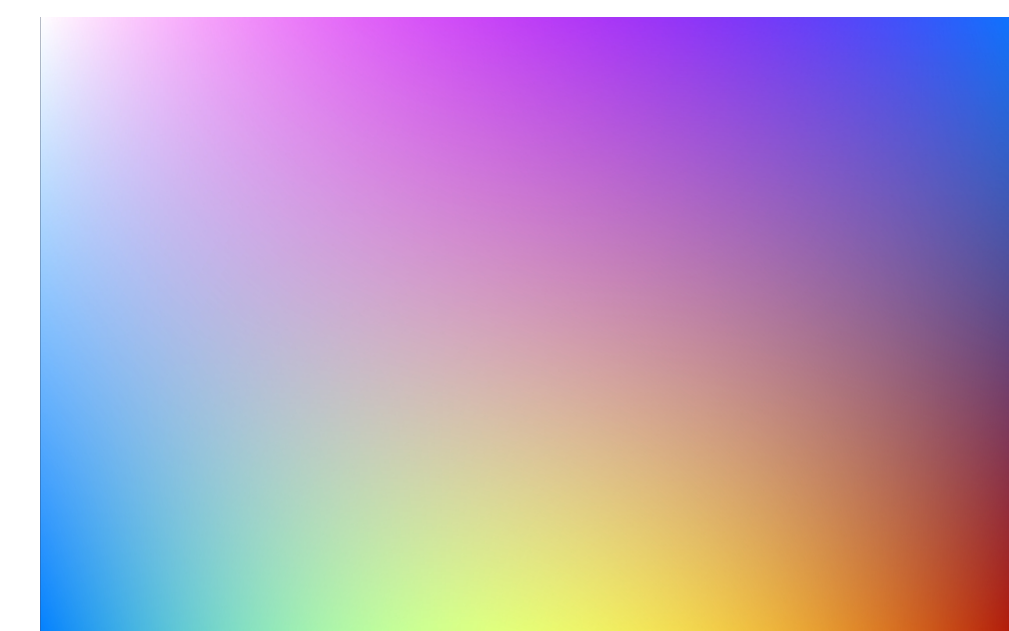


Figure 13: Original image

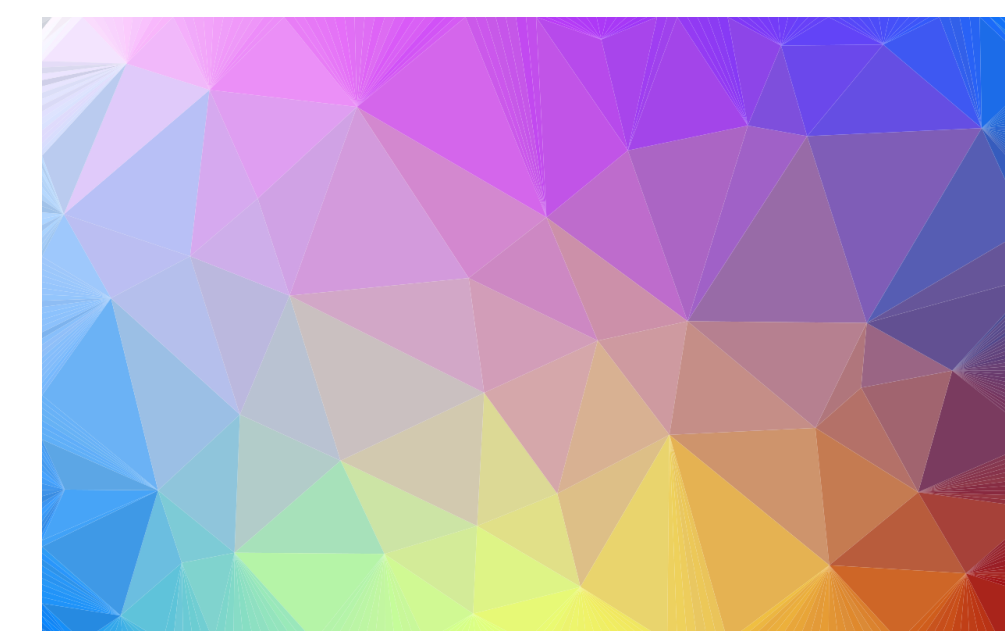


Figure 14: BNS image



Figure 15: Potrace image

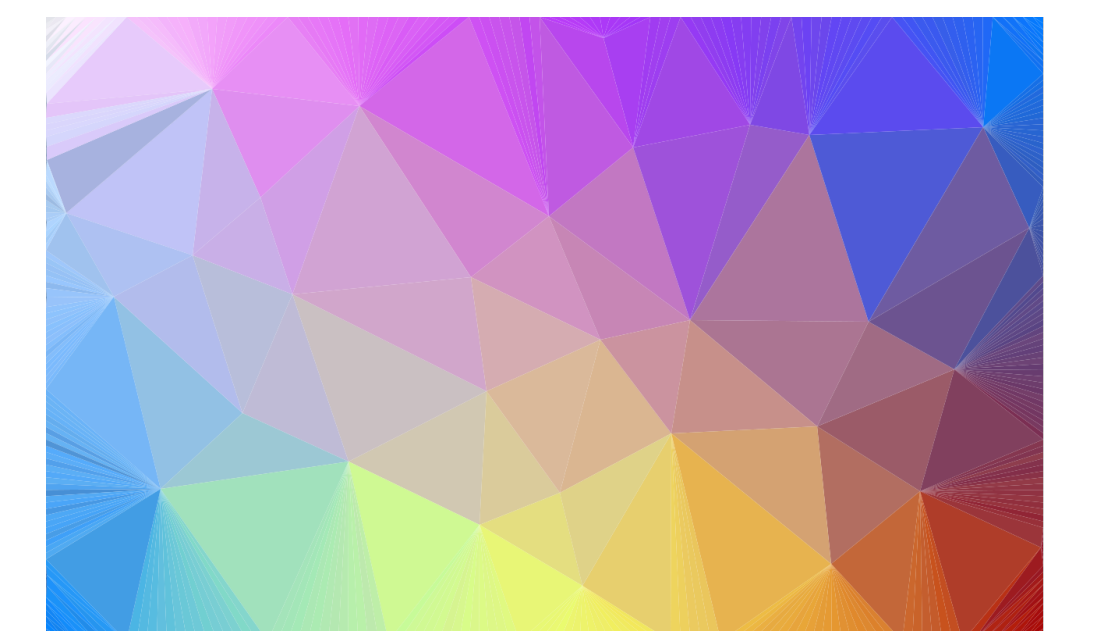


Figure 16: Hybrid image