Image Vectorization for Architecture

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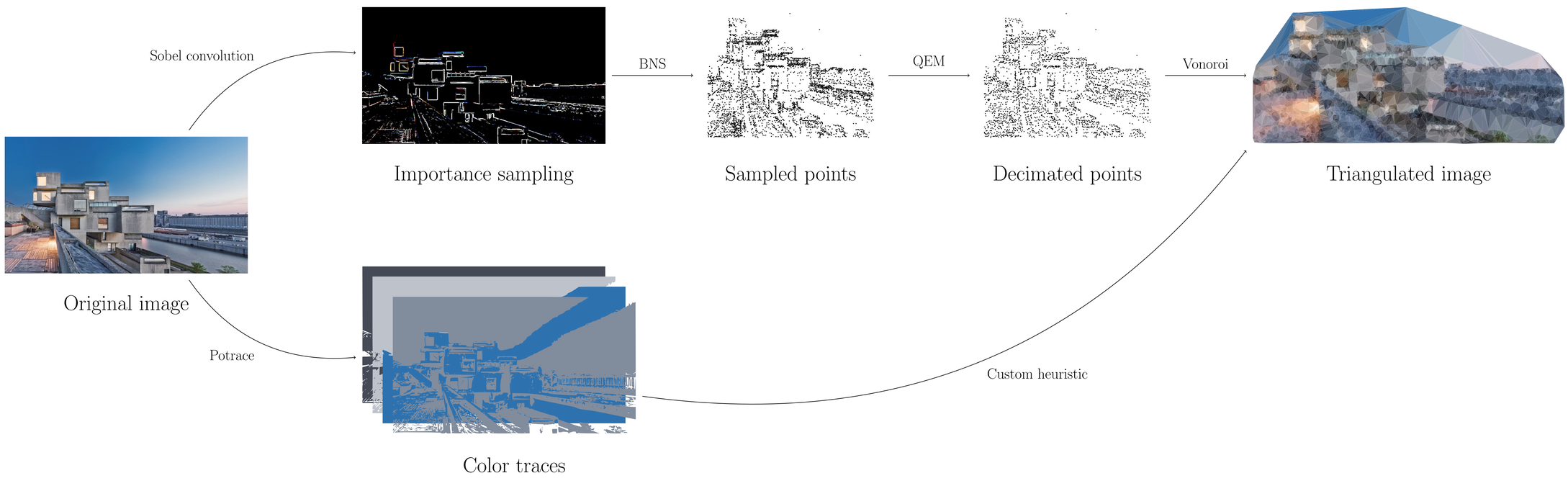
Abstract

Vector (shape-based) images are a useful image representation that may be more efficient than traditional raster (pixel-besed) formats. Our project aims to develop a image vectorization method (a tool to convert from raster to vector format) specialized towards architecture images (or other highly-geometric images), and explores the potential of vector-based images in the architecture design process and as machine learning preprocessing.

Algorithm/Architecture

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]. Then the point cloud is vectorized using a triangulation method and the edges are improved using the Potrace scans, and is outputted to a SVG format. We evaluate the accuracy of the generated image using content loss [1].



Sample Images

Fig. 1: Original image

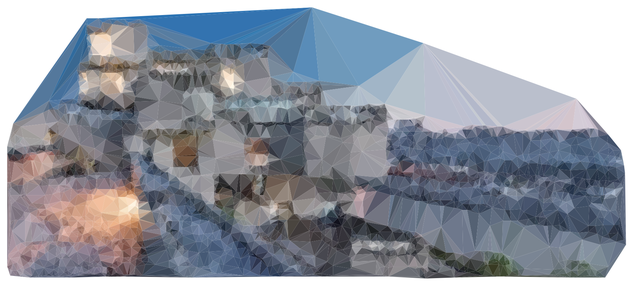


Fig. 2: Vectorized image

Fig. 3: Original image

Fig. 4: Vectorized image

Future Work

For the next iteration of our project, we need to combine our sampled points with the Potrace algorithm, which should improve the quality of edges on the final result. This will likely involve heuristic methods that directs mesh vectorization using the Potrace curves. The end goal is to improve the heuristics well enough to produce edges that resemble architectural line drawings.

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.

GitHub: Victooooooor/Vectorize-Arch