Applications of Fourier Transformations in classification

Julian Ewaied 2023 – Research Report

# Fourier transformations

Fourier transformations are a set of rules which allow us to convert any periodic function into an infinite set of pairs and vice-versa, such that

Notice that:

Therefore, given a continuous function , we can get the coefficients for each with a simple integration.

In this report I will be demonstrating a key application of this method, by transforming an image into a function , then using the Fourier coefficients as features for face recognition.

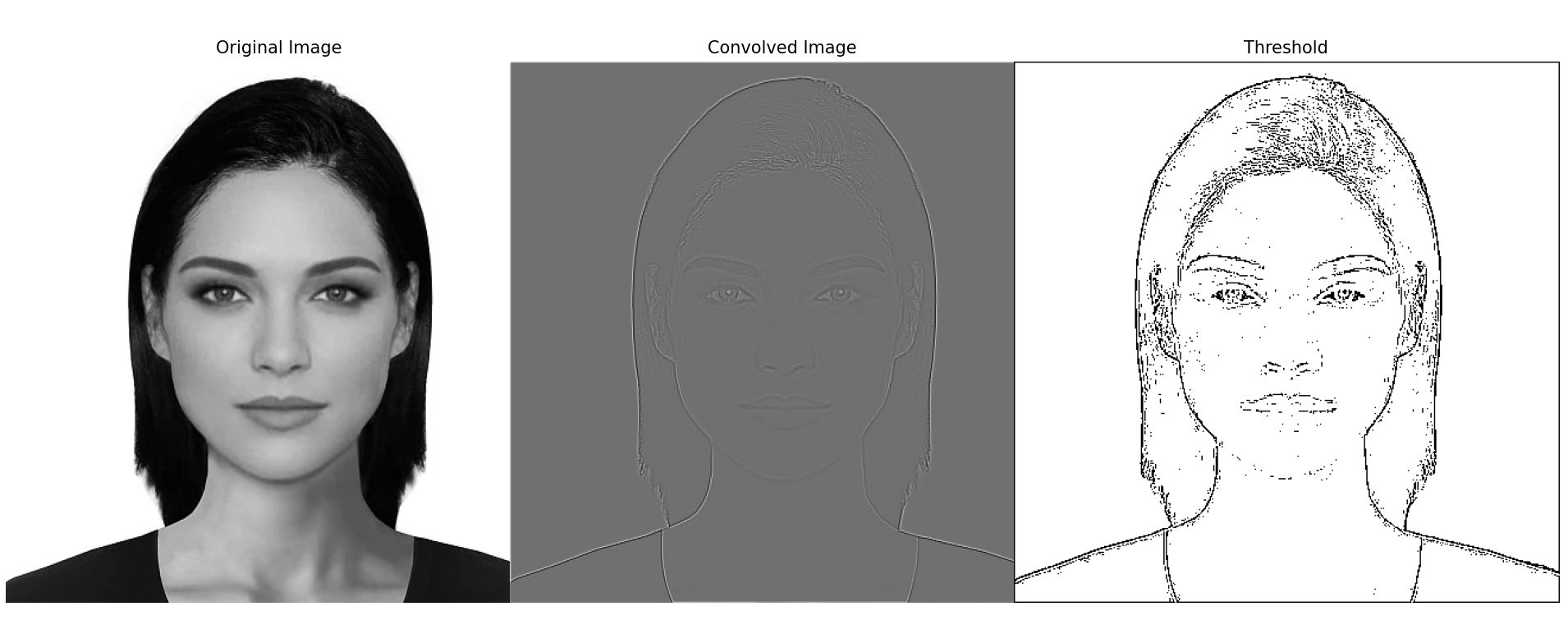
# Converting Images Into Functions

## thresholding images

First of all, we will be using a kernel convolution to get the contrast line. This could be done with the following convolution:

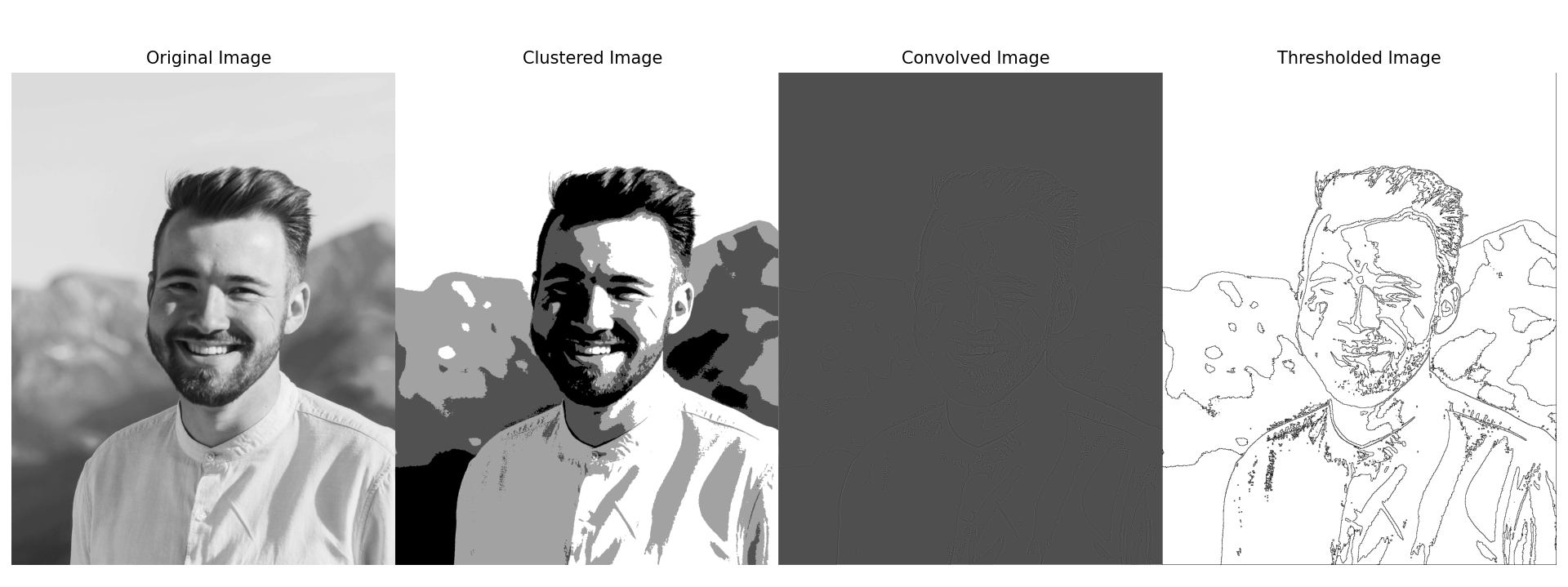
Notice that when the colors are close near a pixel, it becomes white (almost 0), and when it has some color difference, it will become non-zero.

Here's an example of using this kernel, which was amplified by using a threshold

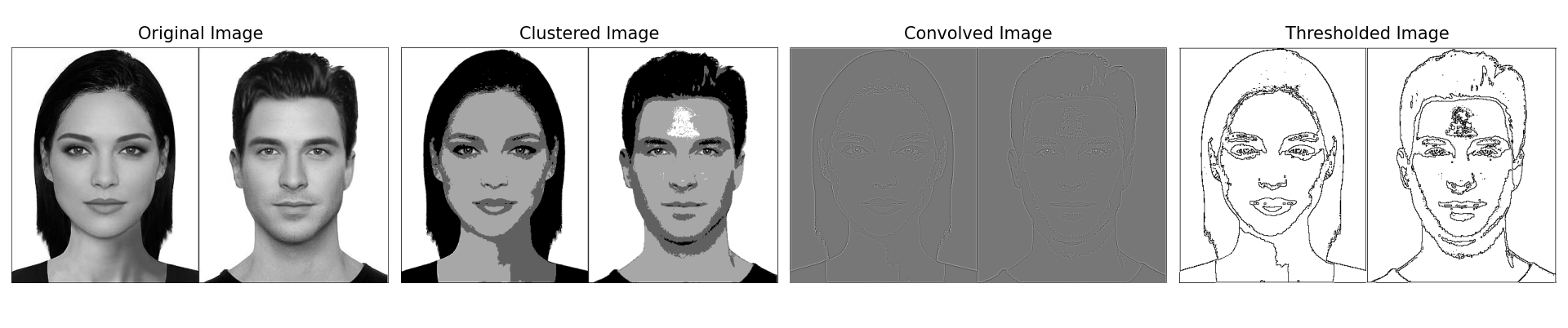


Figure

To ensure cleaner images, we could cluster the image colors using k-means algorithm, using k=4 we could ensure better results. Here are some examples:



Figure



Figure

Now that we have a binary image, we can convert it into a function . We will be sampling black points from the image, and connecting them in way that ensures that the function consists of convex layers of points.

We will want a sort of spiral function, meaning,

For some function . A possible suggestion is:

Since we are working with discrete points, we will be approximating the integral with a sum:

Where .