

Page Scanner App

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Purpose

This app would allow users to make “scanned” copies of their documents using the built-in camera.

The app is composed of several important parts:

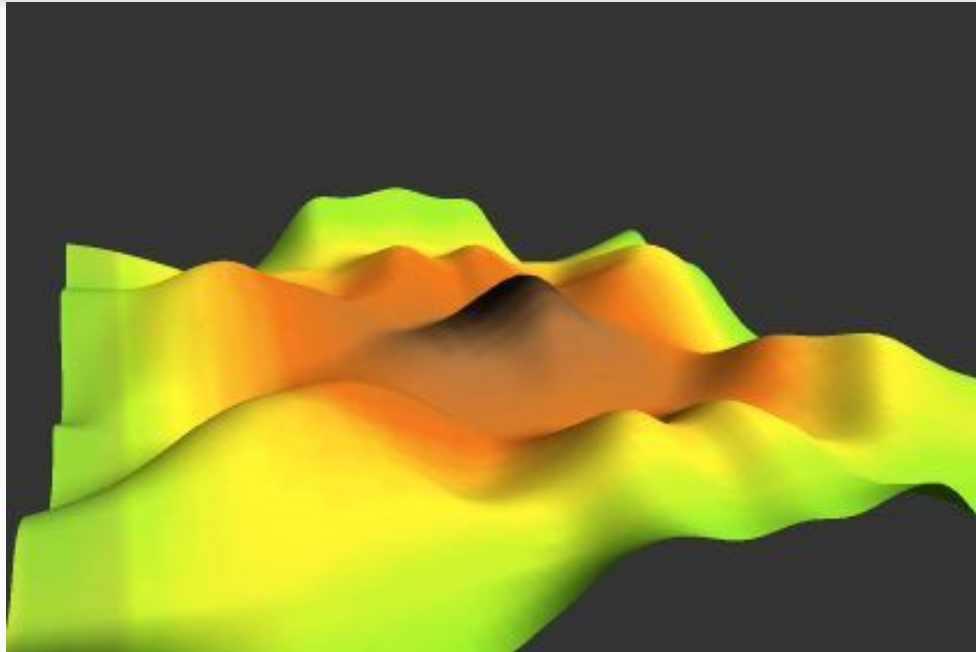
- An edge detection algorithm (Canny Edge Detection)
- A line detection algorithm (Hough Transform)
- An affine transformation algorithm (that I created)

Canny Edge Detection

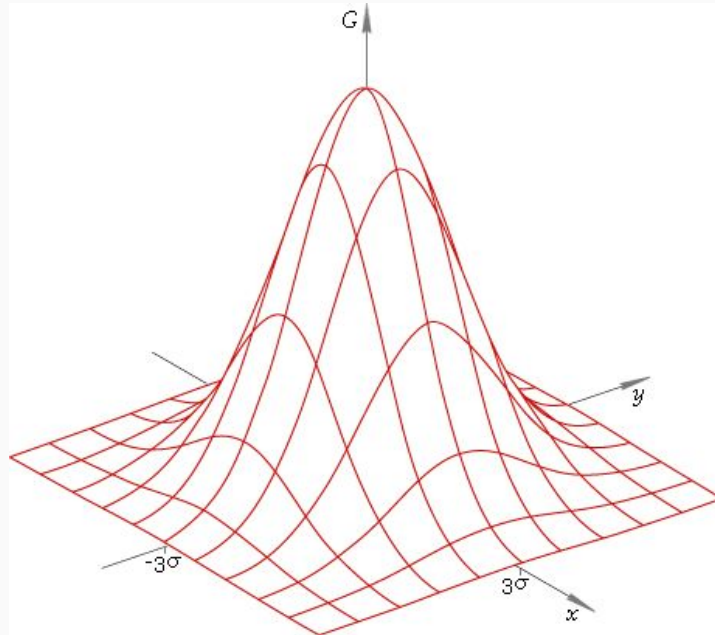
This algorithm is broken down into the following steps:

1. Convert image to grayscale
2. Apply a gaussian blur
3. Calculate the intensity gradient
4. Apply non-maximum suppression
5. Apply double threshold

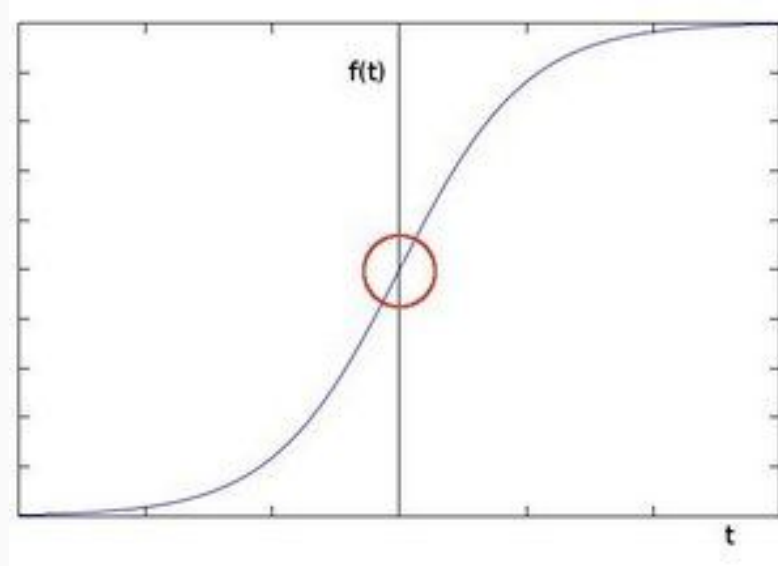
An image is a **surface** in 3D - the height at any point corresponds to its grayscale value



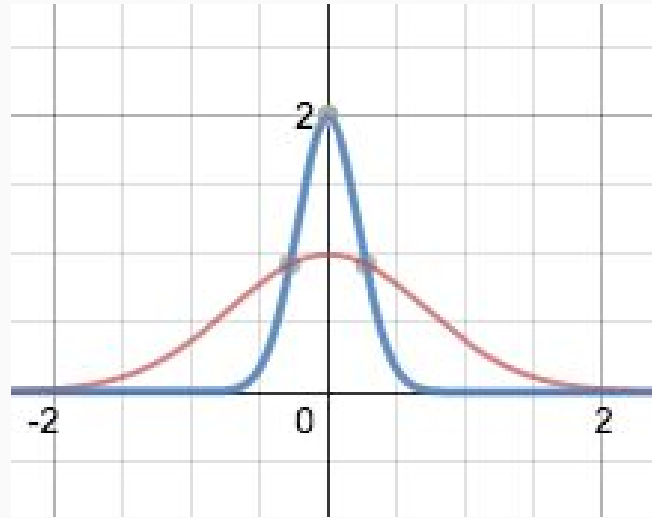
The **Gaussian blur** takes a weighted average of every point and its neighbors



The **intensity gradient** finds inflection points in the image, where the color between neighboring points rapidly changes.

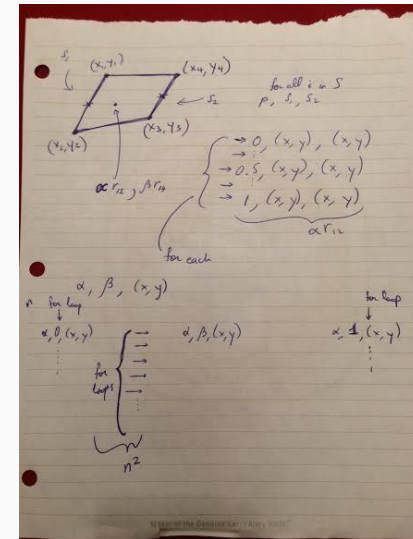
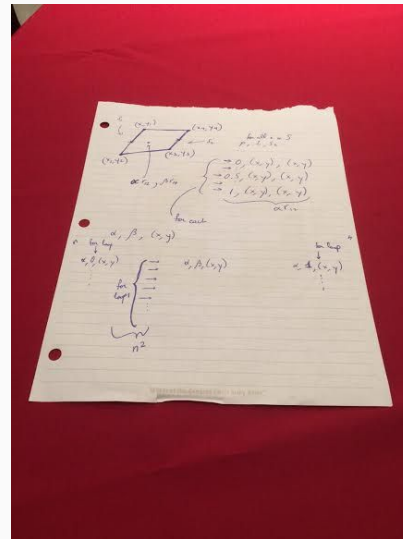
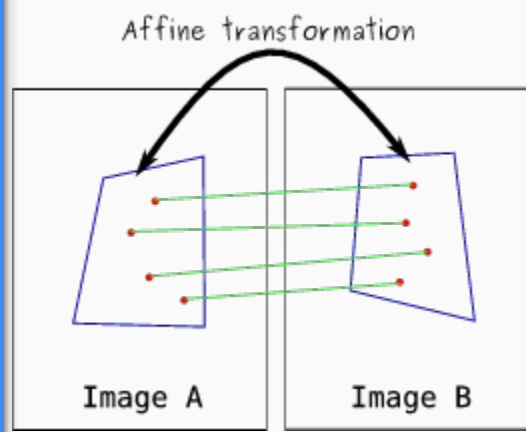


Non-maximum suppression mutes all points except the peaks - where the color change is greatest



Affine Transform

Affine transforms are used to map points from one shape onto another.



Affine Transform Algorithm

Each shape can be represented by a matrix of points, and two different shapes can be related through their corresponding matrices.

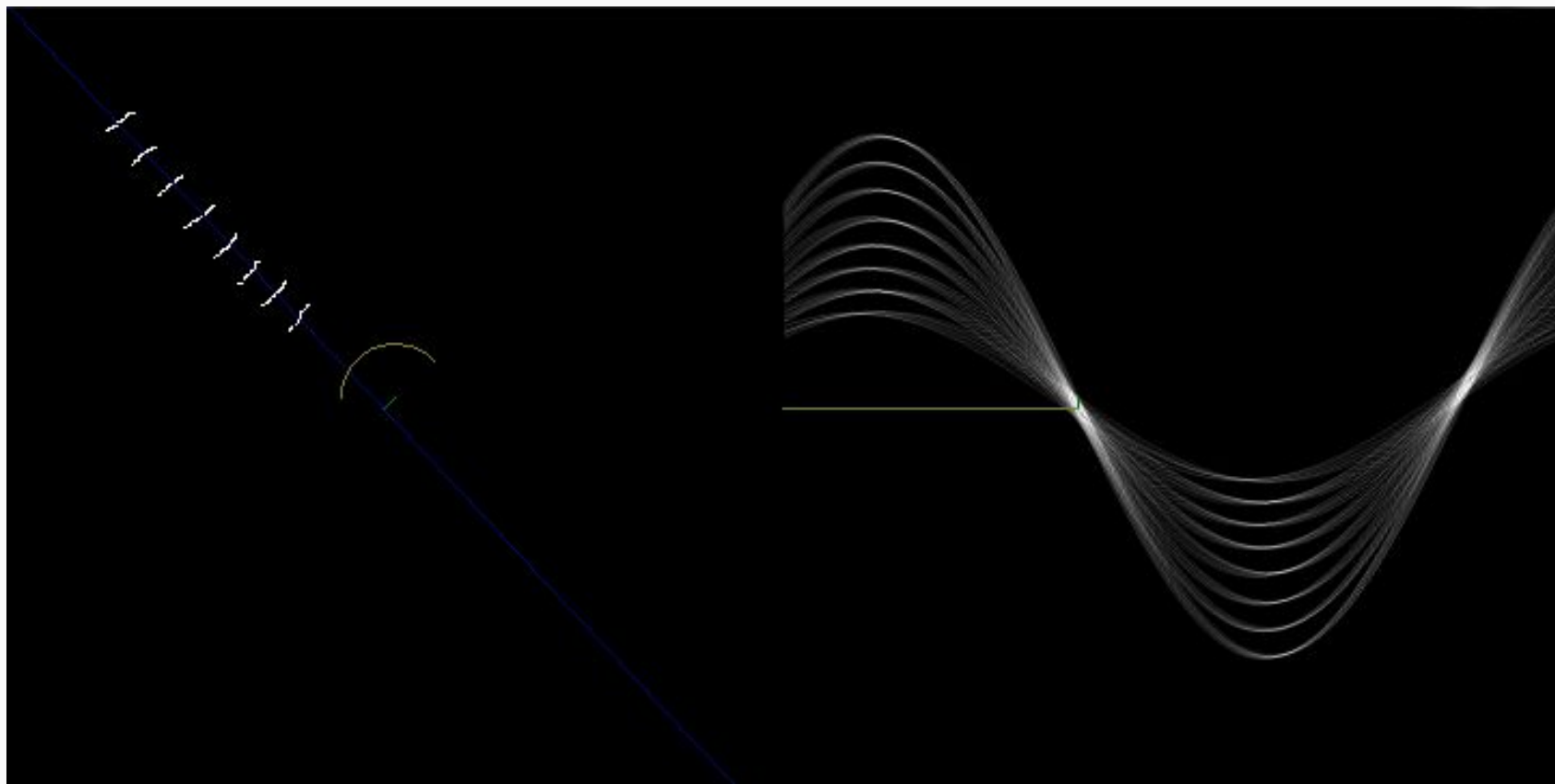
If you can determine the matrix of 2 shapes, you can assign each point in one shape to a unique point in the other.

Each point in a shape has the following attributes:

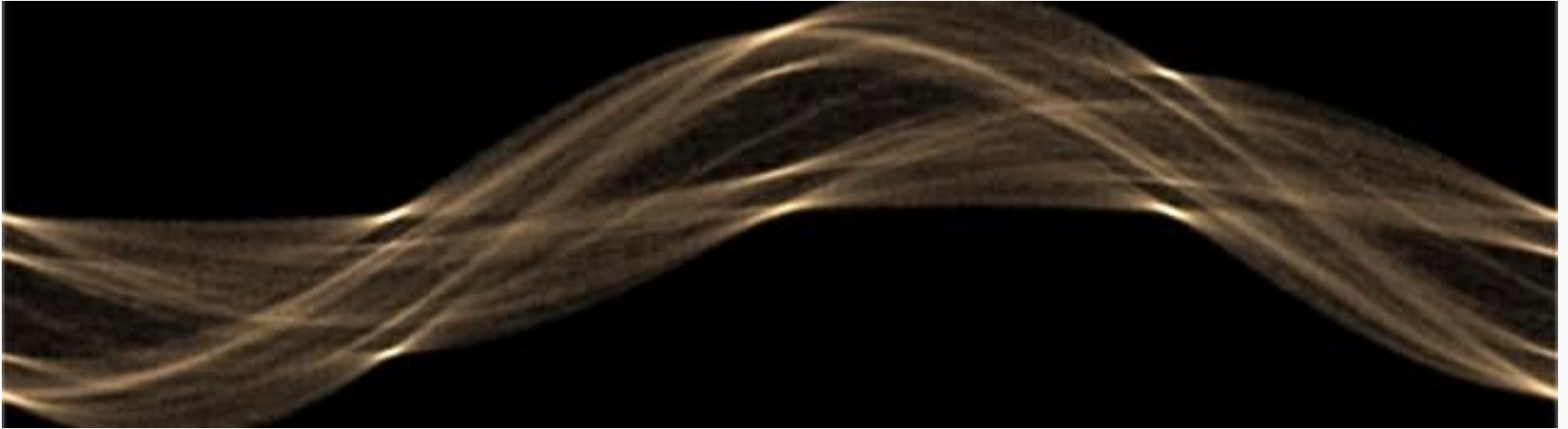
- Their position along the generalized x-axis from 0 to 1
- Their position along the generalized y-axis 0 to 1
- Their actual x-coordinate
- Their actual y-coordinate
- Their rgb value

Hough Transform for line detection

The **Hough Transform** maps lines in the x-y plane onto sine waves in the theta-rho space. Points of intersection in the theta-rho space correspond to lines in the x-y plane.



A more complicated example - how many lines can you detect?



Thanks!

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