Miniature Faking

CSCE 489 Final Project

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Introduction:

The main objective of this project is to manipulate an image of a scene to appear toy-like or made of small-scale diorama set pieces. When taking pictures, cameras with narrower depths of fields can only make objects appear clear within a small area, and anything out of this focus will be blurry. Wide shots of cities and builds allow for everything to be in relative focus, while pictures of small scenes can be difficult to keep everything sharp. We can use this assumption to trick the eyes into thinking that a large, real life object is only a few feet tall. Blurring objects farther away from the focus plane gives off the impression that the scene was taken from the perspective of someone overlooking a table and wanted only one thing to be in focus.

Basic:

A simple approach to achieve this effect is to blur sections at the top and bottom of the image. Doing so performs the basic task of simulating a shallower depth of field. I used a gaussian blur over the top and bottom 1/f areas, where ‘f’ is however wide you want the depth of field to be, a ‘k’ by ‘k’ kernel of pixels in which the filter is processed over one pixel. Typically, a higher ‘k’ creates a blurrier section. Below are some examples of this process.

Original Image

Basic Gaussian Blur
f = 3; k = 5

Basic Gaussian Blur
f = 3; k = 9

Basic Gaussian Blur
f = 6; k = 5

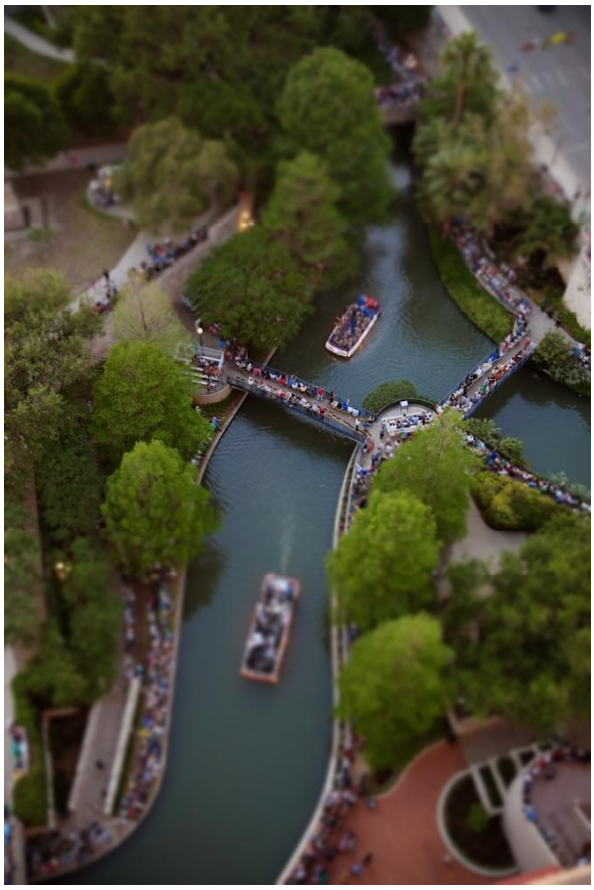
Gradient:

While this is a good start, the seams in which the blurriness starts and stops can easily be seen, especially with higher kernels. In real life, objects gradually becomes less and less sharp as they move away from the focus plane. So, to simulate this effect, we gradually increase the blurriness of the pixel rows as they approach the top and bottom of the image and are farther away from the focus plane. Initially, I thought to accomplish this by applying the blur row by row with increasing kernel 'k'. Since this value can only be an odd, positive integer, each row was given a value proportional to its distance from the center row of the image, then apply the blur with the given kernel. Values were assigned by the following equation,

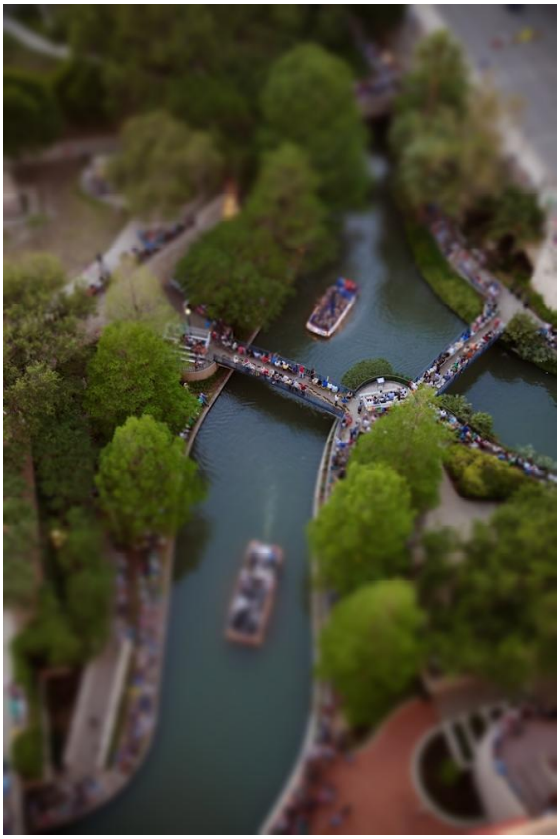
$$\frac{|y_c - y|}{image\ height} \cdot H$$

Where ‘y’ is the row number, ‘y_c’ is the center row, and ‘H’ is some positive constant to effect how large the depth of field will be. Values are rounded to the nearest integer. Higher values have the gaussian blur applied to that row a higher number of times, increasing the blurriness of those sections. You can affect the max number of times the filter is applied with the variable ‘F’ to increase the blurriness of the image at the edges. Below are some examples. It should be noted that ‘F’ can’t be larger than half of ‘H’.

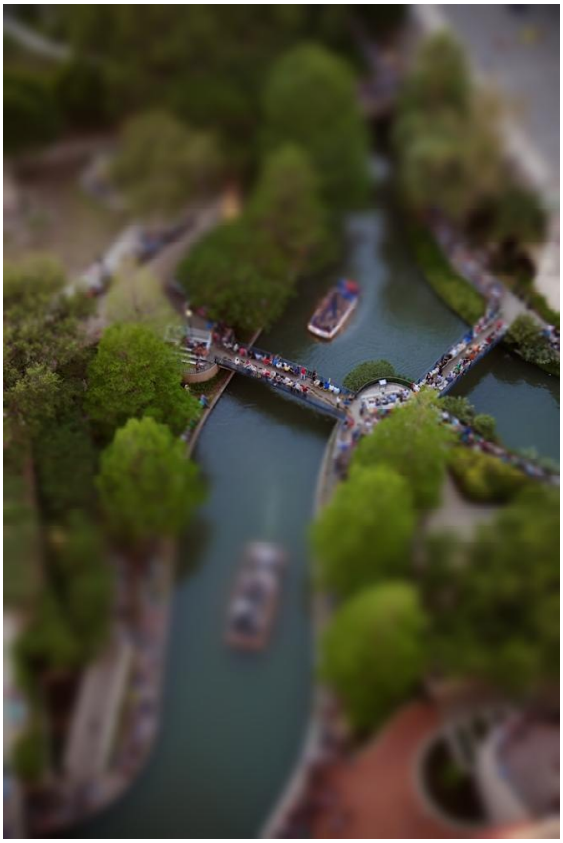
Original Image



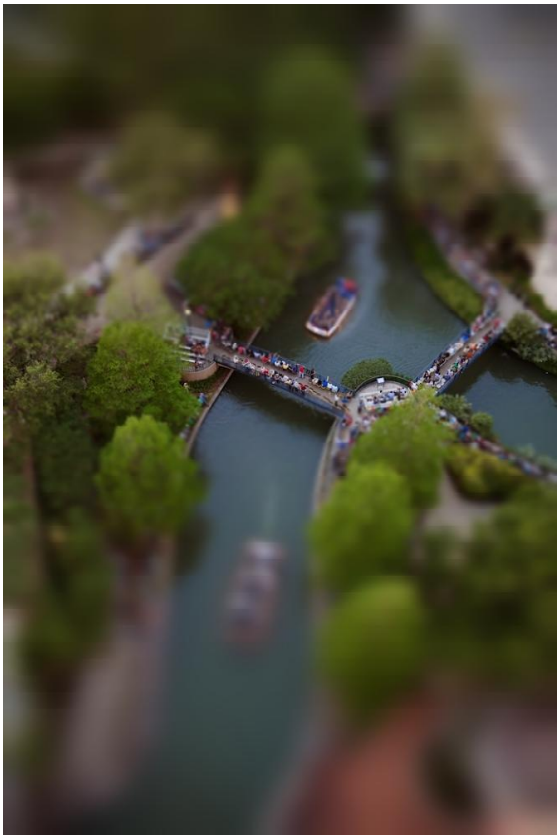
Gradient Gaussian Blur
F = 4; H = 10



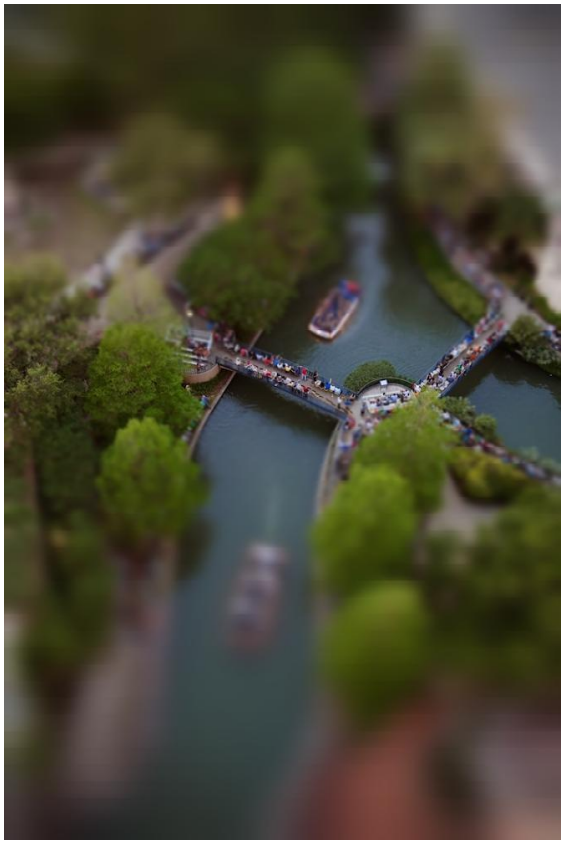
Gradient Gaussian Blur
F = 7; H = 30



Gradient Gaussian Blur
F = 10; H = 30



Gradient Gaussian Blur
F = 20; H = 50



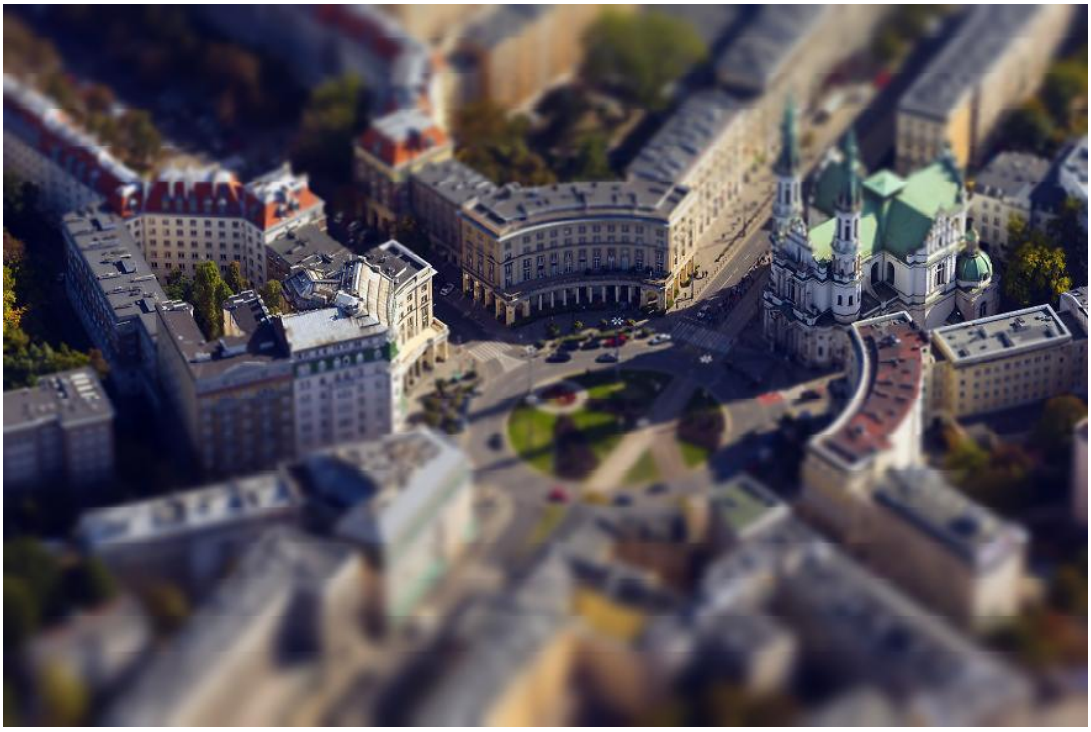
Gradient Gaussian Blur
F = 25; H = 50

This process gives us more of what we want compared to the basic approach. Larger ‘F’ will start to produce more pronounced seam lines, as seen in the last image.

Selective Focus:

We can also manipulate where the focus plane is in the image and give more attention to certain parts of the image. This can be simply achieved by replacing ‘y_c’ with whatever row number we wish. Included in the program is an interface to chose where you want the focus plane to be for the image. Below are a few examples.

Gradient Gaussian Blur
F = 20; H = 50



Gradient Gaussian Blur
F = 10; H = 20

Image References:

-TAMU Hotel and Conference Center - https://theeagle.com/news/local/new-on-campus-hotel-convention-center-planned-at-texas-a-m/article_a6390ca3-8950-529c-a6c9-c720034ea54f.html

-San Antonio River Walk – Stephen Armstrong – https://www.flickr.com/photos/empsf/5946210501/in/photostream/

-Night Traffic – GeoTab – https://storage.googleapis.com/geotab_wfm_production_cms_storage/CMS-Images-production/Blog/NA/_2018/July/traffic_congestion/blog-traffic-congestion-hero@2x.jpg

-Zbawiciela Square and Church in Warsaw – Maciej Margas - https://www.boredpanda.com/i-was-flying-3000ft-above-ground-in-warsaw-poland-to-make-the-photos-no-one-did-before/?utm_source=google&utm_medium=organic&utm_campaign=organic