The code the runs in my submission uses the results of theorem 3 from Smith and Blinn-SIGGRAPH 1996.pdf. In it they outline that the alpha from the matting equation is the sum of the differences of the foreground all divided by the sum of the differences of the background. This is implemented componentwise so the resulting solution runs exceptionally fast for processing of a large image the code takes ~ 0.13 seconds.

This was not the first time reduction that i implemented and i feel that my previous attempt is worth discussing. In my commented out code I used a set constant nosie_level and if the difference of the foreground minus the background for both sets of images was less then the set noise level we would set the alpha for that pixel to zero.

This intuitively has a nice appeal to it. Below i butcher the mathematical intuition behind the concept.

If we are trying to determine

$$1 - \alpha_0$$

Then we have

$$C_\Delta = C_0 - \alpha_0 C_k$$

If $C_\Delta \simeq 0$ then

$$0 \simeq C_0 - \alpha_0 C_k$$

But we are trying to isolate the new image from the background so

$$C_0 = \alpha_0 C_k$$

Is not a good solution to the equation so we have

$$0 \simeq \alpha_0$$

$$0 \simeq C_0$$

Is the desired solution. The only thing that is left fuzzy is what do we mean by $C_\Delta \simeq 0$.

In the given images I found that the most visually appealing solution would be to noise_level = 15. Below on the left is through this noise reduction process the right is the normal process.

Above are the tiny images where the effect is more apparent. Below are the large images.