Matting using a known background and a chroma-key minimization scheme

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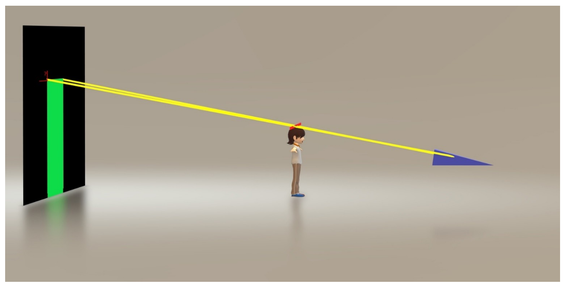
1. Introduction

The new technology of compositing actors and background was introduced in the Mandalorian TV show. Instead of only using green screens behind the actors, that series used screens with the same environment added to the movie.
Actors still must be extracted from the scene, so foreground-background separation scheme, with the known background, is required.

Figure 1: Mandalorian setup. Image by Devin Coldewey [1]

2. Research questions

- How to separate the foreground from the known background?
- Improve the baseline technique
- If background separation is impossible, how to minimize the background solid colour screen area, that will ease the separation?

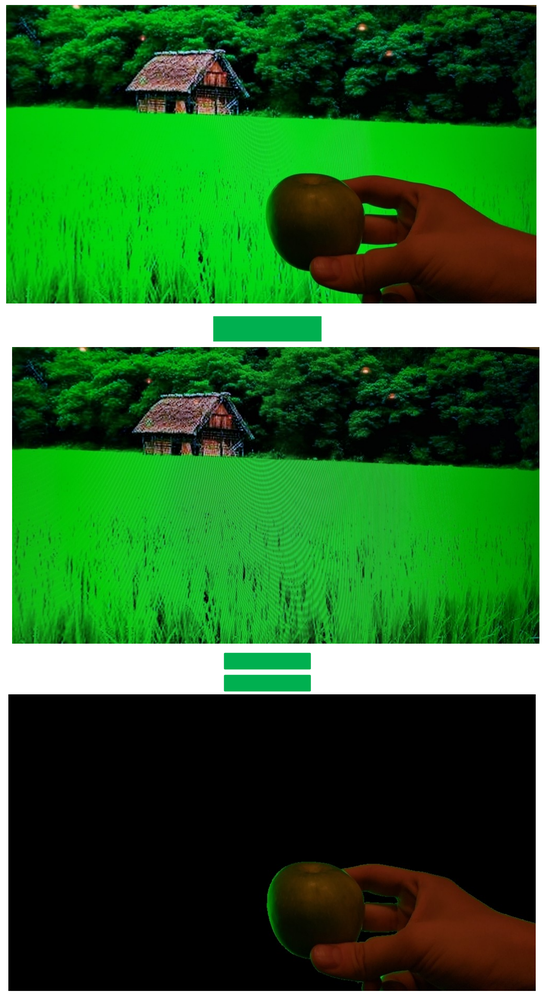


[1] Devin Coldewey. How 'the mandalorian' and ilm invisibly reinvented film and tv production, Feb 2020.. [Online]. Available at: https://techcrunch.com/2020/02/20/how-the-mandalorian-and-ilm-invisibly-reinvented-film-and-tv-production/

3. Methodology

- Knowing the background, it is possible to obtain foreground mask with image difference
- Pipeline: blur the images , take the difference, find contours of the mask and delete very small objects.
- If foreground is almost the same in colour as a background, problems may arise, so change of background might be needed.
- To get the minimal green screen area, we see the region which is visible inside the camera. For that. the pinhole camera theory is used.
- If the user knows the region it wants to extract, the bounding box can be given.

Correct background subtraction



Failed background subtraction

4. Results

- Techniques for both research questions were implemented.
- Out of 20 tested images, 14 gave almost perfect results with < 1% average difference with ground truth, 3 had some holes in an image, average difference < 2.5%.
- Other 3 had not acceptable results with average difference > 10%.
- When the background was changed for those 3 images, there results became almost perfect with the difference < 1%.

5. Possible improvements

- Automatic threshold choice
- Making background less static
- Combining with other background subtraction algorithms
- Changing camera positioning

Background change applied