Arthur Liou
NetID: arthurl3
CS445

MP3 - Gradient-Domain Fusion

Report Prompt

Use both words and images to show us what you've done. Please:
- Show your favorite blending result. Include: 1) the source and target image; 2) the blended image with the source pixels directly copied into the target region; 3) the final blend result. Briefly explain how it works, along with anything special that you did or tried. This should be with your own images, not the included samples.
- Next, show at least two more results for Poisson blending, including one that doesn't work so well (failure example). Explain any difficulties and possible reasons for bad results.
- Show at least one result for blending with mixed gradients. Again, show the source image, target image, and final result.
- Include your Notebook PDF from Project3.ipynb, report PDF, and code for poisson blending, mixed gradients, and the toy reconstruction problem. In your report, you don't need to show the reconstructed toy image, but do report the root-mean-squared (RMS) error, which the starter code will print.
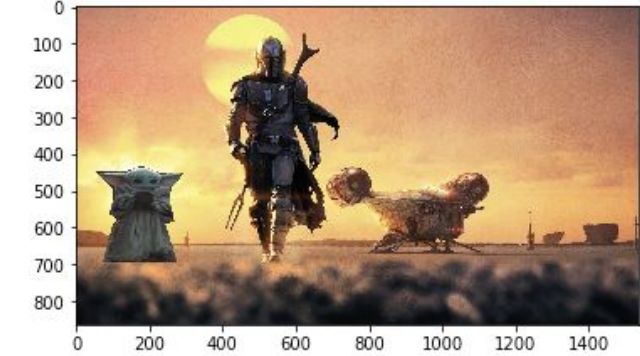- Describe the bells and whistles under a separate heading and include relevant code.
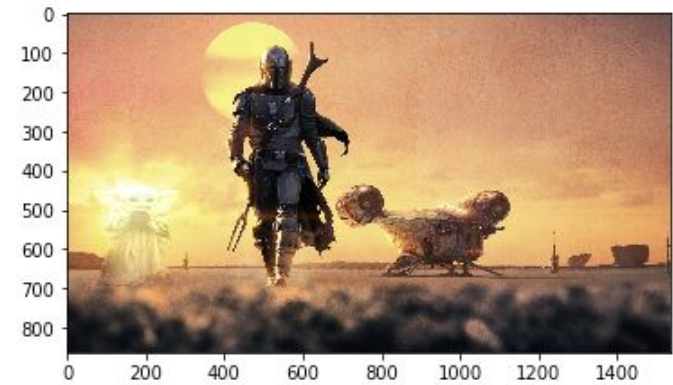
Part 1: Toy Problem (20 points)
- In your report, you don't need to show the reconstructed toy image, but do report the root-mean-squared (RMS) error, which the starter code will print.
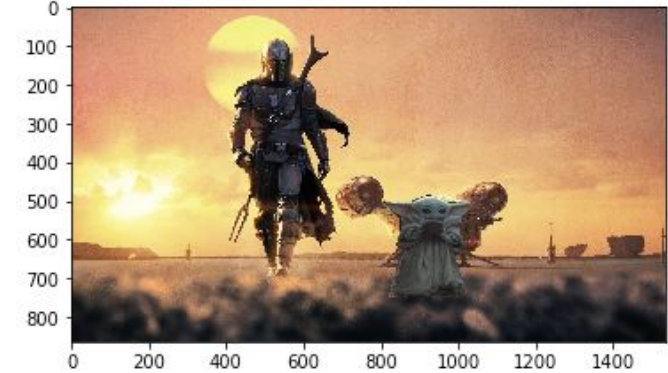 - RMS Error: 0.00031701850079458095

Part 2: Poisson Blending (50 points)
- How it Works: Following the steps and tips, I implemented poisson blending. See Jupyter notebook for pseudo code / what code is doing what.
- For my image #3 (Surfer) I considered this a bad result since the "source" surfer has changed color and is significantly darker than before. Since this was the first result I tried, I went to look for images that were more compatible, had backgrounds that were not vastly different in background (blue vs. brown), and also made a better mask cut in my next steps.
- I then tried pasting Baby Yoda in The Mandalorian poster, which I loved the final blend result, since I had some like a bright yellow Baby Yoda that was luminescent from the sun in the background. I also tried a separate version where Baby Yoda was also pasted in front of the darker background ship, which allowed for less contrast but blocked the ship, leaving the prior as my favorite.
- For my fourth result, I used the same Baby Yoda and pasted him onto one of the recent scenes from the Rise of the Skywalker, leading to a pleasing result.

Favorite Result

Source Image	Target Image
Blended Image	**Final Blend Result**

2nd Result

Source Image (same as above)	Target Image (same as above)
Blended Image	**Final Blend Result**

3rd Result

Source Image (same as above)	Target Image
Blended Image	**Final Blend Result**
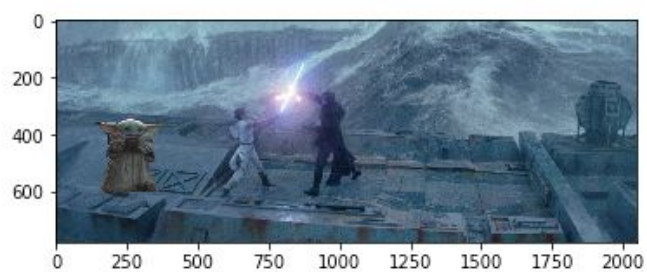
4rd Result - Bad
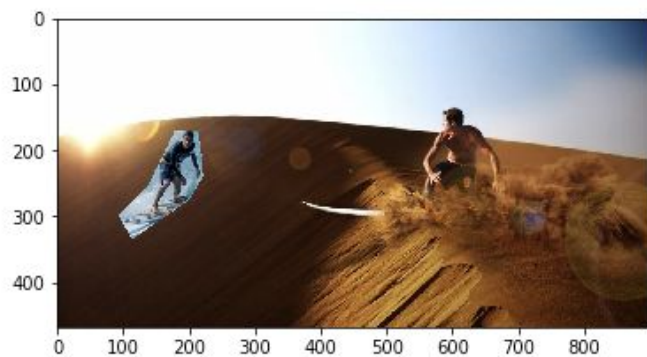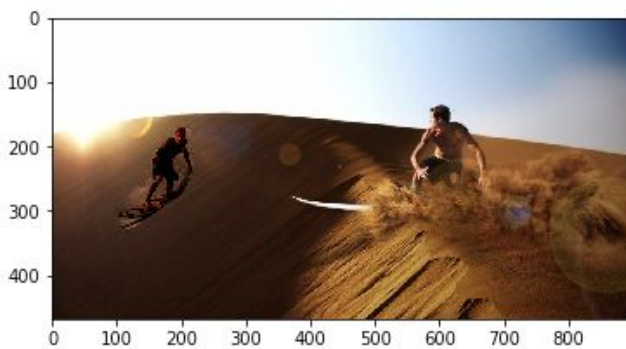
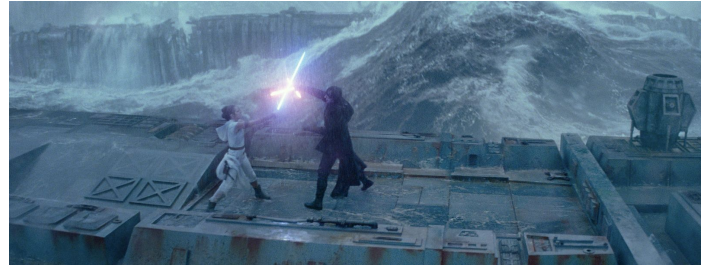| Source Image	Target Image
Blended Image	**Final Blend Result**

Part 3: Mixed Gradients (50 points)

- For mixed gradients, I copied over my Poisson blending code, added a helper function, "d_ij", to get the gradient with the larger magnitude, and inserted the helper function where appropriate in the gradient calculation logic.
- I ran the im_mix on two sets of images, one with Baby Yoda and Star Wars, and one with the surfer. Same source and target images for each set as before.
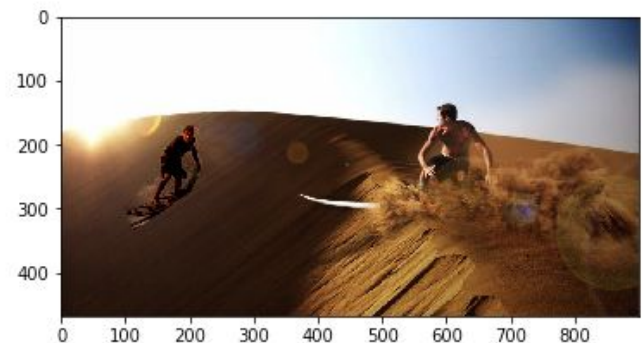
Mixed Gradients

| Source Image	Target Image
Source Image	Target Image
Final Result 1	Final Blend Result 2

Bells and Whistles

- Color2Gray (20 pts)
  - Test your solution on colorBlind8.png and colorBlind4.png, included with the sample images. Hint: your solution may be a combination of the toy problem and mixed gradients.
  - I used my toy reconstruction and mixed gradient functions & modified them to setup the gradient's value on the final results. Playing around with how the gradient was generated, I tested min, average, and max of values. Results below. I found the max results were the best.
    - Min - Results are similar to cv2.COLOR_BGR2GRAY
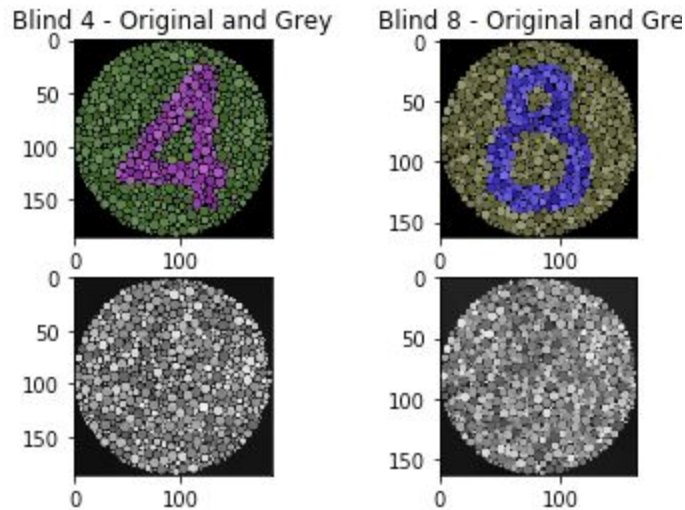
    - Average - Not bad for the 4, but not good for the 8.
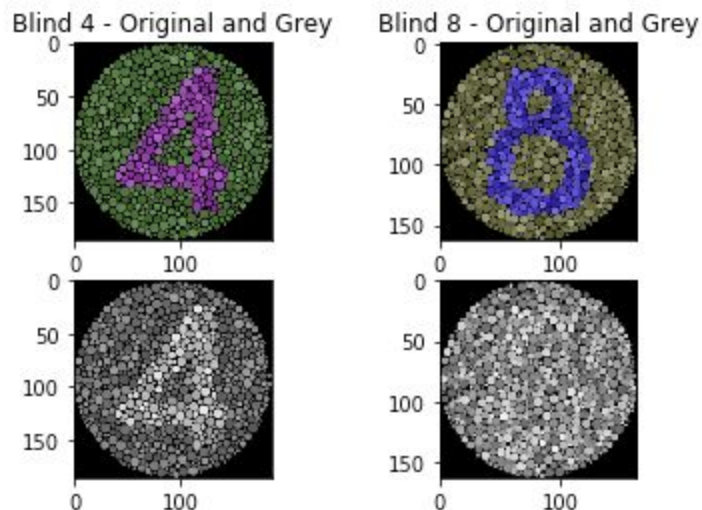
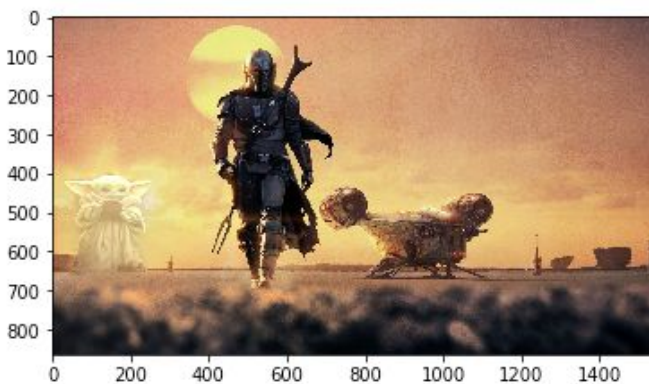   - Max - Similar intensity but has similar gradients from the original images.

Blind 4 - Original and Grey   Blind 8 - Original and Grey
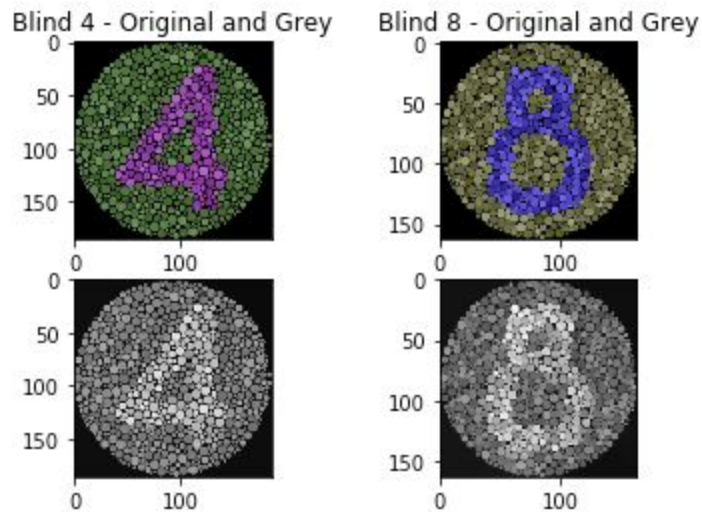
- **Laplacian pyramid blending (20 pts)**
  - Sources Used
    https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_pyramids/py_pyramids.html
  - Image Result vs Baby Yoda Image Set 2 & Set 3

Favorite Result Compare	3rd Result COmpare
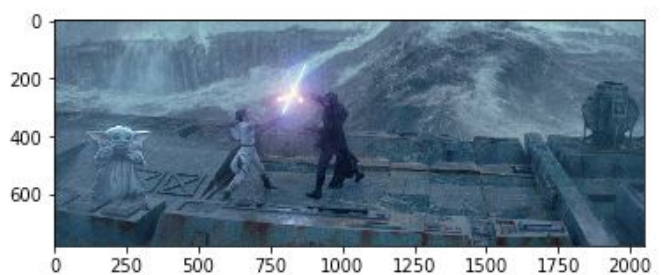
- **More gradient domain process (up to 20 points)**
  - WIP / Incomplete - I started to use texture transfer, but it is close to midnight at the time of this submission and I wanted to get my completed work as I do not want my work on this section to continue wasting late days.
  - I may circle around tomorrow to implement and re-submit. If not, please grade as is.

Expected Points Outline

The core assignment is worth 100 points, as follows:

- 20 points for implementation of toy image reconstruction.
  - Done. RMS provided above
- 50 points for Poisson blending implementation, results, and description: 30 pts for first result; 20 points for additional two (or more) results
  - Done. 4 Results, excluding the sample penguin image (then 5). "Bad" result included
- 20 points for mixed gradients implementation and at least one result.
  - Done. 2 Results Provided
- 10 points for quality of results and clarity of presentation.
  - Done. Up to 10 points

B&W

- 20 for color2gray
  - Done
- 20 for comparison to pyramid blending
  - Done. 2 Sets generated and displayed for comparison to Poisson
- Up to 20 for additional gradient domain processing applications)
  - Attempted. Texture transfer

Regular: 20+50+20+10 = 100
Bells and Whistles: 20 + 20 + TBD = 40