AAD PROJECT DIARY

IMAGE PROCESSING

TEAM - COMPLEXITY: COMPLICATED (H)

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9th October 2020

Content Read:

- I had a group meeting to discuss where and how to start learning about digital image processing. The meeting went for about an hour.
- Revising Linear Algebra

Online Resources:

➢ http://www.math.nagoya-u.ac.jp/~richard/teaching/f2014/Lin_alg_Lang.pdf

Time Spent: 2 hrs

10th October 2020

Content Read:

- We had a group meeting for the future planning of the project. We also distributed roles among ourselves, separating people who will be involved in app designing. The meeting went for about half an hour.
- A basic introduction to Image Processing
- 2D geometric transformations
    - Translations and Scaling
    - Rotations
- Affine geometric transforms
- Homography / Perspective
- Some things have been read from a book by Richard Szeliski.

Online Resources:

- ➢ https://www.cronj.com/blog/geometric-transformation-images-affine-transformations/
- ➢ https://in.mathworks.com/help/images/matrix-representation-of-geometric-transformations.html
- ➢ https://theailearner.com/tag/perspective-transformation/

Time Spent: 3.5 hrs

12th October 2020

Content Read:

- 3D transformations and rotations
- Rodriguez Formula
- Some things have been read from a book by Richard Szeliski.
- Discussed some transformations with Gurkirat and Kannav

Online Resources:

- ➢ https://en.wikipedia.org/wiki/Rodrigues%27_rotation_formula

Time Spent: 1.5 hrs

13th October 2020

Content Read:

- Group meeting with Gurkirat, Sanchit, and Kannav for getting started with Qt5.
- I mostly decided how to get started in QML, Qt Creator, etc.

Online Resources:

- ➢ https://qmlbook.github.io/assets/qt5_cadaques.pdf

Time Spent: 2 hrs

15th October 2020

Content Read:

- Cropping and Resizing of Images
- Essential Functions for image processing in MATLAB and OpenCV

Online Resources:

- ➢ https://in.mathworks.com/help/images/geometric-transformations.html?s_tid=CRUX_lftnav
- ➢ https://stackabuse.com/introduction-to-image-processing-in-python-with-opencv/
- ➢ https://in.mathworks.com/products/image.html

Time Spent: 1.5 hrs

18th October 2020

Content Read:

- 2D Image Filtering and Point operators
- Convolution and Correlation
- Thresholding and its types
    - Otsu Thresholding
    - Adaptive Thresholding
- Histogram Equalization

Online Resources:

- ➢ https://in.mathworks.com/help/images/image-enhancement-and-restoration.html?s_tid=CRUX_lftnav
- ➢ https://en.wikipedia.org/wiki/Thresholding_(image_processing)
- ➢ http://computervisionwithvaibhav.blogspot.com/2015/10/otsu-thresholding.html
- ➢ https://medium.com/@animeshsk3/back-to-basics-part-1-histogram-equalization-in-image-processing-f607f33c5d55
- ➢ https://cimage.se/doc/filters
- ➢ https://setosa.io/ev/image-kernels/

Time Spent: 3.5 hrs

19th October 2020

Content Read:

- I learned about PyQt5. Qt Designer, Qt Creator, making GUI, etc.
- Mostly read through some things and watched youtube tutorials in the morning.
- I had a meeting in the evening to redistribute the roles of people. Permanently shifted to a group of core people reading and implementing various features for the app. (1.5 hr)

Online Resources:

- ➢ https://www.youtube.com/watch?v=GkzncJ71mm0&t=409s

- ➢ https://www.youtube.com/watch?v=vde95l737PI
- ➢ https://www.youtube.com/watch?v=GLqrzLIIW2E&t=1413s
- ➢ https://www.youtube.com/watch?v=Dmo8eZG5I2w

Time Spent: 3.5 hrs

22nd October 2020

Content Read:

- I had a general meeting with teammates to divide the work and discuss future work. (1.25 hr)
- I had meetings with people implementing features to decide on feature implementation and discussed basic OpenCV and python environment setup in Jupyter Lab. (1 hr)

Time Spent: 2.25 hrs

23rd October 2020

Content Read:

- Smoothing and Sharpening of images
- Various techniques to blur images
    - Gaussian
    - Average/mean Blur
    - Weighted median
- Embossing
- Had a meet for project structure (45 min)

Online Resources:

- ➢ http://www.cse.iitm.ac.in/~vplab/courses/optimization/MAths_IM_DEBLUR_ENH_SD_EDT_2016.pdf
- ➢ https://content.sciendo.com/configurable/contentpage/journals$002famns$002f2$002f1$002farticle-p299.xml#j_AMNS.2017.1.00025_fig_001_w2aab2b8d421b1b7b1ab1b1c13b3aAa
- ➢ https://homepages.inf.ed.ac.uk/rbf/HIPR2/unsharp.htm
- ➢ https://en.wikipedia.org/wiki/Unsharp_masking
- ➢ https://lodev.org/cgtutor/filtering.html

Time Spent: 3.75 hrs

25th October 2020

Content Read:

- Implementing geometric transformations for the project
- Also learned about Morphological transformations

Online Resources:

- ➢ https://www.xspdf.com/resolution/50462955.html
- ➢ https://note.nkmk.me/en/python-opencv-numpy-rotate-flip/
- ➢ https://www.pyimagesearch.com/2017/01/02/rotate-images-correctly-with-opencv-and-python/
- ➢ https://www.cs.auckland.ac.nz/courses/compsci773s1c/lectures/ImageProcessing-html/topic4.htm
- ➢ https://docs.opencv.org/master/d9/d61/tutorial_py_morphological_ops.html

Time Spent: 4 hrs

28th October 2020

Content Read:

- Edge Detection Techniques
  - Sobel Edge Detection
  - Prewitt Edge Detection
  - Laplacian and Laplacian of Gaussian Edge Detection
  - Canny Edge Detection
- Performance of various edge detection techniques

Online Resources:

- ➢ https://www.cs.auckland.ac.nz/compsci373s1c/PatricesLectures/Edge%20detection-Sobel_2up.pdf
- ➢ https://www.tutorialspoint.com/dip/concept_of_edge_detection.htm
- ➢ http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.301.927&rep=rep1&type=pdf
- ➢ https://medium.com/@nikatsanka/comparing-edge-detection-methods-638a2919476e
- ➢ https://towardsdatascience.com/canny-edge-detection-step-by-step-in-python-computer-vision-b49c3a2d8123

Time Spent: 3 hrs

30th October 2020

Content Read:

- Ridge Detection Techniques
- Corner Detection Techniques
    - Moravec Corner Detection
    - Harris / Shi-Tomasi Corner Detection
    - Features from Accelerated Segment Test (FAST)

Online Resources:

- ➢ https://hal.archives-ouvertes.fr/hal-00807747/file/Ridges_and_Valleys_Detection_in_Images_using_Difference_of_Rotating_Half_Smoothing_Filters_ACIVS_2011.pdf
- ➢ https://dsp.stackexchange.com/questions/1714/best-way-of-segmenting-veins-in-leaves
- ➢ https://medium.com/data-breach/introduction-to-fast-features-from-accelerated-segment-test-4ed33dde6d65
- ➢ https://en.wikipedia.org/wiki/Corner_detection
- ➢ https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_feature2d/py_shi_tomasi/py_shi_tomasi.html#shi-tomasi

Time Spent: 4 hrs

2nd November 2020

Content Read:

- Image Segmentation and Analysis
- Interpolation and Decimation
- Clustering by K means
- Had a meeting on who will implement what all features (30 min)

Online Resources:

- ➢ https://www.analyticsvidhya.com/blog/2019/04/introduction-image-segmentation-techniques-python/
- ➢ https://www.analyticsvidhya.com/blog/2016/11/an-introduction-to-clustering-and-different-methods-of-clustering/
- ➢ https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_watershed/py_watershed.html
- ➢ http://user.engineering.uiowa.edu/~dip/lecture/Segmentation4.html

Time Spent: 2.5 hrs

3rd November 2020

Content Read:

- Implemented Edge detection techniques for the project, which included Canny Edge detection and Sobel Edge detection.

Online Resources:

- ➢ https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_gradients/py_gradients.html
- ➢ https://gist.github.com/rahit/c078cabc0a48f2570028bff397a9e154

Time Spent: 2 hrs

6th November 2020

Content Read:

- Contour Detection
- Properties and Features of Contour detection
- A basic introduction to Image matching and feature detection
- Read about feature matching from the book by Richard Szeliski.

Online Resources:

- ➢ https://en.wikipedia.org/wiki/Ramer%E2%80%93Douglas%E2%80%93Peucker_algorithm
- ➢ https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_contours/py_contour_features/py_contour_features.html
- ➢ https://docs.opencv.org/3.4.6/d1/d32/tutorial_py_contour_properties.html
- ➢ https://towardsdatascience.com/computer-vision-for-beginners-part-4-64a8d9856208
- ➢ https://courses.cs.washington.edu/courses/cse455/09wi/Lects/lect6.pdf
- ➢ http://cs.haifa.ac.il/hagit/courses/ip/Lectures/Ip14_ImageMatchingx4.pdf
- ➢ https://www.youtube.com/watch?v=P_KDG6UeBoE
- ➢ https://www.pyimagesearch.com/2014/09/15/python-compare-two-images/

Time Spent: 3.5 hrs

9th November 2020

Content Read:

- Primary reading on various feature detection techniques used for image matching, namely -

- Scale Invariant Feature Transform (SIFT)
- Speeded Up Robust Feature (SURF)
- Binary Robust Invariant Scalable Keypoints (BRISK)
- Binary Robust Independent Elementary Features (BRIEF)
- Oriented FAST and Rotated BRIEF (ORB)

Online Resources:

- ➢ https://www.analyticsvidhya.com/blog/2019/10/detailed-guide-powerful-sift-technique-image-matching-python/
- ➢ https://medium.com/data-breach/introduction-to-feature-detection-and-matching-65e27179885d
- ➢ https://medium.com/data-breach/introduction-to-sift-scale-invariant-feature-transform-65d7f3a72d40
- ➢ https://medium.com/@deepanshut041/introduction-to-surf-speeded-up-robust-features-c7396d6e7c4e
- ➢ https://medium.com/data-breach/introduction-to-brief-binary-robust-independent-elementary-features-436f4a31a0e6
- ➢ https://medium.com/data-breach/introduction-to-orb-oriented-fast-and-rotated-brief-4220e8ec40cf
- ➢ https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_feature2d/py_table_of_contents_feature2d/py_table_of_contents_feature2d.html
- ➢ https://www.csc.kth.se/~kootstra/ecse/day_2_part_1_interest_points.pdf
- ➢ https://arxiv.org/pdf/1710.02726.pdf

Time Spent: 5 hrs

10th November 2020

Content Read:

- Blob detection techniques
  - Laplacian of Gaussian
  - Difference of Gaussian
  - Determinant of Hessian
  - Grass-fire Algorithm through 8-way and 4-way connectivity

Online Resources:

- ➢ https://en.wikipedia.org/wiki/Blob_detection
- ➢ http://www.cse.psu.edu/~rtc12/CSE486/lecture11.pdf
- ➢ https://medium.com/image-processing-in-robotics/blob-detection-309226a3ea5b
- ➢ http://what-when-how.com/introduction-to-video-and-image-processing/blob-analysis-introduction-to-video-and-image-processing-part-1/

Time Spent: 3 hrs

11th November 2020

Content Read:

- Image Blending and Masking
- I was reading about the use of bitwise operators in masking and filtering.
- A discussion with teammates about feature detection basically on ORB and BRIEF for better understanding (1 hr)
- Fixed some issues reported by other teammates during implementation (2 hrs)

Online Resources:

- ➢ https://datacarpentry.org/image-processing/04-drawing/
- ➢ https://levelup.gitconnected.com/altering-merging-photos-with-python-bitwise-operators-aedb3fc8b3db
- ➢ https://homepages.inf.ed.ac.uk/rbf/HIPR2/arthops.htm
- ➢ https://theailearner.com/2019/03/26/image-overlays-using-bitwise-operations-opencv-python/

Time Spent: 5 hrs

12th November 2020

Content Read:

- Trying to implement image masking and blending in Jupyter Lab.
- A discussion with Pratyush and Shrey about feature detection with SIFT in the morning. (1 hr)
- A discussion in the evening with Shrey and Pratyush about image masking and distributed other filters in the evening. (1 hr)

Online Resources:

Time Spent: 4.5 hrs

13th November 2020

Content Read:

- Seam Carving
- Discussed and resolved some issues in modules implemented by feature people in the application interface in Morning for about 2 hrs
- Divide operation in OpenCV
- Some other filters

    - Pencil Sketch
    - Cartooning
- Implemented pencil sketch

Online Resources:

- ➢ https://www.analyticsvidhya.com/blog/2020/09/seam-carving-algorithm-a-seemingly-impossible-way-to-resize-an-image/
- ➢ http://cs.brown.edu/courses/cs129/results/proj3/taox/
- ➢ https://www.learnopencv.com/non-photorealistic-rendering-using-opencv-python-c/
- ➢ https://www.tutorialspoint.com/cartooning-an-image-using-opencv-in-python
- ➢ https://medium.com/dataseries/designing-image-filters-using-opencv-like-abode-photoshop-express-part-1-8765e3f4495b
- ➢ https://medium.com/dataseries/designing-image-filters-using-opencv-like-abode-photoshop-express-part-2-4479f99fb35

Time Spent: 5 hrs

14th November 2020

Content Read:

- Color Space Conversions
    - Hue-Saturation-Value (HSV)
    - Hue-Saturation-Intensity (HSI)
    - Hue-Lightness-Saturation (HLS)
    - CMY and CMYK (Cyan-Magenta-Yellow-Black)
- Some other filters due to color space variations
    - Daylight filter, increase light in the image
    - Splash, extracting colors from images
- Implemented Blending, Splash, Daylight filters

Online Resources:

- ➢ https://www.vocal.com/video/rgb-and-hsvhsihsl-color-space-conversion/
- ➢ https://globalaihub.com/image-processing-color-spaces-rgb-hsv-and-cmyk-%F0%9F%8C%88/
- ➢ https://stackoverflow.com/questions/48109650/how-to-detect-two-different-colors-using-cv2-inrange-in-python-opencv
- ➢ https://www.learnopencv.com/color-spaces-in-opencv-cpp-python/
- ➢ https://pysource.com/2019/02/15/detecting-colors-hsv-color-space-opencv-with-python/

Time Spent: 3.5 hrs

16th November 2020

Content Read:

- More on Seam Carving
- Discussed plans for the last few days with Pratyush, Kannav, and Shrey. (1 hr)

Online Resources:

➢ https://adityashrm21.github.io/Image-Compression/
➢ https://people.csail.mit.edu/mrub/talks/SeamCarving_6.865.pdf

Time Spent: 2 hrs

18th November 2020

Content Read:

- Image Morphing and Warping
- Delaunay Triangulation
- Implementation (More of discussion) of SIFT, Seam Carving, Contour detection with Pratyush and Shrey (2 hrs)

Online Resources:

➢ http://alumni.media.mit.edu/~maov/classes/comp_photo_vision08f/lect/07_Image%20Morphing.pdf
➢ http://graphics.cs.cmu.edu/courses/15-463/2011_fall/Lectures/morphing.pdf

Time Spent: 3.5 hrs

20th November 2020

Content Read:

- Handled some issues with the implementation of some modules with interface people. Fixed some bugs in feature codes.

Time Spent: 1.5 hrs

21st November 2020

Content Read:

- Improve Splash by allowing users to add multiple ranges at once. Provided more flexibility in Canny edge detection

- Use of exponential and gamma functions in image processing.

Online Resources:

- ➢ https://homepages.inf.ed.ac.uk/rbf/HIPR2/pixexp.htm#:~:text=Brief%20Description,enhance%20high%20intensity%20pixel%20values.
- ➢ https://theailearner.com/2019/01/26/power-law-gamma-transformations/

Time Spent: 2 hrs

22nd November 2020

Content Read:

- Demonstration of the app by interface people. Discussed some improvements in the app and discussed a few designing things.
- Some implementation of seam carving and image matching with Shrey

Online Resources:

- ➢ https://docs.opencv.org/master/dc/dc3/tutorial_py_matcher.html
- ➢ https://karthikkaranth.me/blog/implementing-seam-carving-with-python/

Time Spent: 3.5 hrs

23rd November 2020

Content Read:

- Implemented image masking to incorporate in the app.
- Saw some methods to determine light and dark backgrounds in the image.
- Final project presentation and discussion with teammates (1 hr)

Time Spent: 2.5 hrs