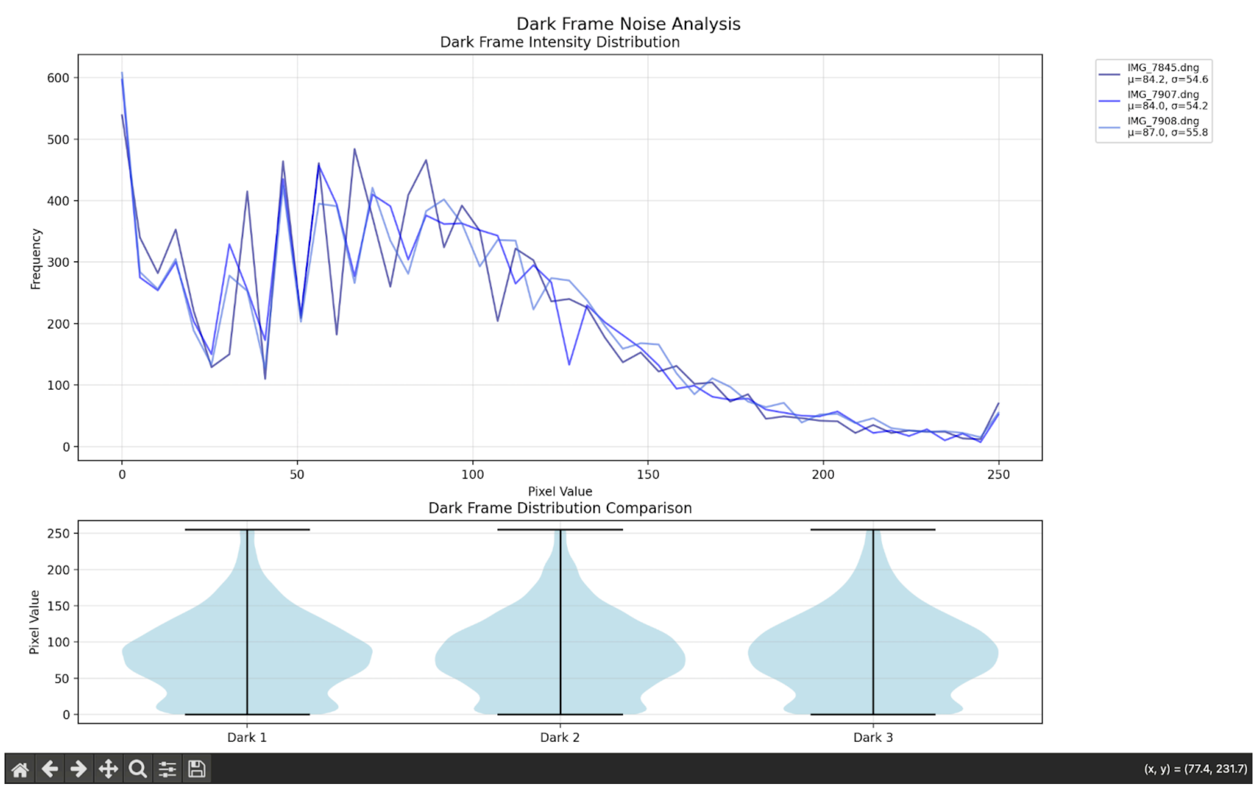
Part 1.

The dark frames revealed patterns of sensor noise for the three images. The mean pixel values were 84.16, 84.04, and 87.03, with a corresponding standard deviation of 54.63, 54.20, and 55.79. These results show signal-to-noise ratios (SNR) ranging from 1.54 to 1.56, with an overall dark current of 85.08, an average noise level of 54.87, and an average SNR of 1.55. The similarity of the mean and standard deviations of the dark frames indicates that the sensor exhibits consistent dark current noise under no-light conditions. The higher standard deviation in IMG_7908.dng shows minor variations in the read noise, but the variation across the frames is slight. The mean represents the dark current of the sensor in all the images. The standard deviations of the image measure the noise fluctuations. The averages show that the sensor produces a dark current that is consistent with stable noise.



Dark 1 = IMG_7845.dng, Dark 2 = IMG_7907.dng, and Dark 3 = IMG_7908.dng
Each histogram shows a distribution around the mean value of 85. The shapes of the distributions are very similar, showing that the noise pattern is consistent across each image. A

violin plot comparison of the three frames illustrates the spread of pixel intensities with no significant deviations between the three images.

This indicates that the sensor produces a low measurable dark current, u = 85, under dark conditions. The random noise σ ≈ 55 reflects sensor-intrinsic fluctuation. Since the mean and standard deviation values are nearly the same across the dark frames, we can conclude that the sensor is stable and can be reproduced. These measurements offer insight into how noise levels vary with different lighting conditions. We see how the dark frames isolate intrinsic sensor noise.

Filename	Mean (μ)	Std Dev (σ)	SNR
IMG_7845.dng	84.16	54.63	1.54
IMG_7907.dng	84.04	54.20	1.55
IMG_7908.dng	87.03	55.79	1.56
Average	**85.08**	**54.87**	1.55

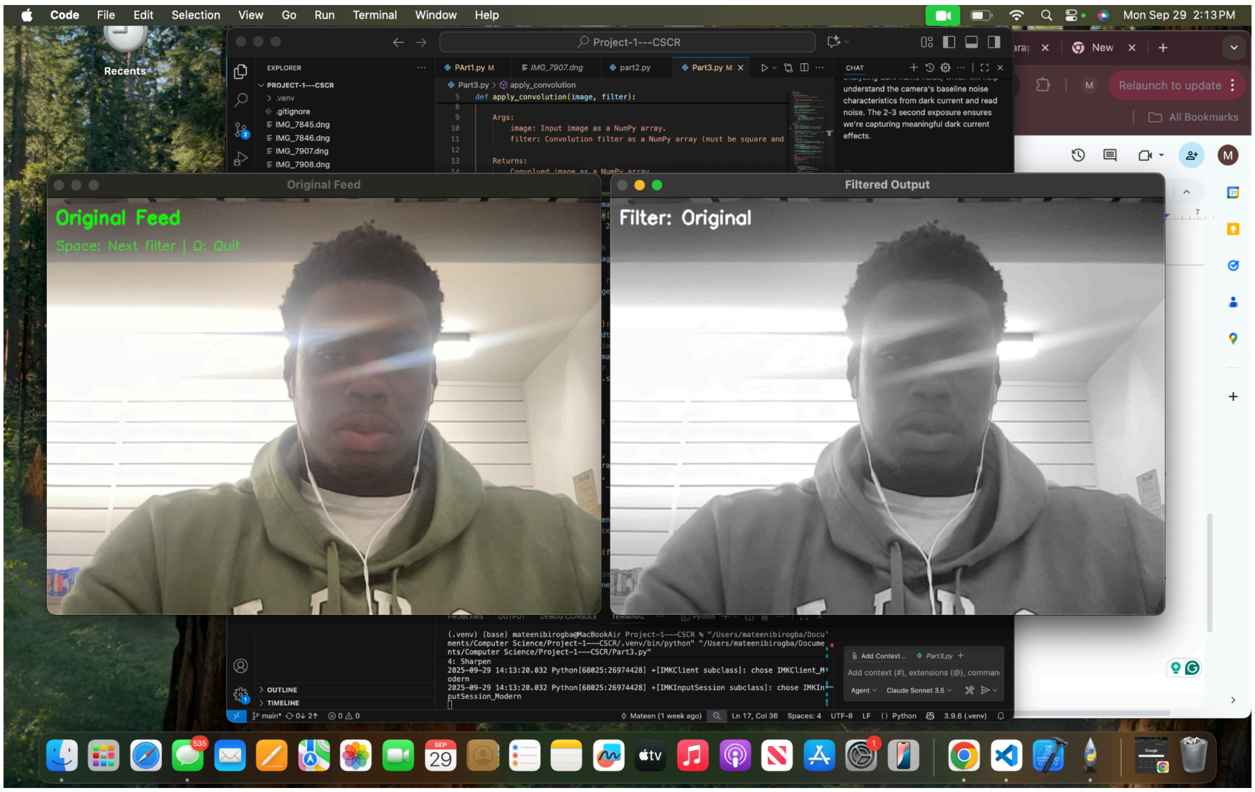
Part 2

				channel snr			mean			SD		
Camera	Focal Length	FOV	Aperture	Red	Green	Blue	Red	Green	blue	Red	Green	Blue
Main (RCAM)	24 mm	15.9	f/1.78	4.06	3.08	2.74	7.63	5.26	4.52	1.88	1.71	1.65
Telephoto(TCAM)	77mm	5.1	f/2.8	6.82	5.17	5.18	24.11	19.37	18.17	3.53	3.75	3.51

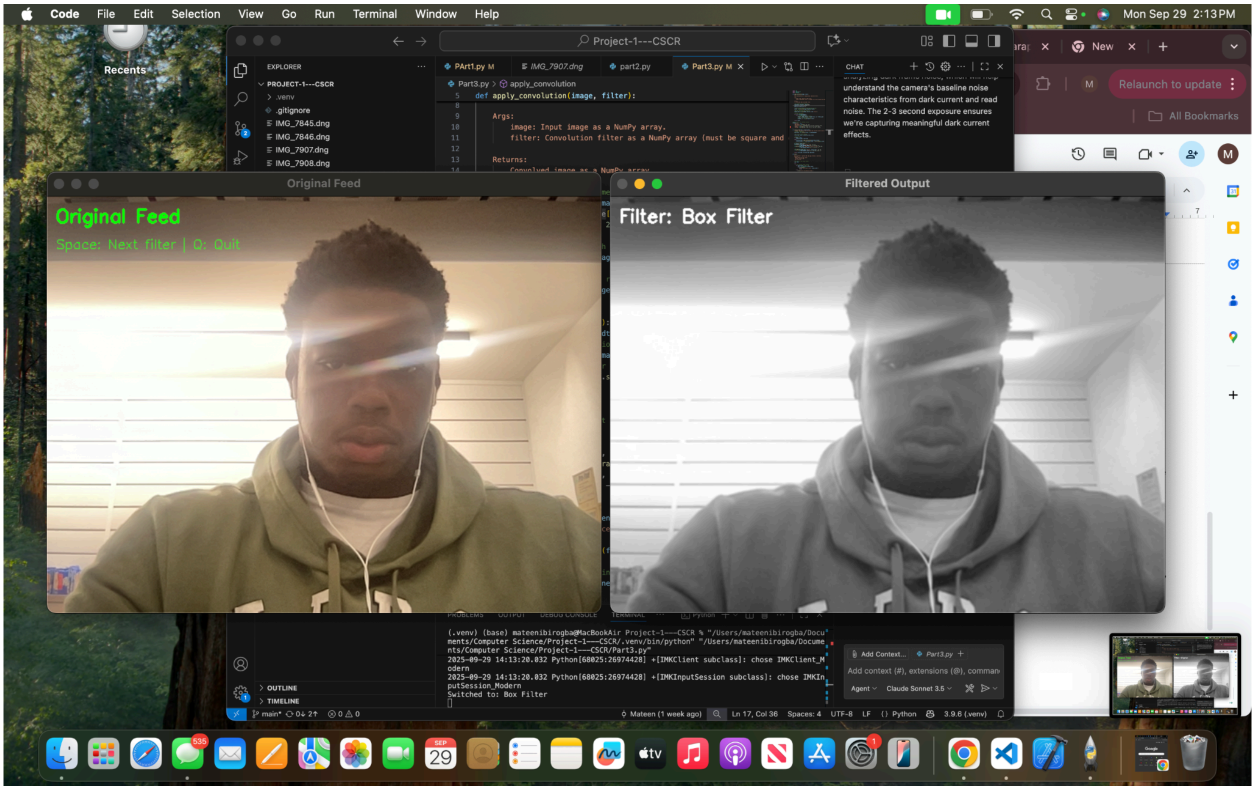
The fields of view (FOV) show the trade-off between the main and telephoto cameras. Using the focal length and sensor width. The main camera has a 24 mm focal length and a 6.86 mm sensor width, which yields a horizontal FOV of approximately 15.9 degrees. In comparison, the telephoto camera has a 77 mm focal length, the same sensor width, and a narrow FOV of about 5.1 degrees. The ratio between these values is 3.1, which matches the 3x optical zoom doctor. The difference is the zoomed-in part of the telephoto lens. A longer focal length reduces the FOV, magnifying distant subjects and compressing the background, which is essential for capturing vast landscapes. The telephoto has a higher noise in all the channels, telephoto mean is much higher and SNR the telephoto wins in all the channels. The noise analysis shows insight into the performance of the two systems. In the uniform regions analyzed, the mean value u represents the signal level, while the standard deviation o reflects the noise. The signal-to-noise ratio quantifies how reliably the sensor captures details over noise fluctuations. The main camera and the telephoto have advantages and disadvantages. The main camera is better for wide angles like landscapes and group photos, where the larger aperture and wider FOV capture more detail and light. The telephoto camera has more noise, but it isolates the image better. Telephoto is ideal for portraits because of the narrow FOV, and background compression produces better images for portraits and isolated objects.

Part 3

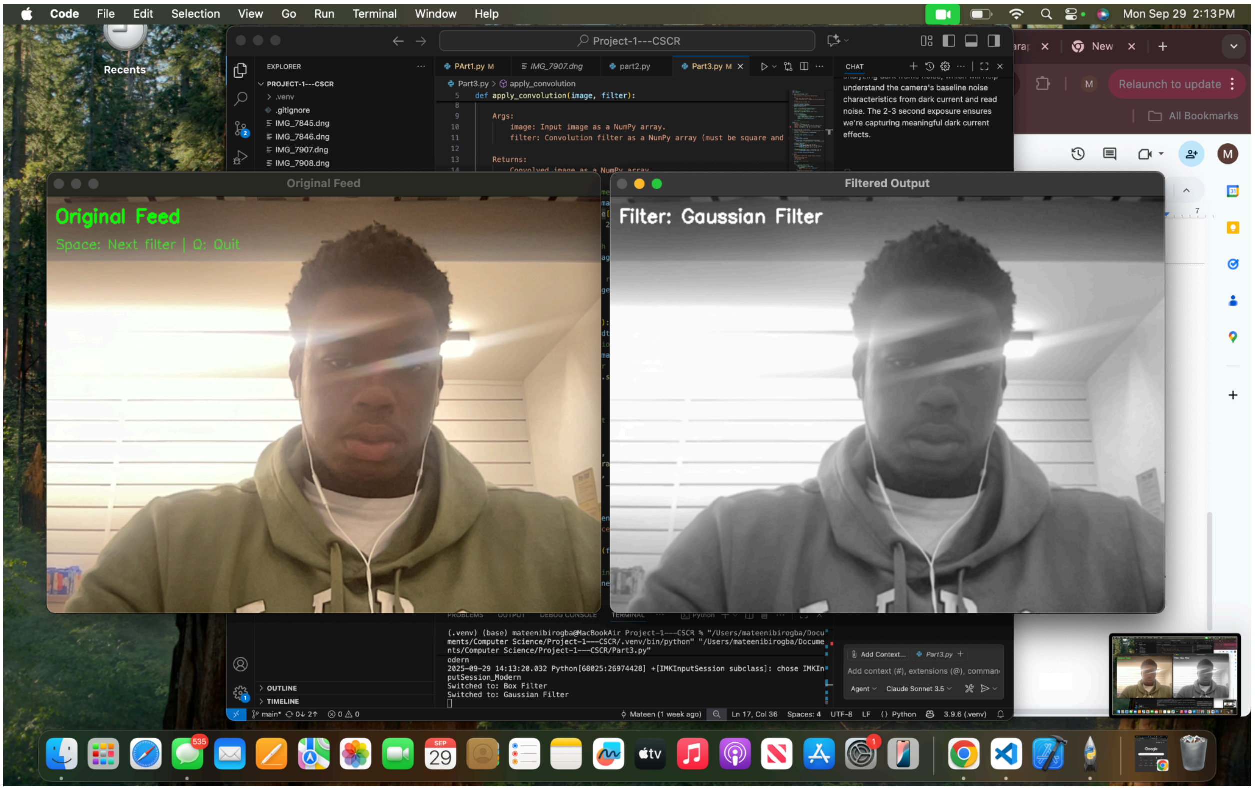
The kernels I picked for the webcam are Box Filter, Gaussian Filter, Sobel X, and Sharpen. We start with the original, unfiltered. The feed appears to be regular, with no colors and normal grayscale. No Kernel was used, and since no convolution is applied, the pixel intensity is the same.



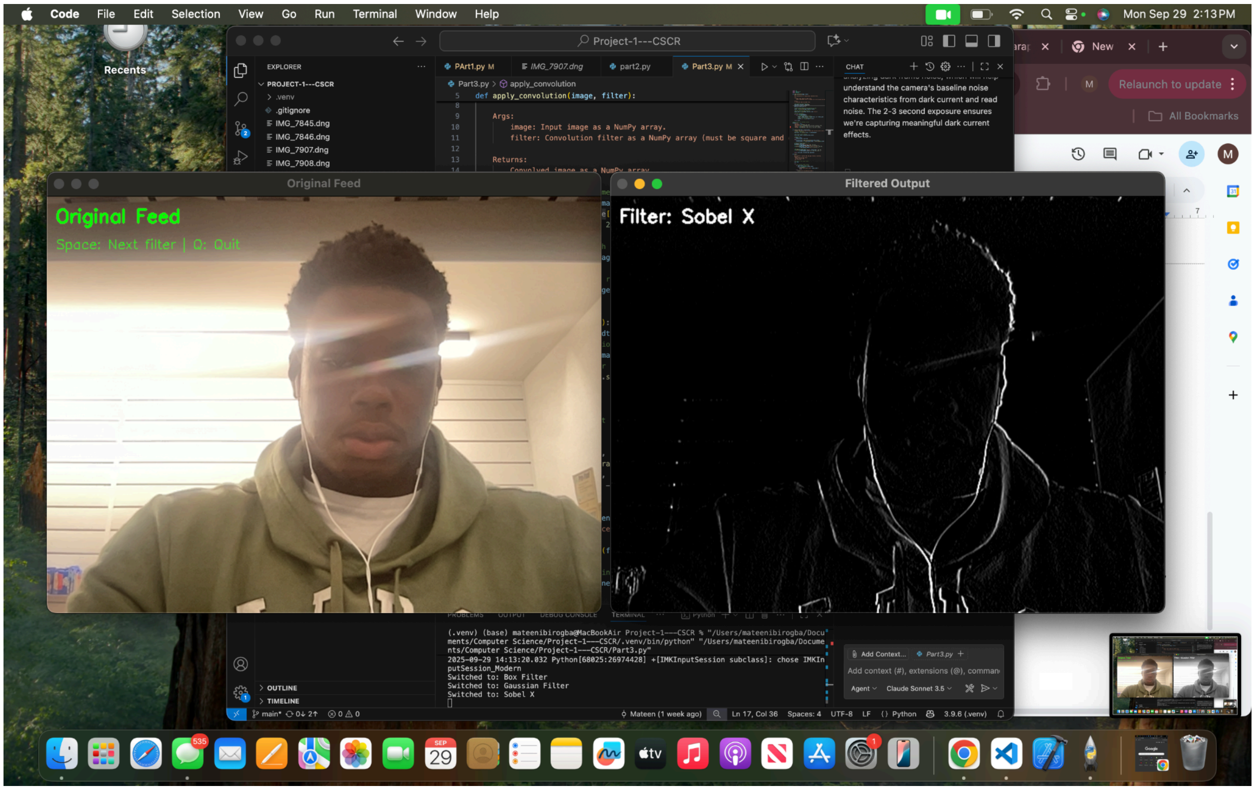
The Box Filter makes the image more blurred, with edges and textures smoothed out. The motion looks softer, and the noise is reduced. The kernel is 1/9 * [[1,1,1],[1,1,1],[1,1,1]]. Each of the output pixels averages its 3x3 neighborhood. The equal values mean the pixels contribute the same, which reduces the sharpness of the intensity.



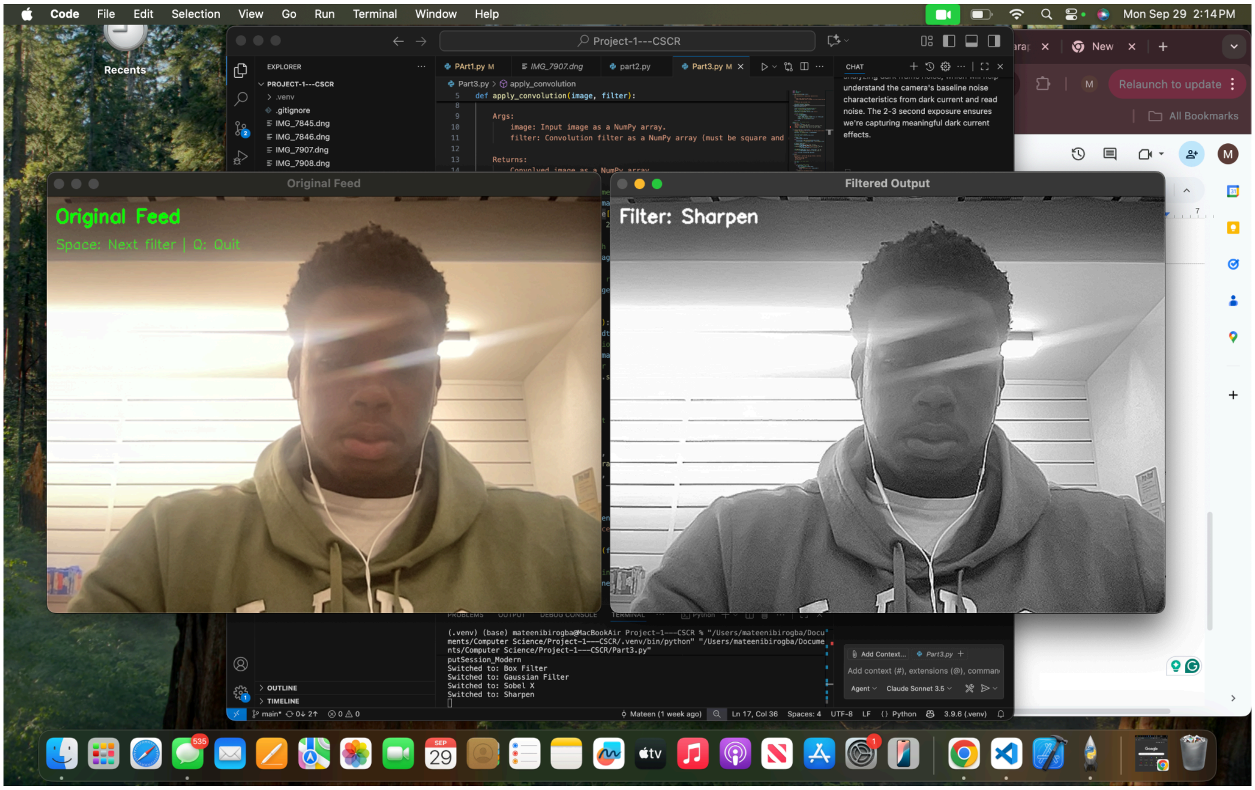
The Gaussian Filter is similar to the box filter, but with a smoother blur, and the edges are preserved a little better. Kernel 1/16 * [[1,2,1],[2,4,2],[1,2,1]]. The center has the largest weight, with the values decreasing towards the edge. This weighting centers on the pixel while still averaging the neighborhood, resulting in a natural, pleasing blur.



Sobel X affects the video as it shows vertical edges, and the horizontal areas are more flattened. It makes the video look like a sketch highlighted by a vertical structure. The Kernel are [[-1,0,1], [-2,0,2], [-1,0,1]]. The kernel measures changes in the x-direction (from left to right). Negative values are on the left and the positive ones on the right to show the changes in the transitions across vertical edges.



The Sharpen filter enhances edges and textures. The image appears with higher contrast and crisper details. The kernel [0,-1,0],[-1,5,-1],[0,-1,0]. The center pixel has a strong positive weight, while the other neighbors have negative weights. This subtracts from the center average and boosts the contrast at the edges.


Code File Edit Selection View Go Run Terminal Window Help
Mon Sep 29 2:14 PM
Project-1---CSCR
EXPLORER
PROJECT-1---CSCR
.venv
.gitignore
IMG_7845.dng
IMG_7846.dng
IMG_7907.dng
IMG_7908.dng
PArt1.py
IMG_7907.dng
part2.py
Part3.py
def apply_convolution(image, filter):
Args:
image: Input image as a NumPy array.
filter: Convolution filter as a NumPy array (must be square and
Returns:
CHAT
understand the camera's baseline noise characteristics from dark current and read noise. The 2-3 second exposure ensures we're capturing meaningful dark current effects.
Relaunch to update
All Bookmarks
Original Feed
Space: Next filter | Q: Quit
Filtered Output
Filter: Sharpen
Switched to: Box Filter
Switched to: Gaussian Filter
Switched to: Sobel X
Switched to: Sharpen
OUTLINE
TIMELINE
Ln 17, Col 36 Spaces: 4 UTF-8 LF Python 3.9.6 (.venv)