

Report 3

Description of the measurement strategies

The measurement strategies in this research paper primarily involve the utilization of simulated sky images obtained from Stellarium which is an open-source planetarium software program. These simulated images are used as a representation of real star data and provide a basis for training and evaluating the proposed CNN based star and constellation detection algorithm. The measurement strategy does not involve making specific measurements in the traditional sense as the focus is on using the simulated sky images to develop and test the CNN algorithm.

Statistical Analysis

Regarding the statistical analysis, it's worth noting that the image data used in this research was collected through the Stellarium program which is known for its precision in simulating real-world star data. As a result, conventional statistical analysis techniques commonly applied to structured text data are not suitable for this type of image data as we did in class. Instead the statistical analysis will be around performance metrics specific to image processing and computer vision tasks. The key objective is to determine whether the model's accuracy and reliability are sufficient to meet the requirements of mission-critical tasks for the star tracker. This evaluation will be crucial in assessing the model's suitability for practical applications in spacecraft attitude determination where precise and dependable star identification is essential for successful operations.

Visualization of the data

After the data collection the obtained data was visualized using Python language with Jupyter Notebook. Initially, both the input and target images were visualized to identify any differences in the constellations' appearance. Here are the example images:

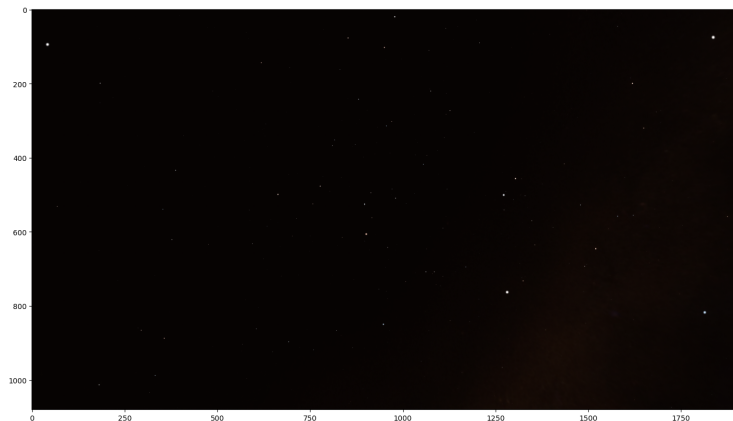


Fig 1: Sky image without constellations (Input image)

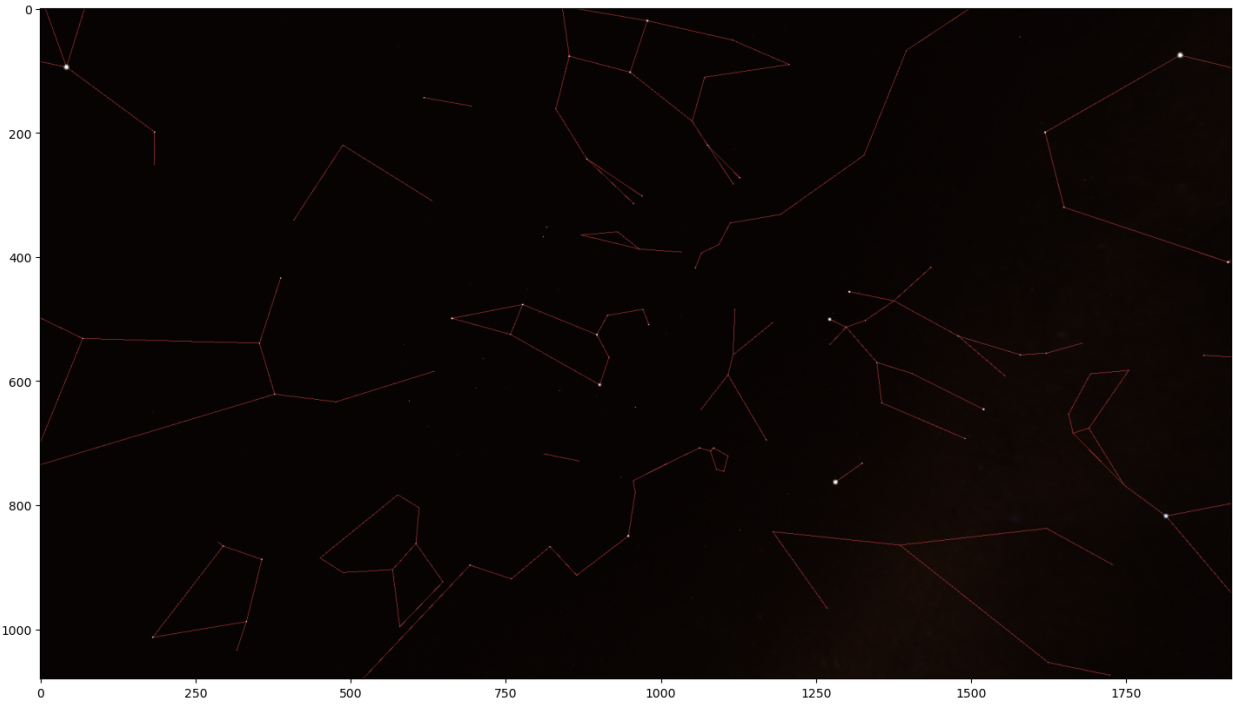


Fig. 2: Sky image with constellations (Target image)

To reduce noise in the images, a specific threshold was selected and applied to filter out the black background noise. Here is the example sky image that was filtered:

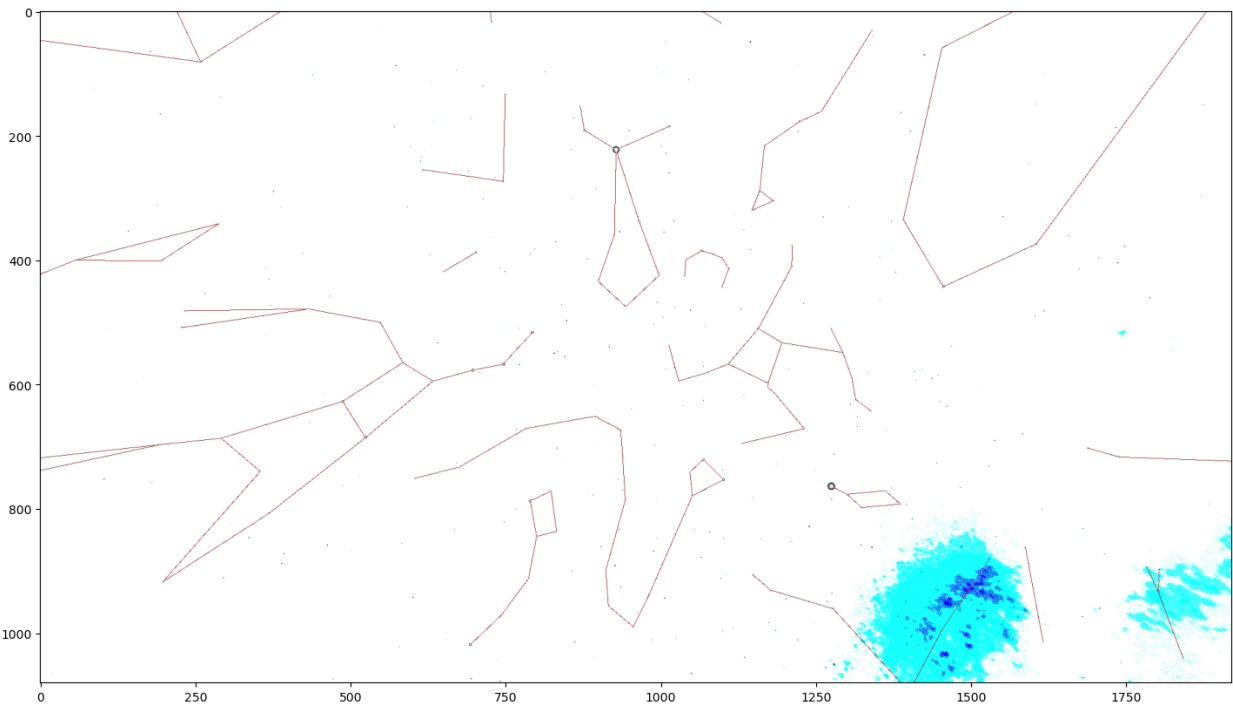


Fig 3: Data technique for removing redundant pixels

The blue sections on the left side of the figure depict the Milky Way. The Milky Way was not removed from the environmental setup of the Stellarium script or wasn't filtered out with choosing the high threshold value because it can assist in detecting the constellations and positions of stars. For instance, the tail of the Cygnus northern constellation is always on the Milky Way. That is why the Milky Way can be used to determine the position of the Cygnus constellation. This method also applies to many other constellations. The technique that is mentioned is not only used for planetarium applications, it is also used by astronomers in the real world. In conclusion, It is very likely that the Milky Way will play a critical part in detecting constellations and star positions for CNN model as well.