- Introduction

  The objective of this project is to create a system that can scan the stars and identify constellations within them. This shows the usage of robotic vision by providing a 360 view from different angles and translating them to recognizable patterns.
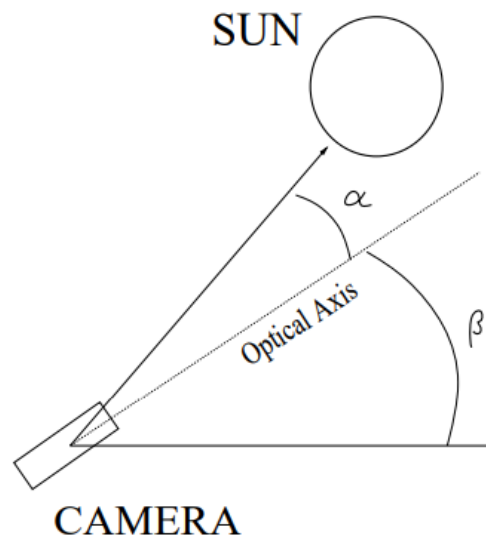
- Related research

Figure 4: Geometry of Sun altitude measurements

The research here provides a system of how to relate Earth's surface to the sun and the surrounding sky to determine how the stars may show if the sun was not there. This is something that can be used in my project to determine locations based on the patterns of the sun and moon and how they relate angularly to their surrounding stars.
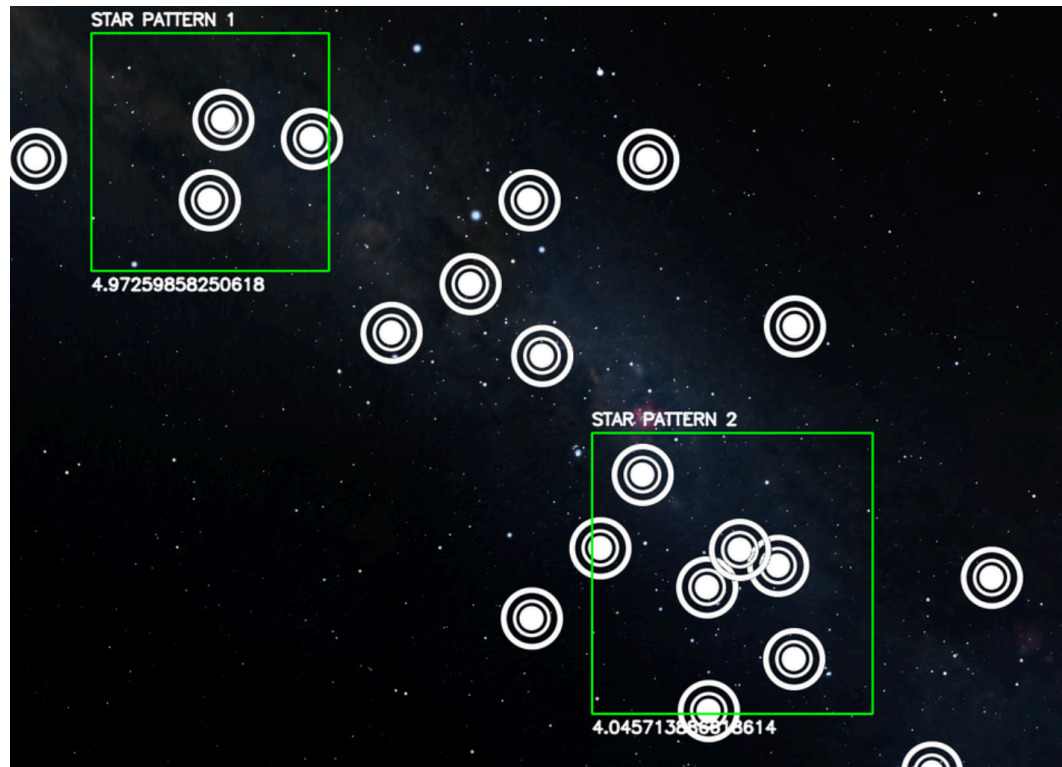
The image here comes from a research study that allowed the creator to create a system that would be able to identify the patterns of stars in a sector based on image processing. This information was done using OpenCV. I will attempt to use this as a framework to create this project using image processing on MATLAB.

- Detection of scale-space extrema

  By taking zoomed in and zoomed out images the image processing will be able to identify the lengths from star to star and determine the patterns regardless of zoom or the brightness of the star.

- Accurate keypoint localization

  The star recognition is constant and can be based off the other stars in the vicinity. This is the only way to recognize which star in which and create a solid estimation of what constellation and stars the image is depicting.

- Orientation assignment

The orientation of the view of the sky changes throughout the night, so i can take multiple images throughout the night and find the stars in different views based on the time of day in order to recognize the patterns at any position.

- The local image descriptor

By isolating the different constellations into recognizable patterns, the system would then be able to look through each individual local image within and find the patterns throughout. The system can recognize the zoom and isolate different sectors to find the bright points in the sky to find the same layout as described at different scales.

- Application to object recognition

By recognizing the different constellations, the system will have to detect each individual pattern of the stars to determine the name and location of them based on the other stars showing around them.

- Recognition examples

Different orientations and layouts can be used in samples to find the same pattern regardless of orientation of the camera or position in the sky by localizing stars and relating them to others.

- Conclusions

The project is a clear depiction of what robotic vision is capable of recognizing without proving to be too intricate for an undergrad to process. The scope of this project lies in the motion of the camera around all angles to detect many different, basic, patterns in the night sky.

- References

Cozman, Fabio. "Robot Localization Using a Computer Vision Sextant." *Robot Localization Using a Computer Vision Sextant*, Robotics Institute, Carnegie Mellon University, citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=f04d2465a4f9e37daf778a1cc1 67beb664626eea. Accessed 2 Mar. 2024.

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