



UMD All-Sky Program

All Sky, All the Time

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Science, Discovery, and the Universe

Computer Engineering Major

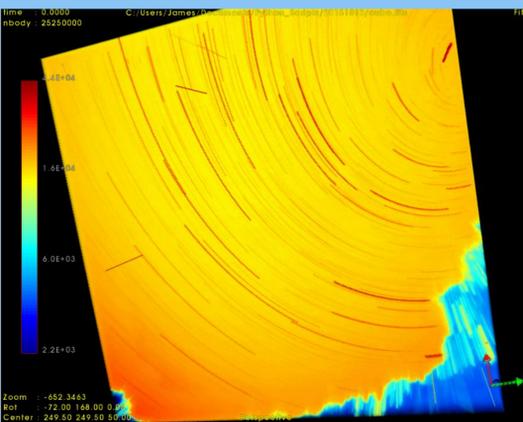


Analyzing Data with Python

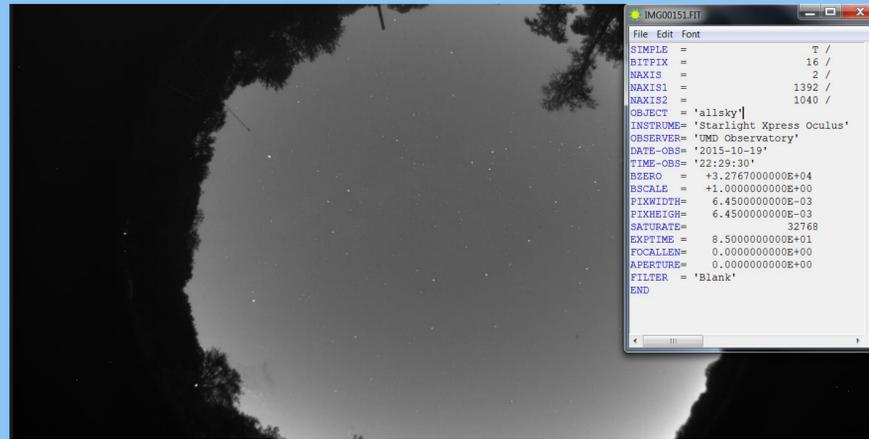
We use Python to analyze data that we receive from the allsky cameras. This includes removing hot pixels, locating meteors, mitigating noise, etc. We also take the data and use techniques to make analyzing the data visually easier. For example, we can take images throughout a night and make a three dimensional cube of images as seen below.

Impact

This helped progress the Allsky program as we have laid out the groundwork for a python pipeline that can be easily used to edit and analyze FITS images. The user can input multiple fits files and what data analytics he or she would like done on them and our pipeline will process it and output the related files without further user input.



This is an example of what we do with Python and FITS images. Here we've taken all of the images throughout the night, put them together in a 3D cube of images, and then spliced the cube. In this cube you can see star trails which have an arc due to the curvature of Earth. The light blue is excessive light which is from nearby trees and straight red lines would be from hot pixels.



This is an image taken with an Oculus camera at the UMD observatory. FITS images also have a header with image data, an example of which can be seen on the right. These images are commonly used for images of space because it includes relevant information like location of the camera and the time in which the image was taken, making it possible to locate stars, planets, meteors, etc found in the image.

Future Work

The All-Sky program is far from finished. The analyzing and automating processes can always be done more efficiently and more features can always be added. In addition to the All-Sky program at UMD the All-Sky program has extended its reach to an observatory in Haiti allowing us to take images of the sky from another perspective on Earth.

Impact on Me

Working on the All-Sky program has taught me valuable skills I will use in future working environments. I have learned how to develop and manage code on larger software than in class, I have learned how to program with a team of people, how to document and share code using github, along with other valuable skills. This has been my first experience working on a coding project outside of class or project I've taken up in my free time and has proven to be very rewarding.

Acknowledgements

Elizabeth Warner

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Automating the system with C++

We use C++ to automate the camera so it will take images, adjust exposure time, save images, and organize them by night without any user interaction. With the help of Python scripts, we will run the program each night with adjusted exposure times and number of images. Starlight Xpress has a public API written in C++ for Oculus cameras which we were able to use to jumpstart this part of the project.

Impact

This has made the process of taking images for the All-Sky project much easier and has laid the groundwork for further development for the project. Before our work, the only way the camera was able to be operated was by remote accessing into a computer at the observatory which then must be manually set to take a certain number of images with the camera and save them to the computer.



<http://www.sxccd.com/>

This is what an Oculus camera looks like. We are able to connect the camera to a computer via USB and can then automate and download pictures from it.