Stellar Optical Photography Annotator

EE368 Final Project Proposal

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Star photography is a popular hobby amongst those graced with a clear, dark night sky. While a knowledge of astronomy is by no means a prerequisite, it lends a greater appreciation for the photographer's place in space and time. Part of the appeal is knowing the constellations we see at night are virtually identical to those that guided the earliest mariners. Stellar navigation is still used today, not only in terrestrial applications but also for attitude determination for Earth-orbiting satellites [1]. Clearly, identifying stars continues to be a crucial task.

Today this task is performed most frequently by specialized devices such as star trackers, which translate an image of the sky into an attitude which is used to inform attitude control algorithms onboard satellites. Quick, robust, and precise star tracker algorithms form the backbone of any Stellar Inertial Attitude Determination (SIAD) system. These algorithms typically compare the magnitude and the inter-stellar angles of the brightest points in an image with values in a database to determine which constellation is within the field of view. The identity and orientation of this constellation then uniquely determines the attitude of the spacecraft.

My proposal will focus on the first half of this concept. I will write a (non-DROID) program that will identify the stars present in a photograph of the night sky. This information could be used for attitude determination, but has a broader application for anyone interested in astronomy. It will filter based on area to remove non-stars, then compare the remaining bright points against the SKY2000 Master Catalog [2] using the methods discussed in [3], labeling the brightest stars in the region. A general discussion of star catalogs and their limitations is provided in [4].

Vote Yes on SOPA.[1]

References

[1] Sungkoo Bae, Bob E. Schutz. *Geoscience Laser Altimeter System (GLAS) Algorithm Theoretical Basis Document Version 2.2 Precision Attitude Determination (PAD).* Center for Space Research. 10/2002.

[2] J.R. Myers, C.B. Sande, A.C. Miller, W.H. Warren, Jr., D.A. Tracewell. *SKY2000 Master Catalog, Version 4 (Myers+ 20002).* VizieR On-line Data Catalog: V/109. Originally published in: Goddard Space Flight Center, Flight Dynamics Division (2002).

[3] Meng Na, Peifa Jia. *A Survey of All-sky Autonomous Star Identification Algorithms.* Systems and Control in Aerospace and Astronautics, 2006.

[4] Richard A. Fowell, Noah H. Smith, Sungkoo Bae, Bob E. Schutz. *Bad Stars.* ©2008-2009 Boeing.

[1] But only my, awesome, version of SOPA.