Tracking Space Junk using Smart Phones: Citizen Science Eyes on the Sky

Using low light imaging apps on smart phones, very wide field of view images can capture satellites and space junk as they orbit the Earth. As the images are accurately time stamped and geo-tagged, they can be used to determine and update the orbits of the objects. This is a very important task for Space Domain Awareness (SDA) – figuring out where everything is and where it is going, to predict and avoid collisions (think the movie Gravity with George Clooney and Sandra Bullock).

If a large number of people with smart phones image the same object from different locations, an accurate orbit can be determined from the database of observations. Thus, this can be rolled out as a very simple Citizen Science project in order to gather a lot of data and get a lot of people interested in space junk and science in general.

Research Field
Astronomy, Citizen Science, Space Science

Project Suitability
PhD
Honours (as appropriate)

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Co-Supervisors

The resulting data and orbit determinations will be uploaded to a national database for SDA (a so-called DataLake) and would be used alongside data from other SDA sensors around Australia and around the world.

Aims of project:

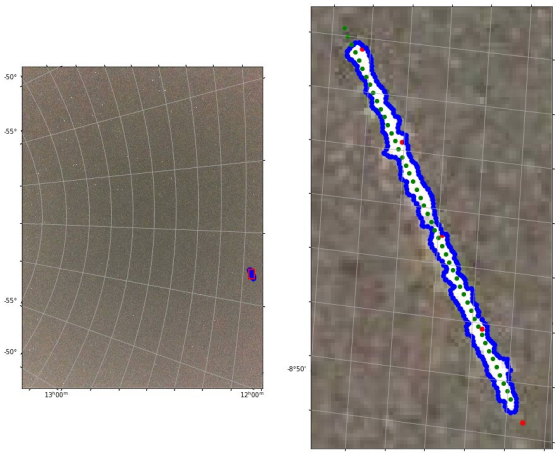
(i) Using python code, develop the software to process the images captured using smart phones, detect the satellites (prototype software has already been developed), and use those data to determine the orbits of the objects;

(ii) Develop a website that allows Citizen Scientists to upload their smart phone images, with the software developed on the back end processing those images. The website would provide feedback to people who have submitted images;

(iii) Develop an interface to the Australian national DataLake for SDA, so that the processed images and orbit determinations can be utilised as part of a multi-sensor national database;

(iv) Publish a series of papers on the software, the observations and data processing, and the orbit determination results;

(v) Present results at international Space Science and Education and Outreach conferences.



This image was taken with an iPhone 6+ and was processed to detect the satellite (a Falcon 9 upper stage rocket body, in this case). Left image is the full field of view of the camera (the satellite track is shown as a small red box and blue points). Right image is a zoom in of that box, showing the detected satellite track in detail, along with its predicted location (red dots) and a trajectory fitted to the observations (green dots).