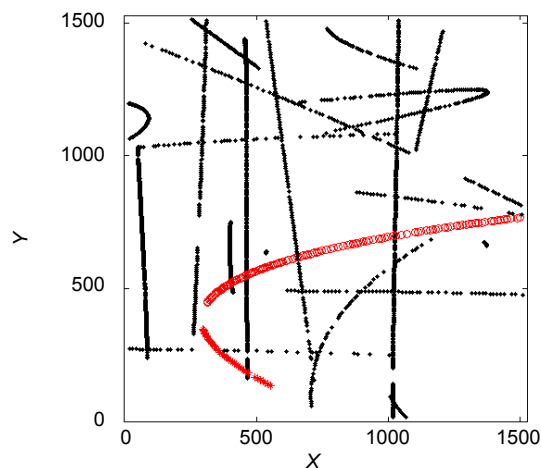


A method of GEO targets recognition in wide-field opto-electronic telescope observation

Hao Luo^{1,2*}, Yindun Mao¹, Yong Yu¹ and Zhenghong Tang¹

¹Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai 200030, China;

²University of Chinese Academy of Sciences, Beijing 100049, China



GEO target's movement track by CCD imaging.

Abstract: Geo-synchronous orbit (GEO) has been highly valued because of the increase of satellite launch activities and the limit of the orbital slots. In order to protect space activities in our exclusive orbit space, it is necessary to carry out the dynamic monitoring of Geo-synchronous orbit. Shanghai Astronomical Observatory developed an equipment with 100-square-degree field of view, called “optical prototype of Geo-synchronous orbit dynamic monitoring system”. The prototype was set up in Gaomeigu observation site in Lijiang. Observation experiment was carried out from December 2015 to February 2016. There are a large number of targets including GEO targets and stars in the field of view. The movement forms of GEO targets are various, including satellites working on orbit, new satellites entering orbit, orbit maneuver and deorbit. Some GEO targets with an inclination not equal to 0 degree move at a very low speed due to the Earth perturbation. Effective recognition of the GEO targets from the complex observation images is the foundation of the monitoring activity, and it is also the focus of this paper. GEO targets have an orbital period equal to the Earth's rotational period and thus appear motionless, at a fixed position in the sky, to ground observers. Due to the earth rotation, stars move at a speed of 15 "/s relative to the ground observers. Therefore, stars move far more quickly in the observation images than the GEO targets, and we can distinguish them by their different forms of movement. We propose the combination of frame difference method and track correlation method to recognize the GEO targets. Frame difference method is used to remove a large number of stars from the images. Then, we compare the images frame by frame, build the track and update it constantly. If the number of the images in one track reaches a certain amount, we can confirm that target in this track is GEO target. So we can use track correlation method to confirm the GEO targets and connect them from different images. This paper will introduce the applications of the method in detail. The feasibility and accuracy of the method are verified by the analyses of the observation data. The method can recognize more than 50 GEO targets in the field of view at the same time, and the recognition accuracy exceeds 95%.

Keywords: GEO targets; wide field of view; objects recognition

Citation: Luo Hao, Mao Yindun, Yu Yong, *et al.* A method of GEO targets recognition in wide-field opto-electronic telescope observation[J]. *Opto-Electronic Engineering*, 2017, **44**(4): 418-426.

See page 418 for full paper.