Recognition of Faint Bolides – Preliminary Works

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1 Introduction

This contribution relates to earlier papers presented at this conference, which deal with detection of meteors in digital astronomical snaps. The use of Hough transformation and clustering for detection of meteors and statistical processing of meteoric images were presented at the SVK 2011 and SVK 2012 (see References Kubičková (2011) and Kubičková (2012a). These methods reached up 80 % successfulness of detected meteors. However new task have arisen and new methods for detection of meteors is needed.

New task for meteor detection represents recognition of faint bolides, which are very difficulty distinguishable from the image background. That represents a complex problem, which includes several different tasks. For that reason the solution was divided into individual steps. This article describes two first steps, which try to resolve main problems for that the use of previous methods is impossible.

2 Conversion of image matrix into sparse matrix

Meteor detection methods mentioned above have a great disadvantage – they are very time consumption. This is not a great problem, when images of small size and small number are processed. However, now thousands of snaps will be processed and time demands are important. Image data represent a number matrix. If it would be possible to perform image processing operations with spare matrix, than demands to computational time would decrease. Sparse matrix contains few non-zero elements and effective methods for computations with sparse matrices exist. The following figures show examples of reduction of image matrices.

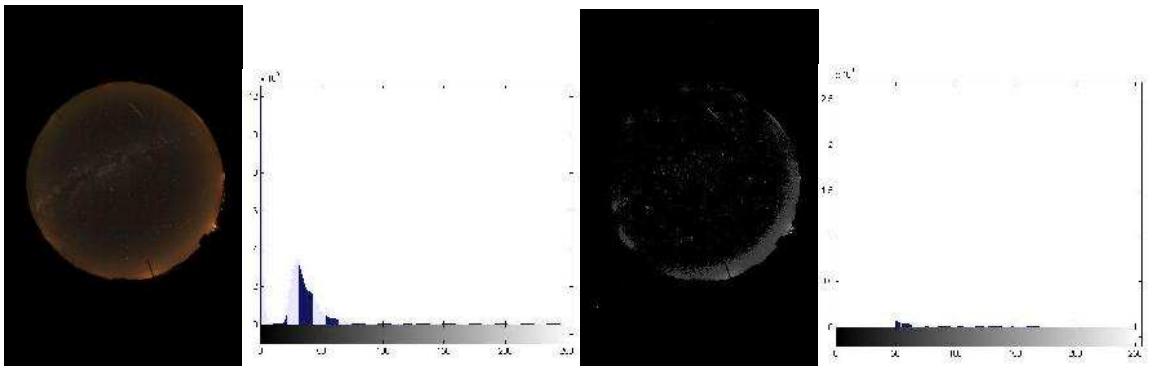

Figure 1: Original image and its histogram and reduced image and its histogram

Images after reduction of brightness can be processed by common image processing methods as Houg or Radon transformation. Numerous meteoric snaps contain bright background with the Moon and stars. The example of such an image is shown in Figure 2.

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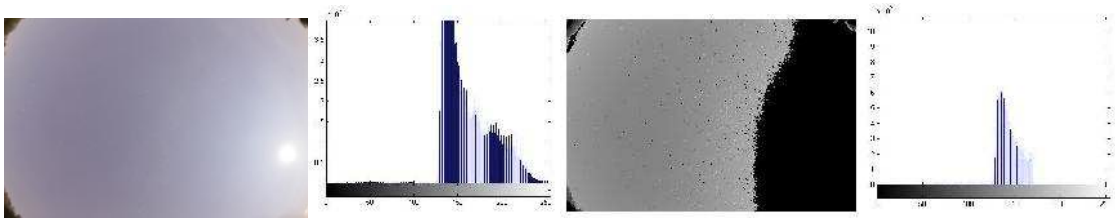

Figure 2: Meteoric image with faint bolide on the bright background

3 Classification of meteoric snaps

The previous paragraph has shown that the problem of recognition of faint bolides in fact represents two different tasks. The first is detection of meteors in typical astronomical snaps with dark night sky. The second task is searching for meteors in snaps, which have obtained during moon nights. For that reason classification and division of meteoric images into minimally two large groups is necessary. Statistical methods for this task are used. Also snaps from the first group represent problem how to determinate threshold for conversion image matrix.

4 Conclusion

The paper has brought a brief introduction into problem of recognition of faint bolides in meteoric images. This problem is up-to-date, because research groups interested in meteoric astronomy are starting to work with digital cameras for capture meteors. There is in the Czech Republic top research in meteor astronomy, Czech astronomers operate Australian bolide network, and also this task was assigned from the Astronomical Institute of the Academy of Sciences of the Czech Republic. Now about two thousand snaps are in process. The automated user menu on the basis of Image Processing Toolbox was created for testing of snaps. The first results show that some images are very dark, some very bright, but there are also snaps in the middle by their value of brightness. It is possible that more than two groups of snaps arisen, which will demand new approaches to problem solving.

Acknowledgement

This work has been supported by the grant SGS-2013-032 of the University of West Bohemia.

References

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