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THE FORMATION OF REFERENCE IMAGES BASED ON THE BRIGHTNESS CHARACTERISTICS OF REFERENCE AREA

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Navigation of aircraft, which uses the correlation-extreme systems (CENS), depends on multiple factors, both external and internal.

The type of surface and the objects located on it, which differ according to informative characteristics, such as brightness, contrast, linear dimensions, are essential. It is often necessary to bind with surfaces with a small number of objects, besides having small vertical dimensions. All these factors can have a significant impact on the accuracy of aircraft positioning, necessitating research and the search for a rational way to generate RI.

It is proposed to form reference images in conditions of a limited number of objects on the surface of the reference area on the basis of the results of a correlation comparison of the original image (OI) of the reference area with a set of selective images. Furthermore, in order to identify and isolate objects (fragments of the image) with a dominant brightness, a correlation is proposed based on the brightness parameter measured by the primary processing sensor of the information extraction system, according to which selective images of the corresponding background are formed. Such objects may, for example, be a dirt road against a field background, a river bed. In order to perform the correlation analysis of the image, it is advisable to carry out the "sliding window" method. The essence of the "sliding window" method is the general analysis of image pixels that are "covered" by some two-dimensional, usually square, area of finite size. All image pixels that enter the comparison sector are processed according to a certain rule. The result of the processing is the brightness (color intensity) of the pixel of the original image or the element of the two-dimensional matrix of the transformation results, which corresponds to the center of the window. The window is then shifted by one pixel and the processing is repeated. The process is completed when the window is shifted to all possible values within the image. If fragments of the input image itself are used alternately to perform the luminance correlation analysis of the image as a "sliding window", the result of this treatment will be a set of joint correlated function (JCF) of fragments of images and whole images.

Therefore, such a correlation analysis will make it possible to determine the contribution of image fragments to the autocorrelation function (ACF) of the whole image. This is necessary to produce a selective RI that includes only those fragments of the image that are important for maintaining the correlation between the original image and the formed RI.

Selective images obtained by highlighting the brightest areas of OI maintain a correlation with the original image. Since the FCAB cross-section level can be different, it is evident that a necessary part of the reference image generation method is the certain quality control of the obtained selective images by constructing and comparing the ACF of the original image and the JCF of the original and selective images.

Since the visual analysis (comparison) of the ACF and the JCF of the original and selective images is subjective, it is appropriate to use a quantitative measure to quantify the ACF (JCF) produced, which will be used as an indicator of selective image quality.

A selective image that will have the best value of such an indicator is RI. The experiment used different images of the same terrain (from different satellites and obtained during different seasons) to form RI using the proposed method and to simulate the process of obtaining current images from external sensors.

The number of iterations of simulations was more than 1,000. The resultant value of the circular probability deviation of an aircraft equipped with CENS from the given location point was 0.6m, which fully meets the modern requirements for the solution of most aircraft navigation problems.

Thus, the developed method of iterative formation of selective reference images for CENS by the "sliding window" method, using the correlation analysis of images based on brightness, can be applied in CENS with external sensors, which form an image in the visible optical, infrared and radar range. The disadvantages of the method may include relatively high requirements for computational resources. The RI preparation time (depending on the power of the calculator) can take several hours. It is therefore appropriate to use this approach for the preparation of reference images in cases where there are no rigid time requirements for the task.

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