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None

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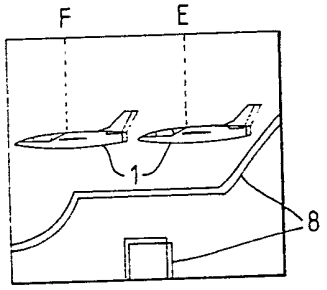
UK CL (Edition J) G1A AAJ AHF, H4F FDG
INT CL⁴ G06F

# (54) Background differencing operator for target motion detection

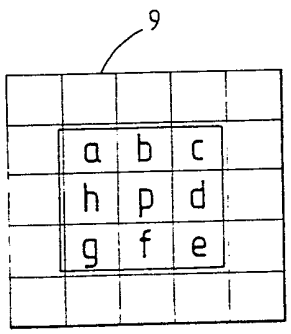
(57) The images of two successive scenes are subtracted pixel by pixel to leave an image containing only a moving target, the background being eliminated. If the background moves relative to the camera the background is not eliminated, edges in particular being prominent, Fig 5. In order to obviate this effect a pixel from the second image is subtracted not only from the corresponding pixel in the first image, but also from each of p x q pixels Figure 6 adjacent to the corresponding pixel and the minimum difference used in the resultant image.

Fig.5.

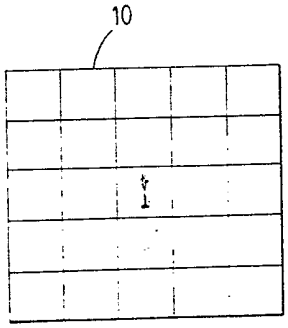



DIFFERENCE SCENE

Fig.6.




FRAME 1




FRAME 2

GB 2 215 938 A

Fig.1.

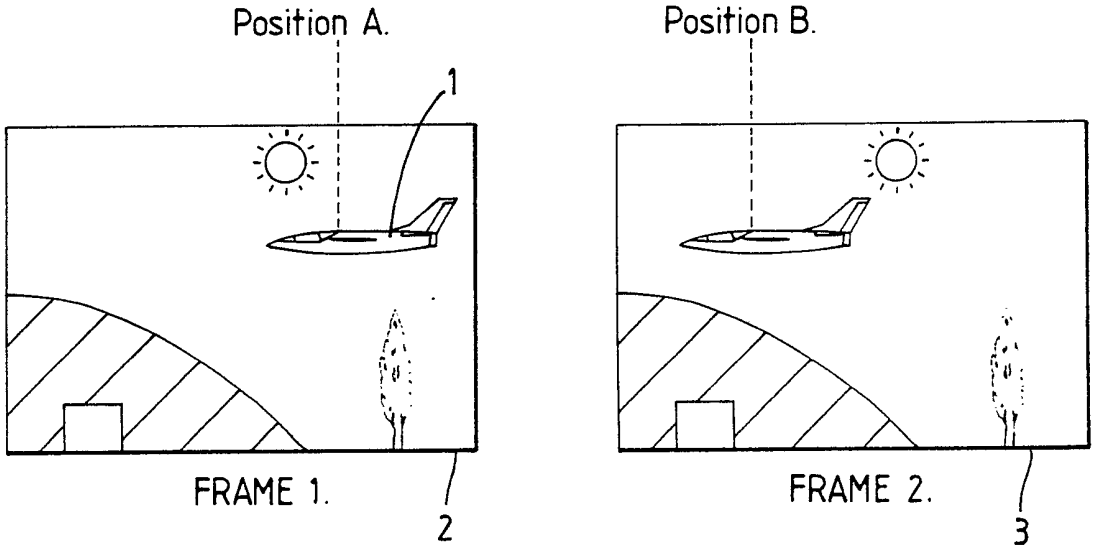

Position A.
Position B.
1
FRAME 1.
FRAME 2.
2
3

Fig. 2.

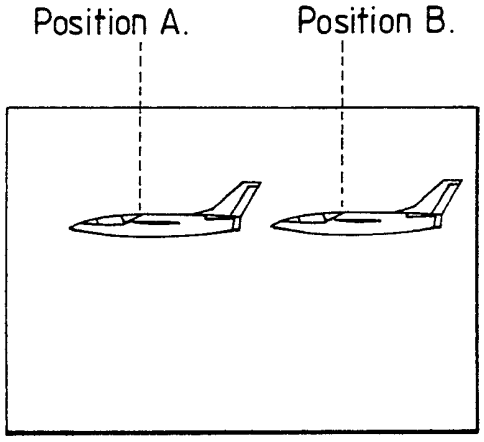

Position A.
Position B.
DIFFERENCE SCENE

Fig.3.

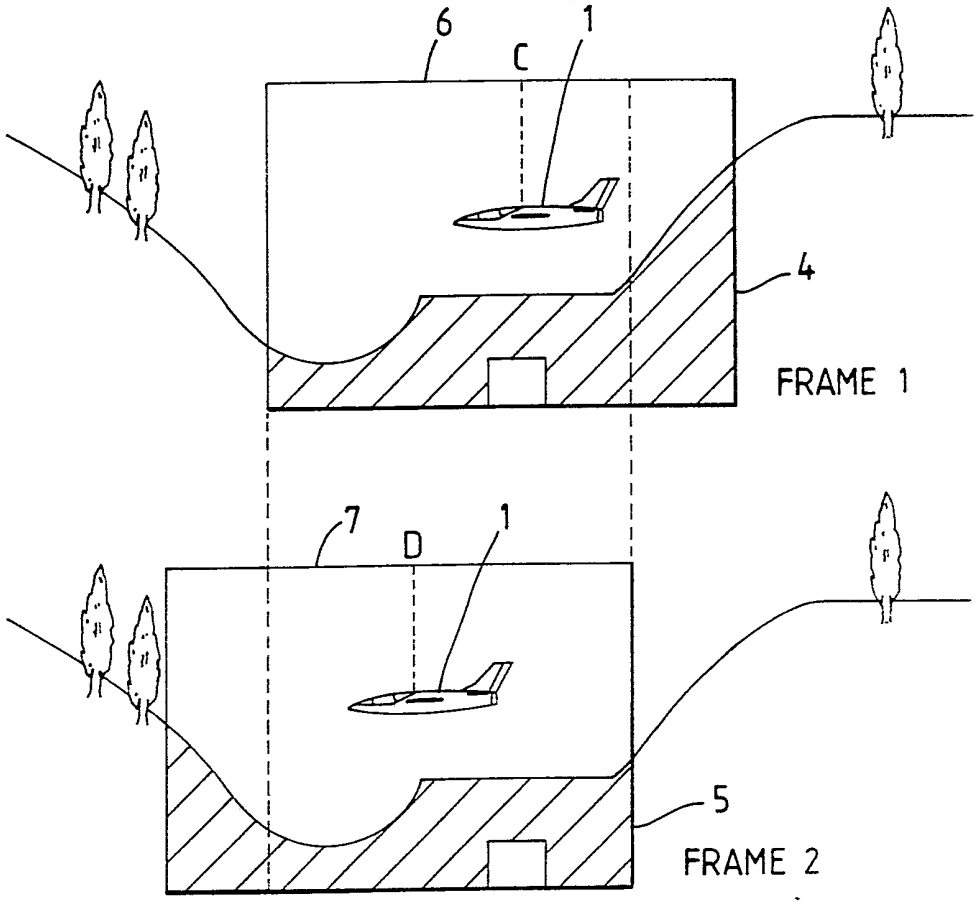



Fig.4.

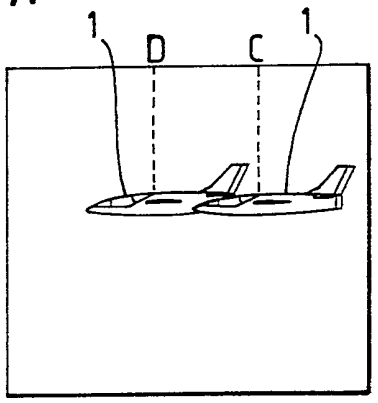
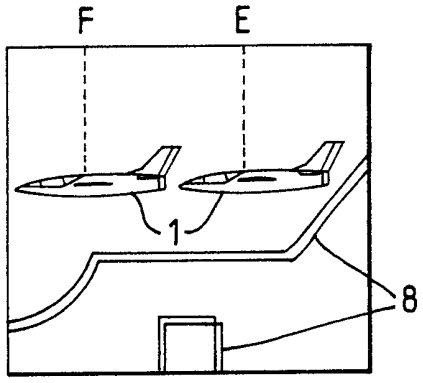
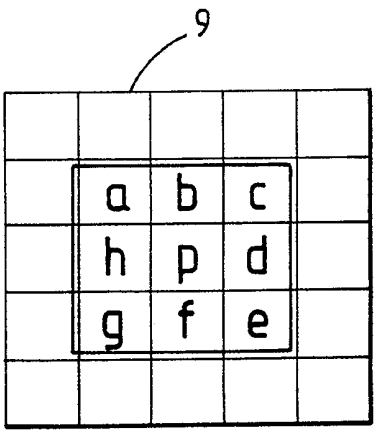


Fig.5.

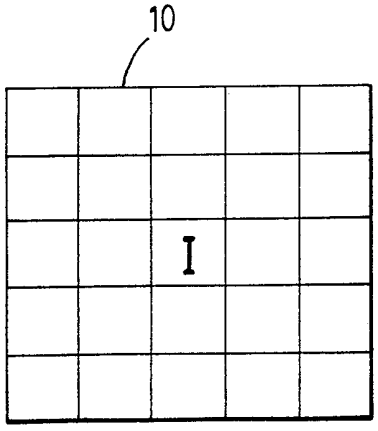



DIFFERENCE SCENE

Fig.6.




FRAME 1




FRAME 2

# BACKGROUND DIFFERENCING OPERATOR FOR TARGET MOTION DETECTION

This invention relates to guidance systems, specifically, but not exclusively, to systems where the background is removed from the field of view (FOV).

Generally the background information in a FOV is removed by differencing two frames. If the camera or guidance system is stationary relative to the background, i.e. only the target is moving, the background can be eliminated from the differenced scene. However, if the camera and/or the background are moving relative to each other the situation is not as simple, as straightforward differencing would result in significant background edge information in the differenced scene.

Accordingly, one object of the present invention is to provide a means for differencing scenes without producing background edge information.

According to a first aspect of the present invention there is provided a video image processing method in which each pixel of one recorded video image is compared with a corresponding pixel of another recorded video image and with each of a plurality of pixels of the another image which are adjacent to said corresponding pixel using a p x q difference operator so as to determine the minimum one of the differences between the pixel of the one image and the corresponding and adjacent pixels of the another image, and then using the minimum difference values to construct a further video image representative of the difference between said one and said another image.

According to a second aspect of the present invention there is provided a method for producing a differenced image for regions of more than one image wherein said regions contain substantially the same stationary features, in which said method includes the steps of:-

recording more than one images of a scene;

locating equivalent regions within two or more of said images in which said regions contain essentially the same stationary features;

applying a 3x3 difference operator to the pixels of one of said regions in which the minimum difference is determined between the pixel at the same location as the central position of said operator in one scene and each of the pixels of said operator in another scene;

scanning said operator raster fashion; and,

producing a difference image from the minimum difference value for each pixel within said regions.

Reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is a diagram of two scenes in which the background is consistent in both scenes;

Figure 2 is a diagram of the difference scene of the Figure 1a scenes;

Figure 3 is a diagram of two further scenes in which the background is different in the scenes;

Figure 4 is a diagram of the ideal differenced scene of the Figure 3 scenes;

Figure 5 is a diagram of the actual differenced scene of the Figure 3 scenes; and,

Figure 6 is a diagram illustrating two pixel masks for placing over the one to the scenes of, for example, Figure 3.

Referring to Figure 1, an aircraft 1 is shown in images 2 and 3 of consecutive scenes. The background in both of image 2 and 3 is identical since the background is not moving relative to the camera (or vice versa). The difference between the images can be seen from Figure 2 and is simply that the aircraft 1 is in different positions (A and B) in each image.

Referring to Figure 3, the aircraft 1 is again shown in images 4 and 5 of two consecutive scenes. In this case however, the background is moving relative to the camera. In order to obtain a differenced image only the regions in which the background is equivalent in both images i.e. regions 6 and 7 should be considered.

Assuming regions 6 and 7 are accurately predicted a differenced image as shown in Figure 4 would be produced. However it is typically only possible to locate regions 6 and 7 to an accuracy of an F1 pixel. Differencing thus results in significant edge information 8 as shown in Figure 5.

In order to overcome this problem a difference operator is used to obtain the differenced image. Referring to Figure 6, pixels I and p are in corresponding positions in images 9 and 10 of two consecutive scenes. Instead of just subtracting pixels I and p from each other, pixel I is in addition taken away from pixel p's eight nearest neighbours (a,b,c,d,e,f,g and h). The

smallest value obtained from these absolute differences goes into the difference scene. The difference scene pixel value D is given by:-

$$D = \min (|I-p|, |I-b|, |I-c|, |I-d|, |I-e|, |I-f|, |I-g|, |I-h|$$

This 3 x 3 operator is applied to the first image of two for each pixel position in the region of common background, (e.g. for 6 and 7). The operator is scanned raster fashion over all the pixels of regions 6 and 7 except for the outer border, one pixel deep. The resulting difference image will contain only target information as in the ideal situation of Figure 4.

## CLAIMS

1. A video image processing method in which each pixel of one recorded video image is compared with a corresponding pixel of another recorded video image and with each of a plurality of pixels of the another image which are adjacent to said corresponding pixel using a p x q difference operator so as to determine the minimum one of the differences between the pixel of the one image and the corresponding and adjacent pixels of the another image, and them using the minimum difference values to construct a further video image representative of the difference between said one and said another image.

2. A method for producing a differenced image for regions of more than one image wherein said regions contain substantially the same stationary features, in which said method includes the steps of:-

recording more than one images of a scene;

locating equivalent regions within two or more of said images in which said regions contain essentially the same stationary features;

applying a 3x3 difference operator to the pixels of one of said regions in which the minimum difference is determined between the pixel at the same location as the central position of said operator and each of the pixels of said operator;

scanning said operator raster fashion; and,

producing a difference image from the minimum difference value for each pixel within said regions.

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