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DETECTION AND CODING OF MODEL FAILURES IN AN ANALYSIS-SYNTHESIS CODER BASED ON MOVING 3D-OBJECTS

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For object-oriented analysis-synthesis coding (Fig. 1) an image analysis algorithm is required which automatically generates the parameter sets which allow to synthesize an image sequence. In this contribution it is assumed that 3-dimensional rigid objects are arbitrarily moving in 3-dimensional space. Thus, the 3-dimensional real world is modelled by a 3-dimensional model world [1,2] . Goal of the modelling is to generate a model world which has a model image identical to the real image.

Task of the image analysis algorithm [2,3] is to find moving objects in the scene and describe each object by means of shape, motion and color parameters. Furthermore, model failures, i.e. areas where the model assumption does not hold, have to be segmented. By means of these parameter sets it is possible to synthesize realistic looking images. These parameter sets have to be coded by parameter coding. Comparing the source models of moving rigid 3D-objects and 2D-objects the amount of bits used for coding motion will not differ significantly but an enormous increase in shape information is possible depending on the representation of 3D-shape. In this contribution the 3D-shape of an object is determined by the object silhouette [3]. Hence, the amount of shape information to be coded is comparable to the case of 2D-objects.

The parameter sets of an object-oriented analysis-synthesis coder [2] are coded by parameter coding. Parameter coding is controlled by coder mode control. Coder mode control allows to concentrate transmission of color parameters on small image areas and to suppress transmission in areas where the image can be synthesized.

Knowing the model world at both sides of the communication link, only changes of object shape and object color, object motion and new objects entering the scene have to be coded.

Goal of this contribution is to detect and code model failures. Model failures are those areas in the image which cannot be described by the source model. Hence model failures are detected by image analysis. This is done in two steps. First, areas of image synthesis errors are segmented. In areas of image synthesis errors the real and the synthesized image differ significantly when compared to background noise. In a second step the areas of image synthesis errors are divided into areas due to geometric distortions and areas representing model failures. The criteria for distinguishing between model failures and geometrical distortions are size and shape of the areas with synthesis errors and the error signal between real image and model image inside these areas. Geometrical distortions include errors caused by small position errors.

Since model failures cannot be described by the source model, they are described by two-dimensional shape information and color information. This shape information is approximated and coded using straight lines and splines [4]. Quality measure of the shape

approximation is the absolute distance D_{max} between the original contour of the area and the approximated contour.

For the source model of moving 3D-objects first results of an analysis-synthesis coder will be presented. Motion information and object silhouettes will be coded efficiently. Model failures are detected and coded. Shape information of model failures is coded with D_{max} = 2.9 pel. Color information of model failures is presently PCM coded. It was found that approximating shape information with D_{max}=2.9 minimizes the amount of bits needed for coding model failures if a color coding algorithm requiring an average bit rate of 1.5 to 2 bits/pel would be applied.

References:

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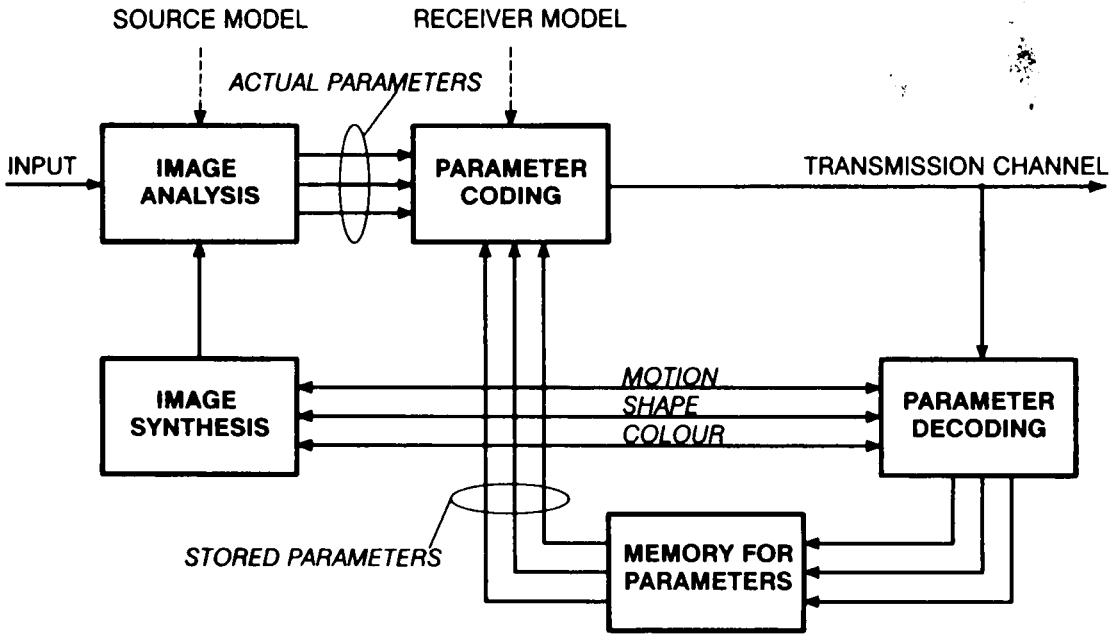

Fig. 1 BLOCK DIAGRAM OF AN OBJECT-ORIENTED ANALYSIS-SYNTHESIS CODER