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Specialist Group on Coding for Visual Telephony

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Titel: Motion Compensating Field Interpolation

In order to achieve very low bit rates for the transmission of television sequences, it is necessary to reduce the number of transmitted fields. At the receiver the skipped fields have to be interpolated with respect to motion of objects to avoid blurring in the reconstructed fields. This contribution summarizes the current state of a Motion Compensating Field Interpolation (MCI) Algorithm, that is under development at the University of Hannover.
The interpolation algorithm has been implemented as a computer program. So far, simulations have been carried out with the agreed Split/Trevor-Sequence of COST 211-bis.

1. Structure of the MCI-Algorithm

Fig. 1 shows that part of the interpolation algorithm described in [1], which has been implemented up to now. The blockdiagram consists of three blocks, these are displacement estimator, change detector and motion compensating interpolation filter.

2. Displacement estimator

To determine the displacement vectors for two successive transmitted fields a differential displacement estimation algorithm developed by Bierling [2] is applied. Compared to other known algorithms the stability behaviour and the precision of estimate is improved using a more accurate image model.
In order to obtain displacement vector fields, which are uniquely defined at each picture element of the fields to be interpolated, a measurement technique proposed by Beyer [3] is adopted, that is independent of the chosen displacement estimation algorithm.

3. Change Detector

The change detection algorithm evaluates the absolute frame differences for each picture element of two transmitted fields, to distinguish between changed and unchanged regions. This information is used to assign zero displacement vectors to the unchanged areas.

4. Motion compensating interpolation filter

The displacement vectors control the motion compensating interpolation filter, that calculates the picture elements for the fields to be interpolated by means of the transmitted fields. The displacement vector field, calculated with the luminance data only, is used for both, the interpolation of luminance signals and the interpolation of chrominance signals.

A publication giving the details of the algorithm is going to be prepared.

References

[1] Thoma, R., "A Refined Structure of a Motion Compensating Interpolation Algorithm", to be published at Picture Coding Symposium Tokyo, Tokyo (Japan), April 1986

[2] Bierling, M., "A Differential Displacement Estimation Algorithm with Improved Stability", 2nd Int. Tech. Symposium on Optical and Electro-Optical Applied Science and Engineering, Cannes, December 1985

[3] Beyer, S., "Displacement-Schätzverfahren für Fernsehbildsignale mit minimaler Schätzfehlervarianz", Dissertation, Universität Hannover, 1985

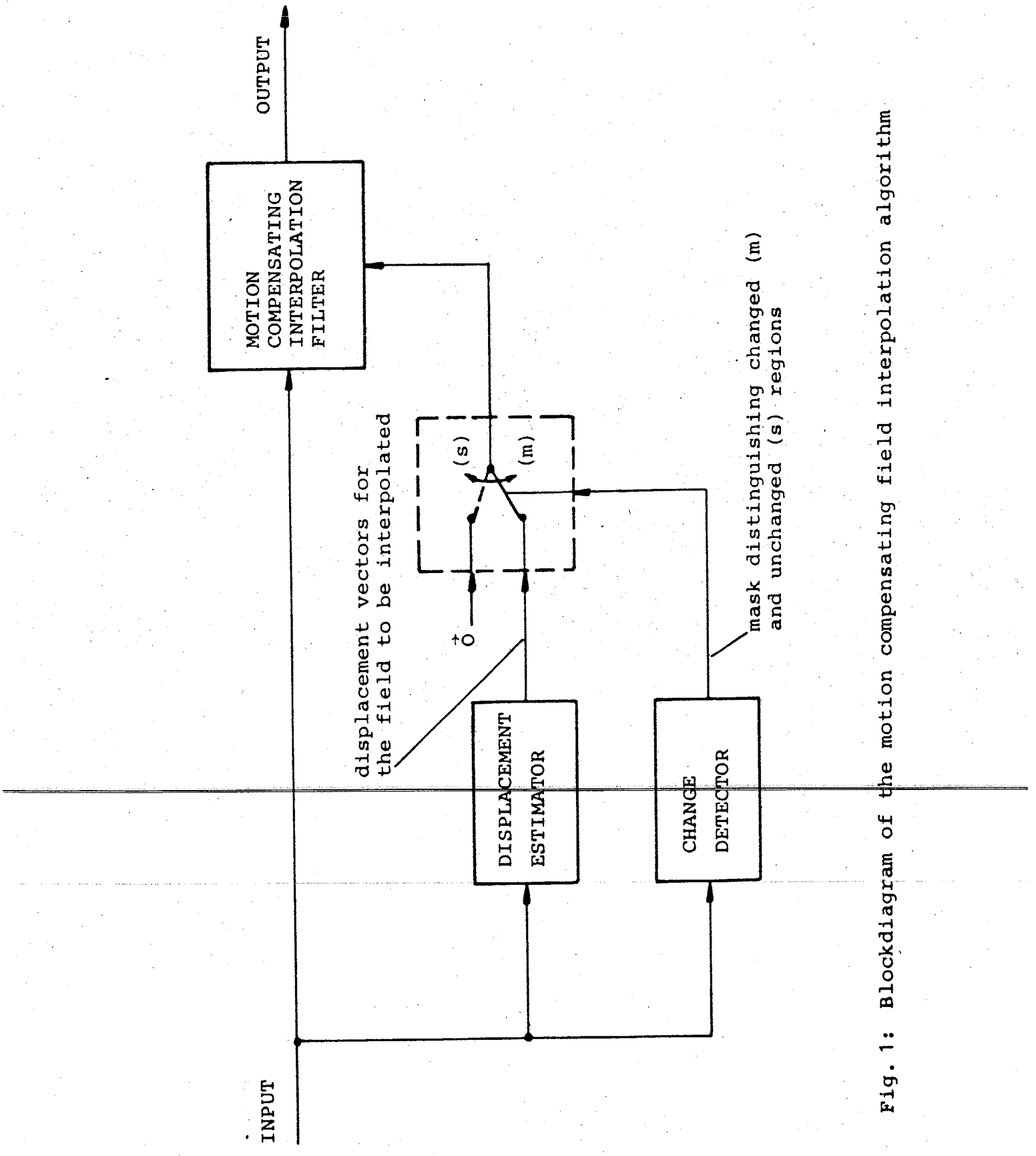

Fig. 1: Blockdiagram of the motion compensating field interpolation algorithm

Explanation to demonstrations

Seq. nr. COST-testsequence SPLIT/SCREEN + TREVOR WHITE

Frame nrs. 1...125

Window: no

Subsampling of luminance: sampling rate conversion 1:2

Subsampling of chrominance: sampling rate conversion 1:2

Temporal subsampling: 1:4

Coding technique:

1. Original PCM-data
2. Hybrid coding technique (256-kbit/s DCT coded/decoded)

Postprocessing:

Motion compensating field interpolation

sampling rate conversion luminance 2:1

sampling rate conversion chrominance 2:1