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SIMOC: A European Initative towards MPEG–4 by COST 211

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1 Introduction

Within the European research initiative COST (**Co**opération européenne dans le domaine de la Recherche **S**cientifique et **T**echnique), the project COST 211ter works on the topic of *Coding of Video Signals in Multimedia Services*. Currently, members from industries, telecoms and universities of 14 European countries are contributing to this topic. These members are Daimler–Benz AG, LEP Philips, Nokia Research Center, Robert Bosch GmbH, Siemens AG, VTT, British Telecom, CCETT, CNET, CSELT, DBP–Telekom, INESC NORTE, Norwegian Telecom Research, PTT Research, Telefonica I+D, Bilkent University, CMM, Dublin City University, ENST, EPFL, Heinrich–Hertz–Institut, Instituto Superior Tecnico, KU Leuven, RWTH Aachen, Tampere University of Technology, Universitat Politecnica de Catalania, Universte Catholique de Louvain, University Coimbra, University of Hannover, and University of Thessaloniki.

Within ITU–T SG15, Working Party 15/1, COST 211ter gives input to the standardization of H.VLC/N. Its major contribution is its simulation model SIM3 which was adopted as test model TMN1 by ITU–T. TMN1 is a block–based hybrid coder with adaptive motion compensation [2]. At PTT Research and CNET, a hardware codec working at a data rate of 24 kbit/s for audio and video is operational since 1993. Furthermore, CNET implement a coding mode VCS1, which is close to TMN1.

Currently, COST 211ter is developing an advanced coding scheme for coding of image sequences at data rates below 64 kbit/s. In close cooperation with the RACE project MAVT, COST 211ter develops the simulation model SIMOC (Simulation model for object–based coding by COST). SIMOC is an object–based analysis–synthesis coder (OBASC) based on the source model of moving flexible 2D objects (F2D) [7][5][4][1][11]. The main difference between OBASC and region–based approaches to coding is that an OBASC segments an image based on motion [10] whereas a region–based coding schemes segment an image based on texture [6][9]. However, both approaches to coding influence each other for their mutual benefit. In the following, some details of SIMOC and the influence of an object–based coder mode on coder control are given.

2 SIMOC

The definition of SIMOC started in the beginning of 1993. SIMOC (Fig. 2.1) is still in its first phase of development. According to the applied source model, objects are defined by their uniform motion. They are topologically connected. Currently, SIMOC is based on the

source model F2D. The coder detects moving objects in the scene and describes them by motion, shape, and colour parameters. Colour parameters denote the chrominance and luminance reflectance on the object surface. A displacement vector field describes object motion. In order to avoid blocking artifacts, the vector field is interpolated between transmitted vectors. Object shape is approximated using a polygon approximation. Due to the object–based image description, a predicted image using current motion and shape parameters as well as previously transmitted colour parameters does not exhibit block or mosquito artifacts as known from block–based coders. Subjectively, it looks correct. Therefore, SIMOC allows a greater irrelevancy reduction than a block–based coder.

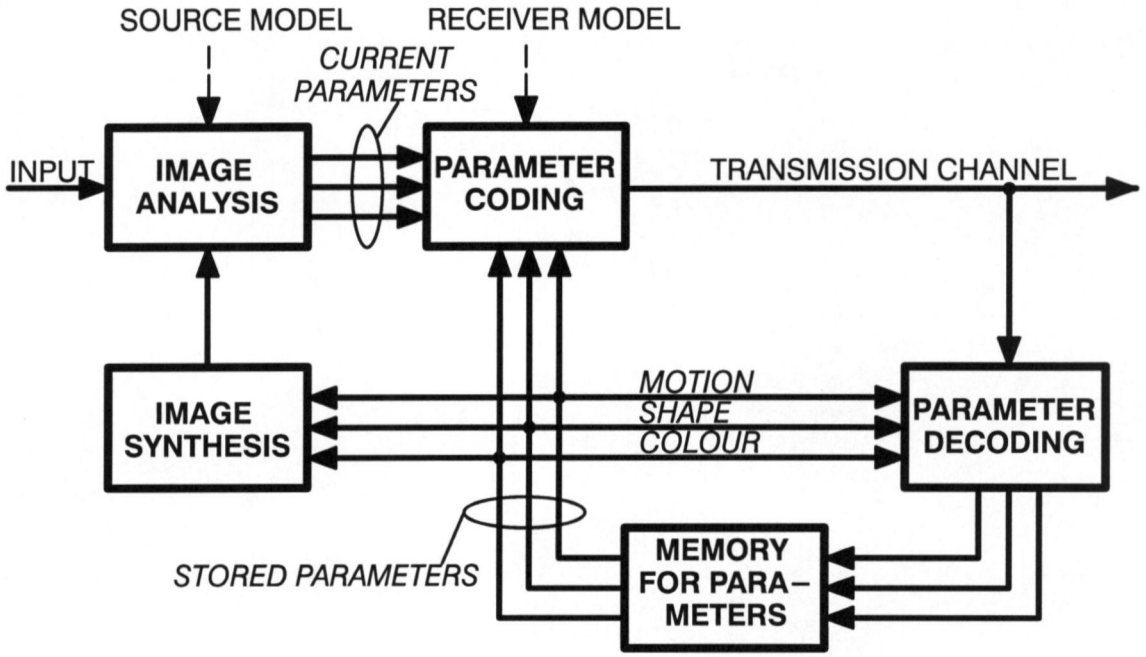

Fig. 2.1: Block diagram of SIMOC.

3 Switching of Coder Modes

Codecs working according to the standards H.261, MPEG–1 or MPEG–2 transmit motion (displacement vectors) and colour parameters (DCT coefficients). In addition to these two parameter sets, SIMOC requires the transmission of shape parameters. Therefore the question arises, in which cases object–based coding is superior to block–based hybrid coding. A similar question had to be answered when block–based hybrid coding was standardized. There are three categories of prediction modes in codecs like H.261, MPEG–1 and MPEG–2: If the motion estimation is successful, the source model of moving square blocks is applied. Motion parameters are transmitted (*MC–mode*) and if need be colour parameters as well. If the motion estimation is not necessary due to a static image part or if it simply fails, the coder switches to an *inter–mode* coding the temporal prediction error. If this temporal prediction error is greater than the original image signal, the coder switches to its basic *intra–mode*.

Under certain circumstances, an OBASC has to switch from its *object–based–mode* to one of the modes known from block–based coders [3]. There are strong indications, that the object–based mode is only efficient if the moving objects are larger than app. 800 pels [8].

A coder–mode control will be an interesting topic for further research. In order to control the coder modes mainly by the size of the moving objects, further progress in image analysis is required although image analysis itself is not a standardization issue.

4 Conclusion

COST 211ter will develop an object–based analysis–synthesis coder based on the source model of moving flexible 2D objects for coding of moving images at very low bit rates. It is a common understanding, that significant effort has to be directed towards image analysis and the switching of coder control between an object–based–mode and modes known from block–based image coders.

5 Literature

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