CELLULAR NEURAL NETWORK-BASED OBJECT-ORIENTED VIDEO COMPRESSION: PERFORMANCE EVALUATION

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Abstract. In the context of video delivering techniques some efforts have been recently devoted to the development of Cellular Neural Network-based (CNN-based) architecture for real-time object-oriented video coding applications. However, until now attention has been mainly focused on the basic functionality of the architecture, rather than on the system performances. This paper bridges the gap by analyzing the compression capabilities related to some benchmark video sequences. In particular, by considering the *bit-per-pixel* and the *Peak Signal to Noise Ratio* related to *Foreman* and *Car-phone* video sequences, the paper shows that the CNN-based coding approach outperforms the $MPEG$-4 codec without any CNN capability. Comparisons with different $MPEG$-4 codecs confirm the potentiality of the proposed CNN-based coding paradigm.

Keywords. Cellular Neural Networks, object-oriented methods, image processing, video compression, neural dynamics.

1   Introduction

In the framework of video delivering techniques, a challenging research topic is the study of coding methods able to provide high compression ratios, while maintaining satisfying picture quality [1]-[5]. Referring to the object-oriented coding schemes (such as the MPEG-4 [1]), they mainly include two kinds of operations, i.e., the image-analysis operations and the coding operations [5]. Since image-analysis is computationally demanding and requires powerful hardware, this poses several challenges to the use of such an approach on-board of devices such as portable hand-sets. To face these issues, the idea recently proposed in [5]-[9] is to exploit the Cellular Neural Network (CNN) Universal Machine [10] as the engine responsible for the image-analysis operations. In particular, in [8] a novel CNN-based architecture for real-time object-oriented video coding applications has been presented. More precisely, in [8] the system architecture has been designed by combining object-oriented CNN algorithms and MPEG processing capabilities. However, in [8] the attention is mainly focused on the design and on the basic functionality of the architecture, rather than on the system performances. Namely, the issue related to the evaluation of the compression capabilities is not discussed by [8].