Towards Semantic Compression from Deep Learning and Neuro-inspired Compression

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ABSTRACT

During the last decade, there is an ever-increasing interest about the decryption and analysis of the human visual system, which offers an intelligent mechanism for capturing and transforming the visual stimulus into a very dense and informative code of spikes [1]. The compression capacity of the visual system is beyond the latest image and video compression standards, motivating the image processing community to investigate whether a neuro-inspired system, that performs according to the visual system, could outperform the state-of-the-art image compression methods. Inspired by neuroscience models, we propose for a first time a neuro-inspired compression architecture for RGB images. Specifically, each colour channel is processed by a retina-inspired filter [2] combined with a compression scheme based on spikes [3]. To evaluate the performance of the proposed algorithm we use Full-Reference (FR) and No- Reference (NR) Image Quality Assessments (IQA). We further validate the performance improvements by applying an edge detector on the decompressed images, illustrating that contour extraction is much more precise for the images compressed via our neuro-inspired algorithm. We demonstrate that, even for a very small number of bits per pixel (bpp), the proposed compression system is capable of extracting faithful and exact knowledge from the input scene, compared against the JPEG that generates strong artefacts [3]. Within the same content, we also utilized Convolutional Neural Networks (CNN) for image classification in order to examine the accuracy of the system when the input image has been highly compressed by the proposed neuro-inspired compression mechanism and by the JPEG standard. According to the experimental results, the neuro-inspired compression seems to better preserve the necessary features that drive a CNN to an accurate prediction.

REFERENCES

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