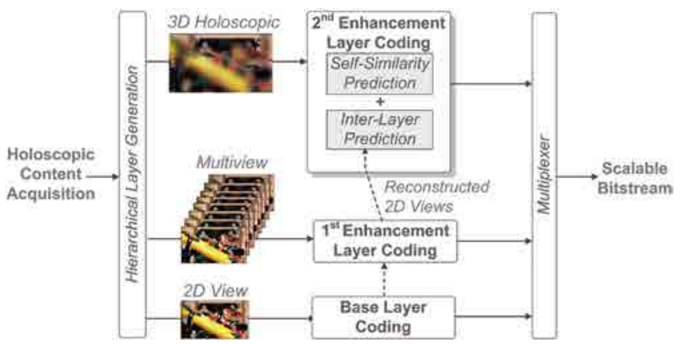
3D-SERVICIS

Scalable Error Resilient 3D Holoscopic Video Coding for Immersive Systems

3D holoscopic imaging, aka light-field imaging, became a practical, prospective technology to create more realistic depth illusions without requiring any eyewear and exhibiting continuous motion parallax through the viewing zone, enabling immersive and closer to reality multimedia experiences. The project advances the state-of-the-art in 3D holoscopic content representation, processing and coding.



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Indicators	
Funding	41k €
Journal papers	2
Conference papers	6
Book Chapters	2
Concluded MSc	2

Two Main Publications

C. Conti, L. D. Soares, P. Nunes, Hevc-Based 3D Holoscopic Video Coding Using Self-Similarity Compensated Prediction, "Signal Processing: Image Communication", Vol. 42, No., Pp. 59 - 78, March, 2016

L. Lucas, C. Conti, P. Nunes, L. D. Soares, Nuno M. M. Rodrigues, C.l.p. Pagliari, E. Silva, S.m.m. Faria, Locally Linear Embedding-Based Prediction For 3D Holoscopic Image Coding Using Hevc, "European Signal Processing Conf. - Eusipco", Lisbon, Portugal, September, 2014

PROJECT WEBPAGE URL
https://www.it.pt/projects/index/1994

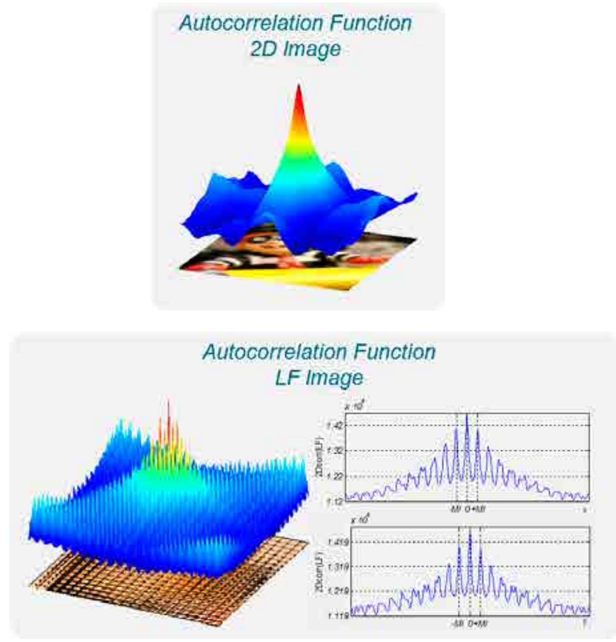

Fig. 1 Light field auto-correlation.

Fig. 2 3D - servicis demonstrator - light field processor.

GENERAL MOTIVATION AND OBJECTIVES

Surpassing the disadvantages related to human factors of currently available video technologies to provide more immersive and closer to reality multimedia experiences to home-users has attracted the attention of many researchers worldwide. In addition, major standardization bodies, such as ISO MPEG, ISO JPEG, and ITU VCEG, have also been stimulating lately the research and development of new imaging technologies beyond state-of-the-art standardization efforts.

Due to recent technological and theoretical advances, light field imaging, became a practical, prospective 3D technology to create more realistic depth illusions without requiring any eyewear and exhibiting continuous motion parallax through the viewing zone, promising to become a popular imaging technology in the near future.

However, to gradually introduce this technology into the consumer market and to efficiently deliver this type content to end-users, backward compatibility with legacy displays is essential. This would mean that a legacy two-dimensional (2D) device (or a legacy 3D stereo device) that does not explicitly support light field content should be able to play a 2D (or 3D stereo) version of the light field content, while a more advanced device should play the light field content in its entirety. Therefore, this project aims to develop a multi-layer display scalable architecture for light field video coding, where each layer represents a different level of display scalability. The developed methods shall improve the coding efficiency when compared to independent compression of the three different display layers (simulcast case).

CHALLENGE

To advance the state-of-the-art in terms of light field content representation, processing and coding, notably, the development of robust and efficient content scalable coding algorithms to enable light field content to be delivered and presented on various types of displays, with different resources and requisites, such as legacy 2D and multi-view displays, as well as on future light field displays, with different characteristics in terms of spatial and view resolutions.

WORK DESCRIPTION AND ACHIEVEMENTS

To record a light field image or video, a regularly spaced array of small lenslets, closely packed together is used. Each of these lenslets "views" the scene at a slightly different angle to its neighbor and, thus guaranteeing that parallax information is recorded. Later the captured intensity modulated image and a microlens array can reintegrate the captured rays to replay the original scene in full color and with continuous parallax in all directions.

Due to the high sensor resolutions needed to capture this type of content, coding efficiency is a fundamental problem that is especially considered in the project, notably to support efficient scalable encoding of natural light field content. In this context, new prediction schemes for inter-layer prediction have be investigated. This new prediction schemes are able to estimate light field images from a sub-set of image-based rendered 2D images, exploiting as much as possible the redundancy between multi-view and light field content representations. In this context, a three-layer coding solution for light field content has been developed, where a combined inter-layer prediction scheme is combined with a self-similarity compensated prediction. It was shown that the proposed display scalable coding scheme always outperforms the simulcast solution based on the state-of-the-art Intra HEVC prediction scheme.

The Light Field Processor is another major outcome of the project. It is an interactive MATLAB demonstrator able to open and decode images from Lytro Illum light field cameras, which it may then store as a new file format (Decoded Light Field). It is able to extract 2D viewpoints, 2D maps of viewpoints or the microlens array, videos showing the intrinsic parallax of the light field and metadata, as well as perform fundamental image processing tasks.