Holographic information representation and coding

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1 Abstract

In 1908, Lippmann has proved positively an important question: "Peut-on demander à la Photographie de nous rendre toute cette variété qu'ofre la vue directe des objets". In the last century, researchers from several areas have struggled to put in practice what Lippmann has proved in theory. A century after Lippman's work, micro and nanophotonics technologies allow new characteristics and capabilities on digital imaging devices towards a more faithful representation of the real world. Key examples are High Dynamic Range (HDR) cameras and displays, light-field sensing devices, and holographic microscopes that enable new capturing, manipulation and visualization modalities and perspectives. In summary, after a century, the static planar-like images are giving place to richer volume-like images, closer to the visual experience that human can have when interacting with real world objects.

These richer volume-like imaging modalities carry obviously more information than typical planar-like images. This information increase requires rethinking the representation modeling and coding of these new image modalities. It is expectable that the new coding standards for these new images modalities follow a scalable approach by encoding a simplified version using the conventional JPEG standard and further encoding extra information in enhancement layers targeting successively improved image experiences.

This master thesis is related to the EmergIMG project that results from a Portuguese consortium that targets to design a common framework for

the representation and quality assessment of emerging imaging modalities, including lightfields and holographic imaging. This consortium aims to boost an international impact in terms of research and standardization. The main goal of this dissertation is to propose a representation framework for the two imaging modalities (lightfields and holographic). The representation framework designed in this task has to provide efficient compression, backward compatibility, scalability, random access, error resilience, and low complexity.

2 Objectives

In this work is intended to study the different representations of holographic information and lightfields information. Characteristics of the information present in the different representations will be studied. The performance of the coding standards for the different representations will also be studied.

3 Task Description

Task 1 Study of the different representations of holographic information.

Task 2 Study of the different representations of lighfields information.

Task 3 Conversion of holographic and lightfields information between the different representations.

Task 4 Study of the Information present in the different representations.

Task 5 Conversion between holographic and lightfields information.

Task 6 Analysis of coding results.

Task 7 Writing.

4 Expected Results

1. Software for conversion of holographic and lightfields information between the different representations;
2. Identification of advantages/problems of standard codecs when used to code the different representations.

5 Timeline

Task 1-2 Set-Oct

Task 3 Oct-Nov

Task 4 Nov-Dec

Task 5-6 Jan-Abril

Task 7 May-June

6 References

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