摘要

从上个世纪三十年代人们提出光场的概念，到后来人们利用七维模型以及四维模型表示光场，再到本世纪初人们发明了光场相机，使得光场和光场图像越来越受到人们的关注。光场相机所拍摄的光场图像由于包含同一场景的许多视点，所以具有强大的三维建模、重聚焦以及深度估计能力。但是光场图像占用数据量之大，使得传输和储存非常困难，有效的光场图像压缩方法对光场图像的广泛应用至关重要。

实际上，光场图像所包含的视点非常相似，相当于一个相机阵列对同一场景的拍摄，所以视点间会存在很多冗余信息，从而，本文提出了两种压缩方法。

其中一种是基于自适应扫描的压缩方法。光场图像在分解成为一个视点阵列之后，自适应扫描会通过一定的扫描方式把所有的视点串联，使之成为一个视频序列，然后用现有的视频编解码器进行压缩。实验结果表明，相比于默认的扫描方式，自适应扫描压缩方法最高可达 9.94%的性能增益。

另一种是基于卷积神经网络的压缩方法。既然在视点阵列中距离越相近的视点会越相似，那么就可以利用训练好的卷积神经网络模型根据相邻视点来生成部分视点，从而达到大大节省码率的目的。实验结果表明，卷积神经网络压缩方法最高可达到 26.14%的性能增益。

最后，本文开发了一个可以展示两类光场图像压缩方法的可视化系统。该系统分为四条主线，分别展示贪心扫描压缩方法，快速贪心扫描压缩方法，卷积神经网络压缩方法和光场图像的变焦。该系统不仅有视频和图像的展示窗口，而且有命令窗口用于实时显示其进程及参数。

关键字：光场图像，自适应扫描，卷积神经网络，可视化系统

High Efficient Coding For Light Field Images

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ABSTRACT

The light field was proposed in last century, and seven-dimension light field and four-dimension light field was proposed latterly. And finally the light field camera was designed in current century. Light field attracts more and more attentions. However, light field image by light field camera can deliver multiple viewpoints for the same scenario. As a result, light field image can be used in 3-D construction, depth estimation and refocus. But the data of light field image is massive and this results in many difficulties in transmission, storage and etc. So, efficient light field image compression schemes are important for popularization of light field images.

In fact, all of the viewpoints from the same light field image are very alike. They can be treated as images captured from a camera array somewhat. As a sequence, there are many redundencies between these viewpoints. Based on this observation, we proposed two kinds of compression methods for light field images.

The first kind of method is adaptive scan-order method. After the light field image is decomposed into hundreds of viewpoints, the adaptive scan-order method will combine all the viewpoints to make it a pseudo-sequence. Afterwards, the sequence will be encoded by the HEVC. Experimental results show that the adaptive scan-order method can achieve 9.94% gains.

The second kind of method is convolutional neural network (CNN) compression method. Now that adjacent viewpoints are more similar, the trained CNN model can be used to predict adjacent viewpoints. Such that a lot of bits can be saved. Experimental results show that CNN compression method can achieve 26.14% gains.

Finally, a visualization system was developed. The system can display the procedure of two type of light field compression method and the refocus of light field. Specifically, the system not only shows images and videos during the process, but also shows a command window which can diaplay the real-time information.

KEY WORDS: Light field images, Adaptive scan-order, CNN, Visualization system