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INVENTEURS DU MONDE NUMÉRIQUE

Open position for a PhD candidate
Inria - SIROCCO research group in Rennes (ERC Advanced Grant project CLIM).

Light field video compression

Light fields are densely sampled high-dimensional signals containing information about the light rays interacting with the physical objects in the scene. Light fields can be captured by either an array of cameras [1], by single cameras mounted on moving gantries, or by plenoptic cameras using arrays of micro-lenses placed in front of the photosensor, leading to the light fields with narrow baselines [2, 3]. In the project, we focus on two types of light fields: 1/ light fields captured by rigs of cameras which are sparse with a wide baseline and low angular resolution and 2/ dense light fields captured by plenoptic cameras having a high angular resolution with a narrow baseline. Light fields are densely sampled high-dimensional signals containing information about the light rays interacting with the physical objects in the scene. They yield a very rich description of a 3D scene which enables advanced creation of novel images from a single capture [2][4]. However, Light fields constitute very large volumes of highly redundant data, hence the need to design efficient compression algorithms to enable practical use of this new imaging modality.

The goal of the PhD will be to develop methods for efficient compression of video light fields. One direction of research will explore the problem of reconstructing a dynamic (video) light field from a sparse set of views. This problem is currently addressed in the team for static light fields using two main approaches, based on a compressive sensing framework and on learning methods (convolutional neural networks) [5]. The goal of the PhD will be to further address the problem for video light fields with underlying issues of temporal coherency. Methods of scene flow analysis, as e.g. [6] which estimate a 3D optical flow will be explored. In addition to motion, these methods estimate the disparity and disparity changes over time, hence allow a coherent geometry tracking over time. The tracked scene geometry will allow having first reconstructed views which will however very likely have artefacts such as cracks and dis-occluded pixels. To enhance the quality of the reconstructed light fields, neural networks architectures may be considered, in the spirit of [5], together with inpainting techniques.

The learned model with the tracked geometry of the scene should allow inter-view and temporal prediction of the light field, which are critical components of a compression algorithm. The rate-distortion performance of these methods will thus be assessed in a complete compression scheme. For this, the statistical properties of the residual signals produces will be analyzed to design coding tools. Sparse and low rank approximation methods may be considered to further compact these residuals prior encoding.

The position is funded by the ERC advanced grant project CLIM: Computational Light Fields Imaging led by Dr Christine Guillemot at INRIA in Rennes, France

Profile:

- Master degree in signal and image processing or computer vision

- Solid programming skills (matlab, C/C++)
- Solid mathematical background
- Fluent in English, both written and spoken

Duration: 3 years
Start date: September or October 2017.
Location: Inria Rennes, France.
Contact: Christine.Guillemot@inria.fr
Please send applications via email, including:
- CV
- Grades for Bachelors, MSc courses and thesis
- Two to three letters of reference

References

- [1] B. Wilburn, N. Joshi, V. Vaish, E. Talvala, E. Antunez, A. Barth, A. Adams, M. Horowitz, and M. Levoy, "High performance imaging using large camera arrays," ACM Trans. on Graphics (TOG), vol. 24, no. 3, pp. 765, 2005.
- [2] R. Ng, "Digital light field photography," Ph.D. dissertation, Stanford university, 2006.
- [3] T. Georgiev, G. Chunev, and A. Lumsdaine, "Superresolution with the focused plenoptic camera," Proc. Of SPIE - The International Society for Optical Engineering, vol. 7873, pp. 78730X–78730X–13, 2011.
- [4] M. Levoy and P. Hanrahan, Light Field Rendering, ACM Siggraph, pp. 31-42,1996.
- [5] N. K. Kalantari, T.-C. Wang, R. Ramamoorthi, Learning-Based View Synthesis for Light Field Cameras, Sept. 2016, https://arxiv.org/pdf/1609.02974.pdf
- [6] P. P. Srinivasan M. W. Tao, R. Ng, R. Ramamoorthi, "Oriented light-field windows for scene flow", ICCV 2015.