

## PhD- Video interactive communication: transmission with user interaction at the receiver

**Place:** INRIA, Campus de Beaulieu, 35042 Rennes, France

### Supervisors:

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**Goal** The goal of the project is to develop the mathematical, algorithmic and experimental tools for Interactive video communication, where the user can freely switch between several proposed views.

**Context** Free-viewpoint TV is a new paradigm, in which users can interact with the server and request in real-time a desired viewpoint among the ones proposed. The targeted applications are numerous, especially when 3D scenes contain some localized points of interest such as sport, concert or cultural events. Enabling users to interactively navigate through different viewpoints of a scene is thus a new interesting functionality that however imposes new challenges for 3D streaming systems. In particular, the encoder must prepare a priori a compressed media stream that is flexible enough to enable the free selection of the viewpoint by the users.

**Envisaged approach** Traditional multi-view encoding compresses jointly all views such that all the views need to be encoded, sent and decoded. When only one (or a few) views are requested by the user, the traditional approach will send all the views. This incurs some waste in terms of transmitted rate but also complexity at the decoder. The key issue is therefore to propose an algorithm that can compress all the streams in a modular way such that, upon request, the sufficient amount of data can be extracted from the compressed data. The information theoretical bounds for this problem have been recently initiated in [7].

The envisaged approach will build upon the insights provided by [7], to develop a video compression algorithm in the context of free-viewpoint TV. For instance, some of the tasks considered by the PhD student will be (i) to derive efficient models between views, when an information of the scene depth is available (ii) to derive algorithms to efficiently estimate the model parameters (iii) to study the effect of errors in the depth information onto the estimation accuracy.

**Candidate profile** The candidate should have

- strong background in image and signal processing, optimization and programming,
- notions of source and channel coding, information theory would be appreciated,
- interest in video processing, computer vision.

**Funding** The PhD is funded by the CominLabs Labex and is expected to start in October 2016, for a period of three years. The PhD will be part of the project "InterCom", with partners at INRIA Rennes, Telecom Bretagne, and L2S (CentraleSupélec and University Paris Sud). The PhD candidate will be based at INRIA Rennes, but he/she will have regular contacts with the other partners through meetings and collaborative work.

**How to apply** Each application should consist of

- (1) a CV,
- (2) a letter of introduction
- (3) a copy of the student's university transcripts.

(PDF format would be appreciated).



In the letter, the applicant should include the following details:

- An explanation of his/her interest in the research we conduct and why he/she believes he/she is suitable for the position.
- Details of final year undergraduate project (if applicable)
- Details of MSc project (if applicable).
- Details of any relevant modules previously taken, at undergraduate and/or Masters Level.
- Details of any relevant work experience (if applicable).

Applications should be submitted by email to Thomas.Maugey AT inria.fr Aline.Roumy AT inria.fr with the subject line "PhD Video interactive" **as soon as possible**.

## **Bibliography**

- [1] T. Maugey and P. Frossard, Interactive multiview video system with low decoding complexity," in Proc. IEEE Int. Conf. on Image Processing, Bruxelles, Belgium, Sep. 2011.
- [2] T. Maugey and P. Frossard, Interactive multiview video system with low complexity 2d look around at decoder," IEEE Trans. on Multimedia, vol. 15, pp. 1-13, Aug. 2013.
- [3] T. Maugey, I. Daribo, G. Cheung, and P. Frossard, Navigation domain representation for interactive multiview imaging," IEEE Trans. on Image Proc., vol. 22, no. 9, pp. 3459-3472, Sep. 2013.
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- [5] N. Papadakis, A. Baeza, A. Bugeau, O. DHondt, P. Gargallo, V Caselles, X. Armangue, and I. Rius, Virtual camera synthesis for soccer game replays," Journal of Virtual Reality and Broadcasting, vol. 9, no. 5, pp. 1-21, 2012.
- [6] T. Maugey, P. Frossard, and G. Cheung, Consistent view synthesis in interactive multiview imaging," in Proc. IEEE Int. Conf. on Image Processing, Orlando, Florida, US, Oct. 2012.
- [7] A. Roumy and T. Maugey, Universal lossless coding with random user access: the cost of interactivity," in Proc. IEEE Int. Conf. on Image Processing, Quebec, Canada, Sep. 2015. Top 10% best papers.