

Patent entitled:

**“A sophisticated device for the processing of raw images or tensor images”**

French patent number : FR 0503483


Summary of patent content:


The patent covers a simple and very efficient device to process tensor-valued images and to estimate them from raw images. Here, a “tensor” means a symmetric and positive-definite matrix. Typical examples in the context of medical imaging are “diffusion tensor images” (DTI or DT-MRI), the raw images being in that case “diffusion-weighted images” (DWI).

The device relies on the notion of *Log-Euclidean metrics* in order to convert computations on the non-linear differential manifold of tensors into vectorial processings in the vector space of symmetric matrices. Thus, it transforms potentially complicated and slow computations into simple and fast ones. To realize that, the patented device proposes one module that performs a tensor/vector conversion, a second module that performs any type of vectorial processing, and a third module that converts the results back to the tensor space (vector/tensor conversion).

In recent years, DT-MRI has been continuously gaining importance for clinical and neuroscience applications. The powerful and innovative device presented here allows to carry out *very efficiently, in a straightforward way and with excellent theoretical properties* the sophisticated processing steps which are necessary to fully benefit from the entire information contained in these images. Such processing steps include the estimation of DTI from DWI, their regularization, their segmentation, or their resampling, which, for example, is a critical task for the tracking of white matter fibres in the brain or the spine. Some (limited) functionalities of this patent for DTI are demonstrated in the **MedINRIA** software (<http://www-sop.inria.fr/asclepios/software/MedINRIA/>).

See publications:

Vincent Arsigny, Pierre Fillard, Xavier Pennec, and Nicholas Ayache. **Log-Euclidean Metrics for Fast and Simple Calculus on Diffusion Tensors.** *Magnetic Resonance in Medicine*, 56(2):411-421, August 2006. .

Pierre Fillard, Vincent Arsigny, Xavier Pennec, and Nicholas Ayache. **Clinical DT-MRI estimation, smoothing and fiber tracking with log-Euclidean metrics.** In *Proceedings of the Third IEEE International Symposium on Biomedical Imaging (ISBI 2006)*, pages 786-789, April 2006. .

