

## PHD POSITION

**PROBABILISTIC ANALYSES AND MODELS OF ANISOTROPIC TEXTURES,  
APPLICATIONS TO MEDICAL IMAGING.**

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**Co-supervisors:** Hermine Biermé (Assoc. Prof.), Lionel Moisan (Prof.) and Frédéric Richard (Assoc. Prof.).

**Location:** University Paris Descartes, laboratory MAP5 (CNRS UMR 8145)  
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**Domains:** applied mathematics, image processing, probability theory, statistics, medicine.

**Keywords:** texture analysis, random fields, anisotropy, medical imaging.

**Deadline:** 15/09/2010

**Publication:** <http://www.mataim.fr/phdthesis2010.pdf>

**DESCRIPTION**

**Context.** This PhD position is part of a research program supported by the french research agency and untitled MATAIM (visit <http://www.mataim.fr>), which gathers several CNRS laboratories of applied mathematics and INSERM units. The MATAIM project focuses on a set of mathematical issues raised by the probabilistic modelling and characterization of anisotropic textures, with applications to medical imaging.

**Texture analysis.** Texture analysis is one of the major issues of image processing, that has many applications in medical imaging. In this PhD thesis, the problem will be tackled from a probabilistic point of view, in the sense that texture images will be viewed as realizations of random fields and analyzed through the parameters of the field. The study will concern a set of random field models that are obtained from different anisotropic extensions of classical isotropic fields. These mathematical models raise several open issues concerning the definition of anisotropy, the estimation of parameters, or even the simulation of the fields. One goal of this thesis will be to address these issues and to define new models to represent and analyze anisotropic textures.

**Applications.** The proposed models will be applied to radiographs so as to extract relevant medical information from images. Two medical applications will be of particular interest: one that concerns bone imaging and aims at the evaluation of bone fracture risk due to osteoporosis, and another that concerns breast imaging and aims at the evaluation of breast cancer risk. In the context of the MATAIM project, several databases will be available for validation: a mammogram database collected at the Inserm unit ERI20 (Gustave Roussy Institute, Villejuif), and several bone radiograph databases acquired at the Inserm unit U658 (Regional hospital center of Orleans).

**Profile:** MS degree in applied mathematics (or an equivalent diploma), with a good background in probability theory, statistics and/or image processing. An interest in medical applications would be appreciated.

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