2018-00519 - [CORDIS - TOSCA] - Simultaneous parameter estimation and pattern detection in spatial data

Level of qualifications required: Graduate degree or equivalent
Fonction: PhD Position
Level of experience: Recently graduated

Context

Location: Inria Nancy Grand Est research center --- Iecl, Nancy, France
Project-team: Tosca
https://team.inria.fr/tosca/

Supervision and contact: Madalina Deaconu, Researcher, Inria Nancy,
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Assignment

Assignments:

Today, the omnipresence of big data in most domains of activity undeniably requires analysis tools that are more and more powerful. These tools should be able to retrieve the hidden information in the data and interpret it within a decision perspective. Adopting a probabilistic developing framework leads to the construction of a model able to find the requested information. Naturally, the model parameters are a statistical descriptor of this information. There are a lot of existing methods already developed following this direction. Nevertheless, these approaches give only partial results. More precisely, if the model parameters are known, then the methods are able to retrieve the requested information. Or, the other way around, if some information is available, then it can be described statistically using the parameters of a model. Still, neither the information nor the model parameters are really available. The aim of this thesis is to tackle this difficult problem, by studying and proposing new methods able to find simultaneously, both requested information and parameters of the probabilistic model, characterising it.

Bibliography:

Main activities

The goal of this thesis is to propose a method of pattern detection in spatial data that simultaneously determines the pattern and the parameters of the probabilistic model characterizing it. The first step is to study related existing methods namely the ones developed for Markov random fields [4]. A direct application of this step may be for instance a complete unsupervised method for image analysis. The second step is extrapolate the existing results to obtain new original ones, for marked point processes [1], [3]. The aimed application is the detection and the characterization of the structured patterns of the galaxies distribution in our Universe. The proposed method can be naturally applied to different data sets coming from several domains of applications such as environmental science or image analysis [2].

This project is connected through scientific cooperations with several European research institutions. Among them, we mention: Tartu Observatory and University of Tartu (Estonia), University of Valencia and University Jaume I (Spain) and Institute of Mathematics of Romanian Academy.

Skills

The student should possess excellent skills in applied mathematics, especially in probability and statistics, while being highly motivated by practical applications. The rigorous knowledge of an object oriented programming language such C++ is also required. Being familiar with mathematical software such as Matlab, Scilab or R, it is also recommended.

Application deadline: May 1, 2018

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport

Remuneration


Monthly salary after taxes: around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year. (medical insurance included).