UPR
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Proposal Title

Master in Statistics Mathematics

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1 Abstract

A brief summary of the research, including objectives, methods, and expected outcomes (more than 150 words).

2 Proposal Keywords

Spatial simulation, Spatial Regressions, GAMs, Tensor Products

3 Introduction

4 Background and Motivation

- Provide background information and context of the research problem.
- What is the research scope?
- What is the question or problem you are trying to answer or solve?
- Why is this important?
- How is it done today, and what are the current limitations and challenges?

5 Systematic Literature Review

- What is the state of the art in this area of research?
- Provide proper references.
- It is recommended that PRISMA guidelines be followed (`https://www.prisma-statement.org/`).

6 Aims and Objectives

- What are you trying to accomplish?
- How are you going to do the work?
- What is new in your approach? How is your approach going to be different from others?
- Why do you think it will be successful?
- Describe the novelty in your approach or how are you going to improve on current approaches.

7 Research Plan and Methodology

- Detailed plans and strategy of how you are going to accomplish the stated goals and objectives.
- Describe the scope of the project.
- Gantt chart for the timeline of the project.

Starting for a simple regression of ordinary least squares (OLS) can be defined as follows:

$$y_i = \alpha + \sum_{i=1}^{p} x_i \beta_i + \epsilon \tag{1}$$

where y is our expicatory variable and x is the independent variables. If we wanted to study the corrolation that a location i has on its neighbors, the classic approach would be to define a relationship matrix W which details how each location relates to all other locations. This classic Spatial regressions

are an extension of the normal regresion with with the addition of a spatialy term, which can be defined as follows:

$$y = X\beta + \rho WX + \epsilon \tag{2}$$

expanding the matrixes we get the following:

$$y_{it} = \alpha + \sum_{i=1}^{p} x_{it}\beta_i + \rho \sum_{j=1}^{N} w_{ij}x_{jt} + \epsilon \tag{3}$$

This spatial can be addapted spatialy control for either your dependent term

$$y = \alpha + X\beta + \rho WY + \epsilon \tag{4}$$

Or even the error term

$$\begin{aligned} y &= \alpha + X\beta + u \\ u &= \gamma Wu + \epsilon \end{aligned} \tag{5}$$

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8 Prototype Design and Implementation

Design a preliminary prototype to solve parts of the proposed problem (e.g., simple code using Python).

9 Success and Impact

- How will you know that you successfully achieved your project goals? What is the expected output of the project?
- Explain what the resulting success of the project would be and what impact could be achieved if the funding is awarded.
- In alignment with Vision 2030.
  - Who can benefit from the project's output? How are you going to reach them?
  - Provide a draft 'plan for the dissemination and exploitation of the project's results'.