

An Indian-Australian research partnership

Project Title:

Project Number

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IITB Department:

Mathematics

Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. [Advanced computational engineering, simulation and manufacture](#)
2. Infrastructure Engineering
3. Clean Energy
4. [Water](#)
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

In this project we will determine optimal designs for spatial and temporo-spatial models. For spatial data the responses are usually correlated with a complicated auto-covariance structure depending on the distance between the covariates. There is a vast literature on optimal designs when responses are uncorrelated, however, for correlated responses, especially with auto-covariance depending on covariate distances, there is almost no work. D-optimal and I-optimal designs for maximizing the accuracy of prediction in spatial models will be studied. Kriging techniques will be used for estimation.

To illustrate the developed methodology we will use data sets on water quality from pre-existing monitoring stations from three river basins in Kerala, India. We will explore and statistically estimate the auto-covariance structure of the water quality data when collected over stream/river networks. Using the given data as a pilot study we will determine the optimal locations of new monitoring stations along the river network.

Project aims

- 1) Estimation and analysis of spatial and temporo-spatial models particularly for river/stream networks.
- 2) Variogram analysis and prediction by kriging.
- 3) Determine D-optimal and I-optimal designs for spatial models.
- 4) Illustrate the developed methodology using the data set on water quality.

Expected outcomes

The possible outcomes are:

- 1) Theoretical and numerical results for optimal designs for spatial models under various auto-covariance structures.
- 2) Theoretical and numerical results for optimal designs for temporo-spatial models under various auto-covariance structures, taking into account the interaction between time and space.
- 3) Thorough analysis of the water quality data set.

How will the project address the Goals of the above Themes?

The project addresses the themes: advanced computation engineering, simulation and manufacture and water.

Determination of designs for spatial and temporo spatial models will be computation intensive. Simulations will be used widely for establishing numerical results.

Designing an efficient ground water quality monitoring network is a critical part of assessment, restoration and protection of river water quality.

Capabilities and Degrees Required

Applications are invited from students with Master's degree in statistics, mathematics and any engineering sciences.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Please provide a few key words relating to this project to make it easier for the students to apply.

Spatial Analysis, Design of Experiments, Regression