PhD Midway Seminar

Simulation Tool and its application

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Introduction

My PhD Plan

PhD Program	
Phase 1	Make a simulation Tool
Phase 2	Apply it for comparing different estimation Methods
Phase 3	Extend the simulation tool for model with background information
Phase 4	Apply it to test multi-matrix extension of PLS models such as LPLS and UPLS

Why I am doing this

Important for:

- Research
- Education and
- Method Evaluation

What I learn

- Advanced Multivariate Model and technique to analyze it
- Programming concept for developing statistical packages and applications for various statistical methods
- Extending and improving existing methods in statistics
- And, obviously, to properly document what I have done

Today's Special

Today I will talk about:

- A comparative study of various estimation techniques by simulating linear model data using simulatr in single response situation Demonstration
- Simulation tool (simulatr) we are building

A comparative study of different estimation methods using simulated data

Overview

Four estimtion methods were considered

Ordinary Least Squares (OLS)

- Although **unbiased**, suffer highly from **multicollinearity**
- Widely used and can be used as **reference for comparison**

Partial Least Squares (PLS)

- **Well established** and widely used method
- Based on Latent Structure and **free of multicollinearity problem**

Overview

Four estimation methods were considered

Envelope

- Relatively **new method** (Cook, Helland, & Su, 2013) and is also based on reduction of regression model
- Based on **Maximum Likelihood** but works better than OLS in p approaches n

Bayes PLS

- **Bayesian Estimation** of regression coefficient
- **Promising performance** was shown in previous studies (I. S. Helland, Sæbø, & Tjelmeland, 2012)

Simulation Design

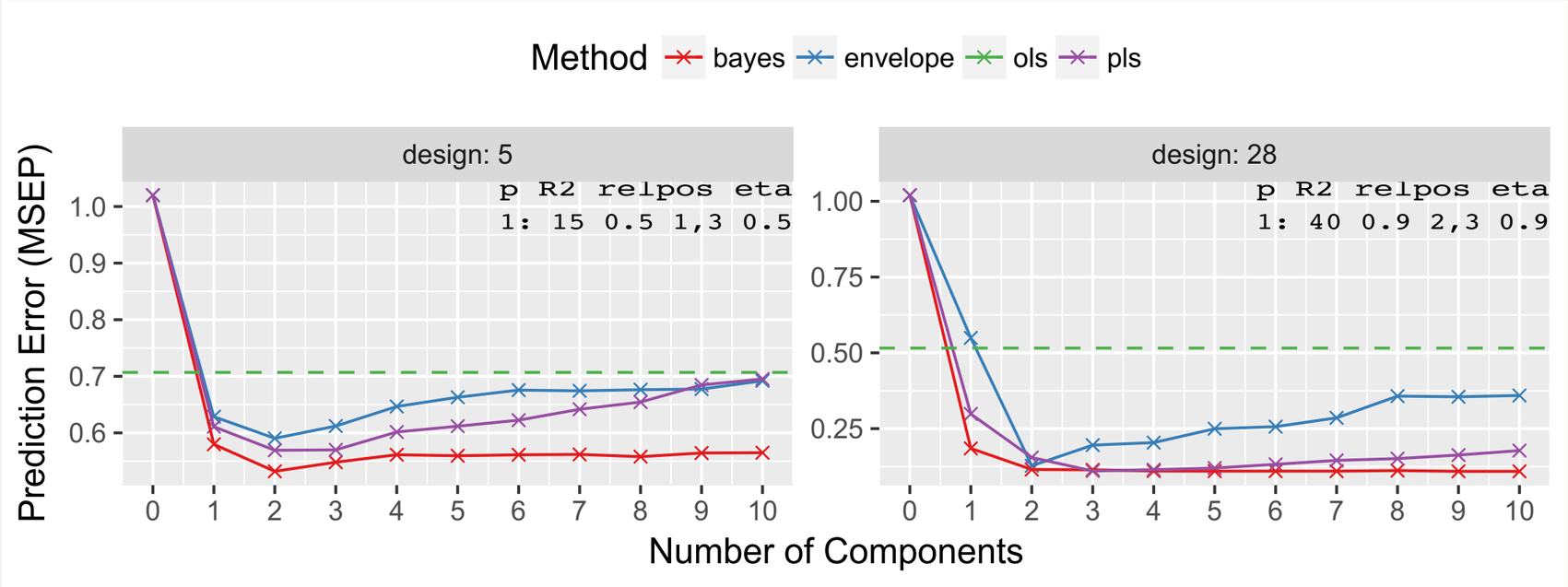
Population Parameters were set as follows:

- **Number of sample observations**: *50*
- **Number of predictor variables**: *15* and *40*
- **Coefficient of determination** (R^2): *0.5* and *0.9*
- **Level of multicollinearity**: *0.5* and *0.9*
- **Position of relevant components**: *1* and *2*; *1* and *3*; *2* and *3*; *1*, *2* and *3*

From the combination of above parameters, **32** datasets were simulated with **5** replication of each, i.e. **160 datasets** with 5 of them having similar population properties.

A Systematic Comparison

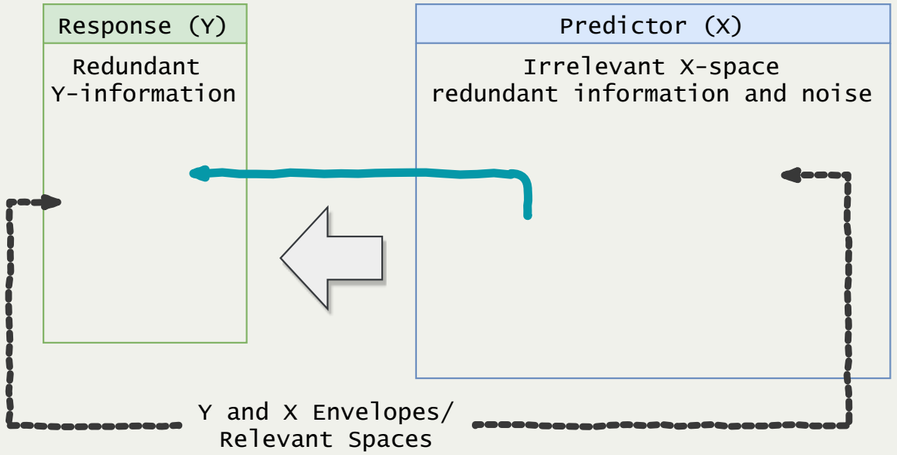
A Systematic Comparison



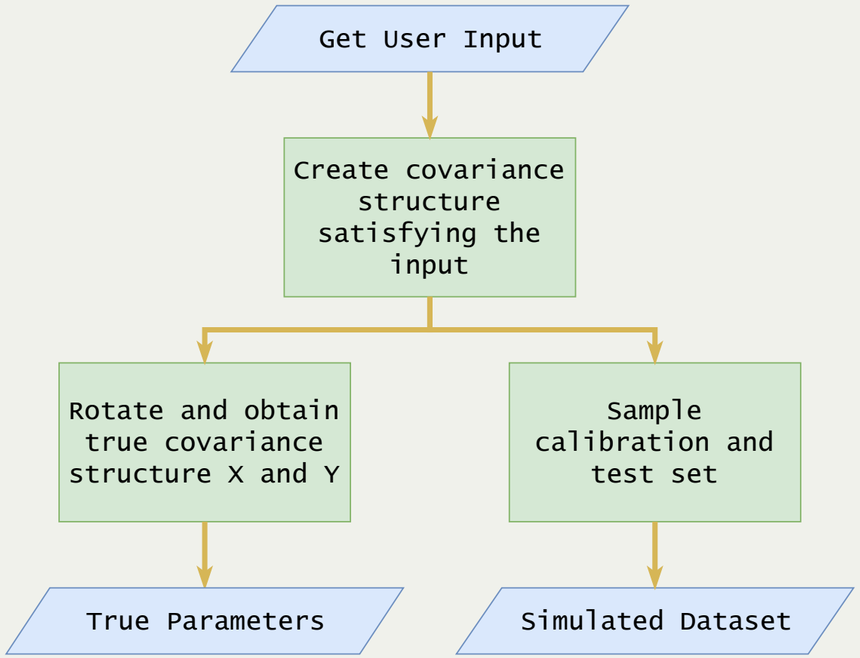
simrel-m: A versatile tool for simulating multi-response linear model data

simrel-m

It is an extension of **simrel** *(Sæbø, Almøy, & Helland, 2015) r-package for simulating* ***multi-response data***

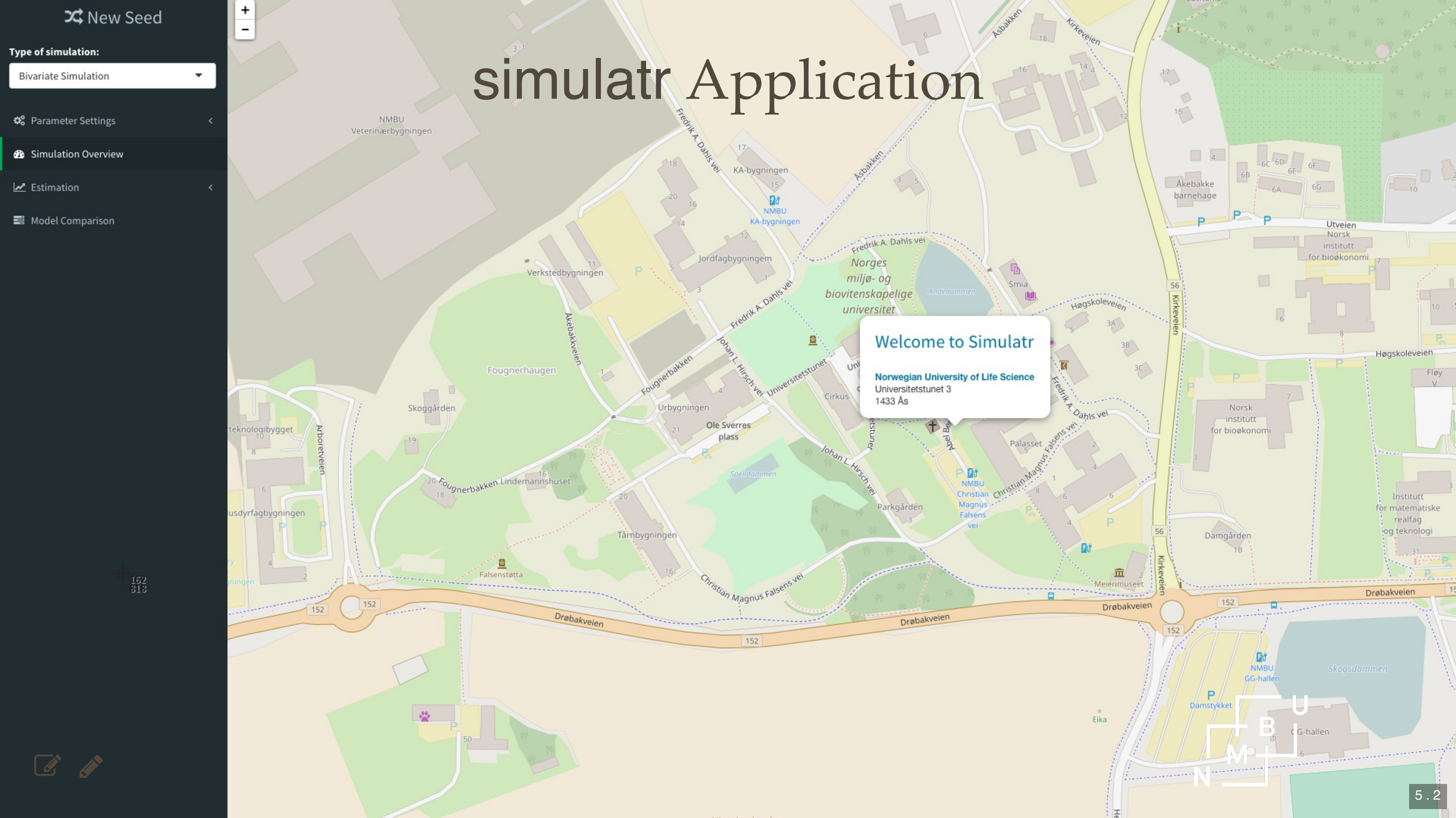


How it works



- Collect input parameters from user
- Make a covariance matrix satisfying those input parameters
- Computes true population properties such as regression coefficients
- Sample calibration and validation sets

Demonstration


New Seed
Type of simulation:
Bivariate Simulation
Parameter Settings
Simulation Overview
Estimation
Model Comparison
simulatr Application
Welcome to Simulatr
Norwegian University of Life Science
Universitetstunet 3
1433 Ås
Norges miljø- og biovitenskapelige universitet
Drøbakveien
Fougnerhaugen
Skogsdammen
5.2


Salamat
Dakujem
GRACIAS
ASANTE
Teşekkür ederim
SUWUN
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hvala
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Ευχαριστώ
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DANKE
Salamat
SUWUN
Благодарам
ASANTE
多謝
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TAKK
gracias
спасибо

References

References

Cook, R., Helland, I., & Su, Z. (2013). Envelopes and partial least squares regression. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, *75*(5), 851–877.

Helland, I. S., Sæbø, S., & Tjelmeland. (2012). Near optimal prediction from relevant components. *Scandinavian Journal of Statistics*, *39*(4), 695–713.

Sæbø, S., Almøy, T., & Helland, I. S. (2015). Simrel—A versatile tool for linear model data simulation based on the concept of a relevant subspace and relevant predictors. *Chemometrics and Intelligent Laboratory Systems*, *146*, 128–135.