ROBUST REGRESSION AS A BENCHMARK FOR REGRESSION BASED FEDERATED LEARNING

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Degree of Master of Science

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Dissertation submitted in partial fulfillment of the requirements for the degree

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DECLARATION

I declare that this is my own work and this Dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The supervisor should certify the Dissertation with the following declaration.

The above candidate has carried out research for the Degree of Master of Science Dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr.Upeka Premaratne

Signature of the Supervisor: Date: 2025.07.23

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ABSTRACT

This research evaluates the effectiveness of robust regression techniques, specifically Theil-Sen and Repeated Median Regression (RMR) as benchmarks for regression-based Federated Learning (FL) across a range of simulated sensor configurations. FL is a privacy-preserving paradigm that enables collaborative model training across distributed nodes without centralizing the raw data. Standard regression techniques such as linear regression, which is not robust against outliers and heterogeneity are commonly employed in real world FL environments. In contrast, RMR demonstrates the highest resilience and lowest error rates, with Theil-Sen also showing strong performance as a more computationally efficient alternative. RMR achieves the overall highest performance gains, with the best efficiency improvement with respect to the linear federated regression. The findings of the study support the use of robust regression as a dependable alternative in distributed, real-world sensor networks.

Keywords: Federated Learning, Repeated Median Regression, Linear Regression, Theil-Sen Regression

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LIST OF ABBREVIATIONS

Abbreviation	**Description**
FL	Federated Learning
IID	Independent and Identically Distributed
MAE	Mean Absolute Error
MSE	Mean Square Error
OLS	Ordinary Least Squares
RFE	Relative Federated Error
RMR	Repeated Median Regression