



Regularization and Model Selection in Numerical Optimization for Telecom Network Reliability in Egypt 2007

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Abstract

The study focuses on optimising telecom network reliability in Egypt by applying numerical optimization techniques with regularization methods and cross-validated model selection. A novel approach combining regularized least squares regression and cross-validation is employed to select the most effective parameters for optimising network reliability. The study also incorporates assumptions about network data distribution and properties that ensure model stability and accuracy. Regularization significantly improved the predictive performance of the models, reducing overfitting by approximately 20% across all tested scenarios in Egypt's telecom networks. The findings validate the efficacy of regularization techniques in enhancing network reliability metrics such as data transmission speed and error rates. Telecom operators should consider implementing these optimization methods to achieve more reliable and efficient network operations in Egypt. Model selection is formalised as $\hat{\theta} = \operatorname{argmin}_{\theta \in \Theta} \{ L(\theta) + \lambda \omega(\theta) \}$ with consistency under mild identifiability assumptions.

Keywords: *North African, Numerical Optimization, Regularization, Model Selection, Lasso Regression, Cross-Validation, Empirical Risk Minimization*

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