A Neural Network Approach to MINMAD Regression Problem Can Be Formulated A Goal Programming Model

Assoc. Prof. Dr. Aysen APAYDIN
Ankara University Faculty of Science
Dept. of Statistics Ankara-Turkiye
E-mail: apaydin@science.ankara.edu.tr

Res. Assist. Turkan ERBAY
Karadeniz Technical University
Faculty of Science Dept. Of Statistics
Trabzon-Turkiye
E-mail: erbay@osf01.ktu.edu.tr

Abstract

In this paper, we propose the Minimum Mean Absolute Deviations (MINMAD) (or the minimum of sum of absolute errors (MSAE) or L1 norm) criterion for estimating the unknown parameters of a multivariate multiple linear regressions model. It is less sensitive to outliers than the popular least squares procedure. A multivariate multiple linear regression problem may be viewed as a multiple criteria decision problem. Using the MINMAD criterion the estimation problem can be formulated as a goal programming and solved by neural network. Then classical regression method and neural network method are compared using numerical examples.

1. Neural Network

Neural Networks as complex problem solvers have been applied to solve numerous problems in a variety of application settings. The desirable features in neural information processing makes neural networks attractive for solving complex problems. The initial success in neural network applications has inspired renewed interests from industries and business.

Over the past several years many operations researchers and management scientists have been engaging in neural network research. From operational researchers/ management science (OR/MS) perspective, the neural networks offer three opportunities. First, networks are alternatives to conventional OR algorithms or heuristics for solving optimization problems. A second view is that the neural networks are biologically inspire statistical methods.

Linear programming (LP) plays an important role in many disciplines such as economics, strategic planning, combinatorial problems, operational research. For the real-time application, neural networks have been applied to several classes of constrained optimization problems and have shown promise for solving such problems more efficiently.

The neural network based algorithms for solving LP problems can be viewed as infinite algorithms. The infinite algorithms can sometimes be better than finite algorithms on finite problems. It is important to investigate the neural network approach to solving LP problems as an alternative class of mathematically infinite algorithms.

2. MINMAD Regression Problem and Goal Programming

Statistical technology plays an indispensable role in almost every possible sphere of human activity in the modern world. The inferential aspects as statistical methods have made them essential to the toolkit of anyone engaged in scientific enquiry. Regression analysis, estimation. Testing of statistical hypotheses, desing and analysis of experiments, sample surveys, data classification and grouping and time-series analysis are most of the major statistical methods than have found many applications in various fields. Such applications have also contributed to the growth of the theory and methods of inference based on data.

Charnes, Cooper and Ferguson (1955) formulated problem as a goal programming problem. Further, interests in the MINMAD regression reviewed with the linear programming formulation of the problem by Wagner (1959).
MINMAD regression problem can be formulated as the following goal programming problem:

P1: \(\text{Min } Z = \sum_{j=1}^{n} I (d_j^- + d_j^+)\)

\[\sum_{j=1}^{n} W_j \beta_j \leq d\]

\(d_j^-, d_j^+ \geq 0\)

\(\beta_j\), unrestricted in sign.

In P1 problem, \(\sum_{j=1}^{n} W_j = 1\), \(0 \leq W_j \leq 1\), \(j = 1...n\)

3. **Neural Network Approach To Goal Programming Model**

Neural network approach is applied to the goal programming model defined by P1. This way of solution process is defined by problem P2 as:

\(\text{P2: Min } E(\beta, d, \lambda) = C^T d + \lambda p(\beta)\)

\(\beta_j\), unrestricted in sign

\(d_1, d_2 \geq 0\).

\(E(\beta, d, \lambda)\); evaluation function

\(p(\beta)\); nonnegative penalty function

\(p(\beta) = (X\beta - Y)^T (X\beta - Y) / 2\) \(X[x,W]\)

\(E(\beta(t),d(t),\lambda(t)) = C^T d(t) + \lambda p(\beta)\)

**REFERENCES**


**Résumé**

Dans ce travaille on determinera l’approche de “Réseaux neuronaux” au probleme de “MINMAD Régression” modelisé comme programme de but.