1. Fuzzy Minmad Regression

There is uncertainty that the crisp function in classic regression analysis presents the relationship between the dependent and independent variables, it is more realistic to use fuzzy regression analysis in real world problems. Fuzzy linear regression analysis can be examined in two main sub-titles as; “fuzzy linear regression analysis with crisp data and fuzzy parameters” and “fuzzy linear regression analysis with crisp parameters and fuzzy data”. The classical regression model where \( i = 1, \ldots, n \) and \( j = 1, \ldots, p \) is in the form of,

\[
Y_i = \sum_{i=1}^{n} X_{ij} \beta_j + e_j
\]

In the regression model above \( \beta_j \)'s are fuzzy numbers and dependent variable \( Y \) is a fuzzy number. Fuzzy parameters are symmetric triangular fuzzy numbers and the fuzzy regression model is defined by,

\[
\min \sum_{i=1}^{n} s_i
\]

\[
s.t. \quad (1-h) s^T [a_j - |b_j - a_j^T c|] \geq 0, \quad j \in N_m
\]

\[
s_i \geq 0, \quad i \in N_n
\]

2. Goal Programming

In the analysis of the multivariate multiple regression, it is known that when the regression problem is modelled as a goal programming model, the minimum square error is less than the classical regression model’s. While a multivariate multiple linear regression problem can be viewed as a multiple criteria decision problem, the regression model is determined as a goal programming model in the form,

\[
P_1: \quad \sum_{j=1}^{n} \lambda_j b_j X + d_j^+ - d_j^- = y_j
\]

subject to

\[
\sum_{j=1}^{n} \lambda_j b_j \leq d_j^+, \quad j = 1, \ldots, n
\]

\[
d_j^+, d_j^- \geq 0, \quad j = 1, \ldots, n
\]

3. Genetic Algorithm Approach

In the Genetic Algorithm approach, a random initial population is selected. Coding, crossover and mutation operators are applied to the problem. Genetic Algorithms are based on evolutionary theory, so only the best suited individuals survive. Through the iterations in the algorithm, a random initial population is selected. After applying the crossover and mutation operations, new genes are generated. New genes are evaluated and the most suited individuals are selected as being the parents for the next generation.
Simple Genetic Algorithm is used in this work and the best suited population size (1500), crossover rate (0.5) and mutation rate (0.001) are determined after a few tries.

4. Conclusion

As a conclusion, we attempt to apply Genetic Algorithm approach to the fuzzy regression problem, modelled as a goal programming model, in order to demonstrate that this approach gives the most satisfactory results. Model P1 is transformed into fuzzy structure, before transformed into unconstraint optimization model.

\[
\mu \left[ f(\beta) \right] = \begin{cases} 
0 & \text{if } f(\beta) \leq b - t_L \\
\frac{f(\beta) - (b - t_L)}{t_L} & \text{if } b - t_L \leq f(\beta) \leq b \\
1 & \text{if } f(\beta) = b \\
1 - \frac{f(\beta) - b}{t_U} & \text{if } b \leq f(\beta) \leq b + t_U \\
0 & \text{if } f(\beta) > b + t_U 
\end{cases}
\]

where,

\[
f(\beta) = Y, \ b = (x'\beta), \ t_L = S_L^i|x_i|, \ t_U = S_U^i|x_i|, \ \beta_i - S_L \leq \beta \leq \beta_i + S_U, \quad i = 1, \ldots, n
\]

P2 : \quad Max \ \lambda
subject to \quad \lambda \leq \mu( f(\beta) )
\theta \beta \leq d
\beta_L > 0
0 \leq \lambda \leq 1
0 \leq \theta \leq 1

P1 is reformulated as a fuzzy model by using the membership function \(\mu[f(\beta)]\) and P2 is defined. Model P2 is solved by the iterations of Genetic Algorithm.

REFERENCES


RÉSUMÉ

Dans ce travail on determinera l’approche de l’algorithme génétique au probleme de “Fuzzy Minmad de régression” modelisé comme programme de but.