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Parameter Estimation of Gumbel Distribution with Maximum-Likelihood Based on Broyden Fletcher Goldfarb Shanno Quasi-Newton

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Abstract : Extreme data on an observation can occur due to unusual circumstances in the observation. The data can provide important information that can't be provided by other data so that its existence needs to be further investigated. The method for obtaining extreme data is one of them using maxima block method. The distribution of extreme data sets taken with the maxima block method is called the distribution of extreme values. Distribution of extreme values is Gumbel distribution with two parameters. The parameter estimation of Gumbel distribution with maximum likelihood method (ML) is difficult to determine its exact value so that it is necessary to solve the approach. The purpose of this study was to determine the parameter estimation of Gumbel distribution with quasi-Newton BFGS method. The quasi-Newton BFGS method is a numerical method used for nonlinear function optimization without constraint so that the method can be used for parameter estimation from Gumbel distribution whose distribution function is in the form of exponential doubel function. The quasi-New BFGS method is a development of the Newton method. The Newton method uses the second derivative to calculate the parameter value changes on each iteration. Newton's method is then modified with the addition of a step length to provide a guarantee of convergence when the second derivative requires complex calculations. In the quasi-Newton BFGS method, Newton's method is modified by updating both derivatives on each iteration. The parameter estimation of the Gumbel distribution by a numerical approach using the quasi-Newton BFGS method is done by calculating the parameter values that make the distribution function maximum. In this method, we need gradient vector and hessian matrix. This research is a theory research and application by studying several journals and textbooks. The results of this study obtained the quasi-Newton BFGS algorithm and estimation of Gumbel distribution parameters. The estimation method is then applied to daily rainfall data in Purworejo District to estimate the distribution parameters. This indicates that the high rainfall that occurred in Purworejo District decreased its intensity and the range of rainfall that occurred decreased.

Keywords : parameter estimation, Gumbel distribution, maximum likelihood, broyden fletcher goldfarb shanno (BFGS)quasi newton

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