# The Generalized Additive Models for Location, Scale and Shape in R

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## Abstract

Generalized Additive Models for Location, Scale and Shape (GAMLSS) were introduced by Rigby and Stasinopoulos (2005). GAMLSS is a general framework for univariate regression type statistical problems. In GAMLSS the exponential family distribution assumption used in Generalized Linear Model (GLM) and Generalized Additive Model (GAM), (see Nelder and Wedderburn, 1972 and Hastie and Tibshirani, 1990, respectively) is relaxed and replaced by a very general distribution family including highly skew and kurtotic discrete and continuous distributions. The systematic part of the model is expanded to allow modelling not only the mean (or location) but other parameters of the distribution of $y$ as linear parametric, non-linear parametric or additive non-parametric functions of explanatory variables and/or random effects terms. Maximum (penalized) likelihood estimation is used to fit the models. The algorithms used to fit the model are described in detail in Rigby and Stasinopoulos (2005). For medium to large size data, GAMLSS allow flexibility in statistical modelling far beyond other currently available methods.

The most important application of GAMLSS up to now is its use by the Department of Nutrition for Health and Development of the World Health Organization to construct the worldwide standard growth curves. The range of possible applications for GAMLSS though is a lot more general and examples will be given of its usefulness in modelling medical and insurance data.

In the talk we will describe the GAMLSS model, the variety of different (two, three and four) distributions that are implemented within the GAMLSS package and the variety of different additive terms that can be used in the current implementation. New distributions and new additive terms can be easily added to the package. We shall also discuss the difference of GAMLSS with other available packages in R such as *gam* and *mgcv*. More recent work, for example the inclusion of non linear parameter components as additive terms and the inclusion of truncated distributions and censored data within the GAMLSS family, will be also discussed.

## References

Hastie, T.J., and Tibshirani, R.J. (1990) *Generalized Additive Models.* London: Chapman & Hall.

Nelder, J.A. and Wedderburn, R.W.M. (1972) Generalized Linear Models. *J. R. Statist. Soc. A*, **135**, 370-384.

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