Additive model

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In statistics, an **additive model** (**AM**) is a nonparametric regression method. It was suggested by Jerome H. Friedman and Werner Stuetzle (1981)[1] and is an essential part of the ACE algorithm. The *AM* uses a one-dimensional smoother to build a restricted class of nonparametric regression models. Because of this, it is less affected by the curse of dimensionality than e.g. a *p*-dimensional smoother. Furthermore, the *AM* is more flexible than a standard linear model, while being more interpretable than a general regression surface at the cost of approximation errors. Problems with *AM* include model selection, overfitting, and multicollinearity.

Contents

Description

Given a data set $\{y_i,\, x_{i1},\ldots,x_{ip}\}_{i=1}^n$ of *n* statistical units, where $\{x_{i1},\ldots,x_{ip}\}_{i=1}^n$ represent predictors and y_i is the outcome, the *additive model* takes the form

$$E[y_i|x_{i1},\ldots,x_{ip}] = \beta_0 + \sum_{j=1}^p f_j(x_{ij})$$

or

$$Y = \beta_0 + \sum_{j=1}^p f_j(X_j) + \varepsilon$$

Where $E[\epsilon] = 0$, $Var(\epsilon) = \sigma^2$ and $E[f_j(X_j)] = 0$. The functions $f_j(x_{ij})$ are unknown smooth functions fit from the data. Fitting the *AM* (i.e. the functions $f_j(x_{ij})$) can be done using the backfitting algorithm proposed by Andreas Buja, Trevor Hastie and Robert Tibshirani (1989).[2]

See also

- Generalized additive model
- Backfitting algorithm
- Projection pursuit regression
- Generalized additive model for location, scale, and shape (GAMLSS)
- Median polish

References

1. Friedman, J.H. and Stuetzle, W. (1981). "Projection Pursuit Regression", *Journal of the American Statistical Association* 76:817–823. doi:10.1080/01621459.1981.10477729 (https://dx.doi.org/10.1080%2F01621459.1981.10477729)

2. Buja, A., Hastie, T., and Tibshirani, R. (1989). "Linear Smoothers and Additive Models", *The Annals of Statistics* 17(2):453–555. JSTOR 2241560 (https://www.jstor.org/stable/2241560)

Further reading

- Breiman, L. and Friedman, J.H. (1985). "Estimating Optimal Transformations for Multiple Regression and Correlation", *Journal of the American Statistical Association* 80:580–598. doi:10.1080/01621459.1985.10478157