R-Package JOP: Optimization of Multiple Responses

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In technical applications, often a set of response variables with corresponding target values depends on a number of control variables. In these cases an off-line quality control prior to the actual manufacturing process frequently implies optimizing the mean as well as minimizing the variance of the responses.

Many existing methods for the optimization of multiple responses require some kind of weighting of these responses, for instance in terms of costs or desirabilities. Kuhnt and Erdbruegge (2004) present an alternative strategy using loss functions and a penalty matrix which can be decomposed into a standardizing and a weight matrix. The Joint Optimization Plot displays the effect of different weight matrices in terms of predicted response means and variances. Furthermore Erdbruegge et al. (2011) show that every point that minimizes the conditional mean of the loss function is Pareto optimal.

The new *R* package **JOP** (Kuhnt and Rudak, 2011) is an implementation of the Joint Optimization Plot and is available on CRAN in the version 2.0.1. **JOP** includes an automated procedure to fit double generalized linear models by means of the *R* package **Joint Modeling** (see (Ribatet and Iooss, 2010)). For the optimization actual three different optimization routines can be chosen, depending on the complexity of the problem, more precisely by `nlminb`, `gosolnp` (see (Ghalanos and Theussl, 2011)) or `genoud` (see (Walter et al., 2009)). The resulting optimal responses together with corresponding settings of the control variables are displayed by the Joint Optimization Plot. **JOP** returns an object containing the optimal response and control variable values as well as the fitted double generalized linear models. Furthermore the user can choose a compromise with the mouse directly on the plot and **JOP** returns the corresponding optimal control variable settings.

We demonstrate the use of the Joint Optimization Plot in various applications from mechanical engineering.

References

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