Response surface methodology for overdispersion generalized linear models

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We combine the response surface methodology with generalized linear models to estimate the probability of success in a dichotomy response variable and the number of occurrences in an interval of length, time, space or region studied for a Poisson response, among others. Once connected both methodologies, the parameters of second order model are estimated through maximum likelihood. Thus, the hypotheses' tests are made and so, there is obtained the variance analysis with the objective of making inference. Furthermore, the response surface methodology is used to optimize a binomial response with over-dispersion. Basically, the idea is to bring directly the problems of variation in the fitted model using the extended quasi-likelihood to modify the traditional confidence intervals for the predictions and the optimized response.

The methodology proposed is illustrated with two particular applications: the first is a rotatable central composite design used to investigate the number of defects in a semiconductor wafer manufacturing processes in a time period, and the second is an experiment to determine the median lethal concentration (LC_{50}) and half lethal time (LT_{50}) to measure the virulence on individuals' mite; five concentrations of prepared fungus previously (2×10^4, 2×10^5, 2×10^6, 2×10^7 and 2×10^8 spores$\times mL^{-1}$) were performed. They have five repetitions, where each repetition corresponds to a Petri dish with a sheet of pink and twenty adult twenty individuals in it, for a total of 100 individuals per concentration. Furthermore, three tests were carried out in time every ten days, following the same test procedure. The concentration in each of the repetitions once was applied, and the number of mites that were dying every day until the end of each trial was measured.

Keywords: Generalized linear model, Response surfaces, Overdispersion, Optimization