Max-linear regression models with regularization

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Abstract: Motivated by the newly developed max-linear competing copula factor models and max-stable nonlinear time series models, we propose a new class of max-linear regression models to take advantages of easy interpretable features embedded in linear regression models. It can be seen that linear relation is a special case of max-linear relation. We develop an EM algorithm based maximum likelihood estimation procedure. The consistency and asymptotics of the estimators for parameters are proved. To advance max-linear models to deal with high dimensional predictors, we adopt the common strategy of regularization in the high dimensional regression literature. We demonstrate the broad applicability of max-linear models using simulation examples and real applications in econometric and business modeling. The results, in terms of predictability, show a significant improvement compared with solely using regular regression models and other existing machine learning methods. The results enhance our understanding of the relationsthip between the response variable and the predictors, and among the predictors as well.