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Change-point detection in an high-dimensional model with possibly asymmetric errors

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Quite often in industrial applications modeled using statistical models, the problem of changing these models at unknown times arises. These changes can be detected in real time during the process, or after all observations have been collected, and are called respectively, on line change-point detection, and a posteriori change-point detection. Moreover, depending on the theoretical conditions satisfied by the model, the statistical inference and the obtained results may differ. Note that very often in practice, the theoretical conditions are not satisfied. This will be the case in this presentation where a high-dimensional linear model with possible change-points is considered. The errors do not satisfy the classical homoscedasticity assumption considered in standard linear regression settings. Both the change-points and the coefficients are estimated through an expectile loss function. An adaptive LASSO penalty is added to simultaneously perform feature selection. First, theoretical results will be presented. The convergence rates of the obtained estimators are given, and we show that the coefficients' estimators fulfill the sparsity property in each phase of the model. We also give a criterion for selecting the number of change-points. To show the superiority of our method, a numerical study is performed to compare the performance of the proposed penalized expectile method with the ordinary least squares and the quantile methods also penalized. A real-life application on weather data is provided to validate the analytical results. This type of change-point model can be used to detect potential breaks in an industrial process.

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