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Title: Changepoint and anomaly detection—from timeline to spatial grid

Abstract: There has been a growing interest in multiple change points and anomaly detection problems recently. A common approach to detect multiple structure changes is to minimise a measure of data fit plus a penalty that is linear in the number of changes. In the first project, we establish the general finite sample behaviour of such a method that can be related to its behaviour when analysing data with either none or one changepoint. This property results in simpler conditions for verifying whether the method will consistently estimate the number and locations of the changepoints. We apply and demonstrate the usefulness of these simple conditions for a range of changepoint problems. Whilst focuses are mostly on changes taking place on the time index, in the second project we investigate the changes-in-mean model on a two-dimensional spatial lattice, that is, to detect the number and locations of anomaly regions from the baseline region. In addition to the usual L0 penalisation cost, we also introduce a new penalty on the diameter of the anomaly regions, which limits each estimated anomaly region being too scattered. We show that the estimated number and locations of changepoints are both consistent, and characterise the error (localisation rate) of anomaly region detection based on the signal strength.