# Multivariate functional outlier detection using Invariant Component Selection

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**Abstract:**
Multivariate functional anomaly detection has received a large amount of attention recently. Accounting both the time dimension and the correlations between variables is challenging due to the existence of different types of outliers and the dimension of the data. Most of the existing methods focus on a small number of variables. In the context of predictive maintenance and quality control however, data sets often contain a large number of functional variables. Moreover, in fields that have high reliability standards, detecting a small number of potential multivariate functional outliers with as few false positives as possible is crucial. In such a context, the adaptation of the Invariant Component Selection (ICS) method from the multivariate to the multivariate functional case is of particular interest. Two extensions of ICS are proposed: point-wise and global. For both methods, the choice of the relevant components together with outlier identification and interpretation are discussed. A comparison is made on a predictive maintenance example from the avionics field and a quality control example from the microelectronics field. It appears that in such a context, point-wise and global ICS with a small number of selected components are complementary and can be recommended.

**Keywords:**
Anomaly detection; dimension reduction; predictive maintenance; quality control.