Poster Snapshot

A Control Chart for Online Shape Monitoring in Image Data

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Sequential monitoring of the shape of the image object is a relatively new research area in statistics and machine learning. It has a wide range of applications in different disciplines of science, including satellite imaging, medical research, industrial applications, and so forth. For instance, the gradual shrinking of the Salton Sea comprises the loss of water resources, damaging the local environment and ecosystems. Note that shape monitoring in the image data is a challenging problem because (i) image surface contains discontinuities in the boundary of the image object; therefore, the traditional smoothing technique is inefficient; (ii) shape of the image object is often irregular in nature; (iii) sequence of images is not always geometrically aligned; therefore, the problem of rigid body image registration is also associated with it. In this article, we propose a shape monitoring algorithm that is rotation and translation invariant and, therefore, capable of detecting changes in the shape of the image object efficiently while ignoring the change due to rigid body image transformation. By this method, for comparing two shapes (two images), we construct a test statistic based on the distribution of the distance from the centroid of the image object to the boundary. For online monitoring, we propose a nonparametric CUSUM control chart based on the statistic mentioned above. The proposed method is simple to interpret and also capable of handling all the issues mentioned above. Theoretical justification and numerical performances show that the proposed algorithm works well in many different situations.

Joint work with Partha Sarathi Mukherjee