Executive Summary of MRP

OBJECTIVES OF THE PROJECT:

1) To develop new nonparametric control charts for monitoring processes.
2) The performance of the proposed methods will assess for both the in control state and out of control state under different underlying distributions.
3) Applications of the proposed nonparametric control procedures will done for real life situation and will be useful in all manufacturing industries where the process needs to be continuously monitored for the one or more than one process characteristics.

In this study, we use the run test statistic as a charting statistic for detecting location shifts of a symmetric process. The nonparametric chart for monitoring the process location is based on runs computed within samples. Nonparametric control chart based on run statistic is for monitoring the location of a continuous symmetric process distribution. This chart is distribution-free so that its application does not require the assumption of parametric model (such as normality). The performance of the proposed chart is evaluated by simulating data from normal and non-normal distributions and compared with the existing nonparametric chart based on sign statistic and traditional $\overline{X}$ chart. It is observed that the performance of proposed nonparametric chart is similar to that of the sign chart in terms of detecting shifts in process location under normal and non-normal process distributions. In this study, nonparametric control chart based on run statistic is developed for monitoring the process location of a continuous symmetric process distribution. This chart requires simple calculations and it is straightforward to implement. The performance of the proposed control charts is studied by simulation under normal, light tailed and heavy tailed process distributions. Simulation study indicates that the proposed NP-R chart is more efficient than the traditional Shewhart $\overline{X}$ chart under heavy tailed distributions, where as it is less efficient under normal and light tailed distributions.

The simulation study indicates that the proposed chart is robust against contamination by outliers while the traditional $\overline{X}$ chart is not. The performance and the inter-quartile ranges of the run length distribution of proposed chart is almost similar to that of the Shewhart chart for detecting shifts in process location when underlying process distribution is normal, heavy tailed or light tailed. Performance of the proposed chart is improved by using runs rules. The CUSUM chart based on run statistic perform better than Shewhart-type chart for detecting small shifts in process location for all distributions under study. Thus, proposed chart is good alternative to Shewhart chart for detecting shifts in process location for normal and normal-like distributions.

The purpose of this study is to develop a nonparametric control charts for monitoring the scale parameter of a process. Shewhart-type and CUSUM-type nonparametric control charts are developed for monitoring the process variability. The proposed charts are based on nonparametric two-sample tests for testing equality of variance developed by Sukhatme and Mood. The performance of the proposed control charts is evaluated through average run length for the normal, double exponential and uniform distributions. The rest of the chapter is organized as follows. The Shewhart-type nonparametric control chart for monitoring process variability based on Sukhatme test statistic is presented. Another Shewhart-type nonparametric control chart for monitoring process variability based on Mood test statistic is presented. The performance of proposed Shewhart-type nonparametric control charts is evaluated and compared. The performance of the nonparametric control charts is improved using runs rules. A nonparametric CUSUM chart for monitoring process variability based on Sukhatme and Mood statistic is developed. It is well known that the Shewhart-type control charts are relatively inefficient in detecting small shifts of the process parameters. Memory based control charts such as CUSUM and EWMA are developed as alternative to the Shewhart-type charts for the detection of small shifts in theprocess parameters. They use the additional information from recent history of process hence are more effective than a Shewhart-type control chart in detecting small process shifts.Principal Investigator several nonparametric control charts were referred for monitoring processes location, scale and joint monitoring process location and scale.

Nonparametric Shewhart-type control chart for monitoring process center based on the run test statistic and nonparametric CUSUM control chart based on run test statistic for monitoring a process center were developed. Principal Investigator also developed a nonparametric Shewhart-type control chart for monitoring process variability based on nonparametric tests such as Mood test, Sukhatme test and nonparametric CUSUM charts were developed based on the same nonparametric tests for variability.

Nonparametric control charts used extensively to monitor and improve the quality and productivity of manufacturing processes and service operations. Nowadays, there is an ncreasing demand in production process for quality improvements. They are applied widely for monitoring various industrial manufacturing processes in which control charts re the most widely used to detect special causes of process variation.

Nonparametric Control charts are very important tools in statistical quality control whose main objective is to improve the quality of processes so as to satisfy customer requirements. The practical application of control charts have now extended far beyond manufacturing industries to the nonmanufacturing industries such as health care, banking, insurance etc. These charts make a valuable contribution to the overall process control and require minimal assumptions and are especially useful in applications where not much is known about underlying process distribution.

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