

## **Abstract**

Today's manufacturing processes acutely pressurize all quality control systems, including the stability in process conditions and product conformity. The performance of the statistical process control will be further improved with machine learning methods, including ANN applications; their modeling will contribute much more to the effective monitoring and prediction of process variables. The research will study the process of ice cream production at Al-Arz Ice Cream Company and utilize historical data to study key quality indicators such as box weight, casting weight, chocolate temperature, and the weight of added chocolate.

The objective of this work was to propose a predictive model, that will optimize the quality control process by joining SPC principles with ANNs. A dataset collected over four months was analyzed, preprocessed, and then used to train multiple ANN models. These models have been evaluated for performance and compared to traditional SPC methods. The developed models showed more accuracy for the identification of complex patterns and prediction of deviations from the quality standard.

ANN implementation in this project showed significant improvement in the effectiveness of quality control, reducing the chances of error appearance and making production processes stable. Data inconsistencies and model parameter optimizations are the major challenges. The results showed that machine learning could offer new impulses for a completely changed quality management approach; the early detection of variations of the processes, while realtime monitoring is enabled, can offer a scalable, adaptive, and effective solution for contemporary industries.