Title Evaluation of technique to overcome small dataset problems during neural-network based contamination classification of packaged beef using integrated olfactory sensor system

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Abstract

Similar to most biological studies, beef contamination classification studies using artificial neural networks are restricted to small datasets. This study evaluates multivariate normal (MVN) technique of synthetic sample generation on small datasets associated with *Salmonella* contamination in beef. Six experiments were conducted to evaluate the performance of integrated sensor system towards identification of *Salmonella* contaminated beef packages. Pattern recognition involved using wavelet packet transform for feature extraction from sensor array responses and radial basis function network (RBFN) based classification of contaminated beef packages from uncontaminated packages. The MVN generated synthetic olfactory sensor signatures were used to train and test the RBFN classifiers. For the datasets analyzed in this study, genetic algorithm optimized RBF networks conferred average contamination test classification accuracies of 90.33% ± 7.68% (mean ± std. dev.) which were higher compared to the bootstrapped quadratic discriminant analysis based average accuracies. RBFN classifier based average overall classification accuracies of six synthetically generated datasets were in the range of 86.66%–98.89% with highest average overall classification accuracies of 98.89% ± 1.92%.