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Pattern Recognition Applied to Improve Pig Slaughterhouses Processes

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Abstract: The framework defined as industry 4.0 is active in all industrial sectors. The meat industry and slaughterhouses are no exception. These technologies enable product traceability and process improvement. Optimizing the process avoids reprocessing the product which leads to process performance improvements and energy savings. The subcutaneous fat thickness in hams is one of the most critical factors for the curing process and largely determines the final quality of the product. The correct classification of hams on-line according to weight and subcutaneous fat allows an optimization of the later stages of the process. This study compares the accuracy of a manual classification carried out by an operator with an automatic classification based on SVM algorithms. These algorithms have been trained with data collected at the slaughterhouse for more than 500,000 pigs. As "Golden Standard" the thickness of the subcutaneous fat (mm) of 400 hams manually measured once they have been refined for the proper dry-curing. Based on this measure, hams have been classified into four classes. Results show that the accuracy of the manual classification is lower (68.6\%) than the accuracy of the automatic classification based on SVM (75.3\%). In conclusion, IoT and big data analytics applied to production line improve the case shown in a 6.7\%. Avoiding the reprocessing of 6.7\% of the total production means a saving in energy consumption of the industrial production lines and the plant's cooling system. In the case studied, which corresponds to a small slaughterhouse that processes 2000-2500 pigs/day, it represents a daily saving of about 30 minutes of chain operation per day. The optimization in the classification of the hams allows applying the optimal process to each class, which supposes an increase in the final quality of the produced food.

Keywords: IoT, SCADA-data, meat industry, ANN, SVM, automatic ham classification