

VIDEO IMAGE ANALYSIS (VIA) IN EVALUATION OF PIG FRESH THIGH FOR CURED HAM PRODUCTION*

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Key words: VIA, cured ham, heavy pigs.

Background: The EEC quality evaluation of swine carcasses is based on lean meat quantity. Every country, including Italy, has lean meat percentage calculation formula specific for the used instruments. Only for Italy there are two sets of calculation formula: one for carcasses of over 120 kg (heavy pigs) and one for carcasses under 120 kg.

The thighs for the production of ham are of great importance in the valorization of heavy pigs carcasses: they are the 35-40% of the commercial value of the carcasses. If the legs are processed in DOP cured ham (like Parma and San Daniele hams), we have a lot of rules that should be respected during livestock and slaughtering too, and a specific evaluation of raw leg quality before the processing is needed.

The percentage of lean meat can't represent the attitude of meat towards processing; this attitude is now evaluated subjectively by technicians on the basis of the experience. The EEC Commission has recognized the inadaptability of the evaluation of heavy pig quality based only on lean meat quantity for Italy; so the EEC leaves us the possibility to adopte other criteria (objective and repeatable) in addition to the lean meat grid.

Objectives: An objective and repeatable classification instrument, to be applied during the operative stage, which can maintain the same methodology and classification criteria over time and on large numbers of thighs, is, however, essential. The formation of a large batch of products, distinguishable on the basis of single parameters (e.g. fat or lean, globular, pale thighs...) or thanks to their belonging to different quality categories, represents a considerable value added to the product.

The raw meat prototype realized can satisfy the condition explained above. At present, the prototypes need an intensive training period in operative conditions for the validation.

Methods: A box, completely made of inox steel (3.1 m high x 6.99 m long), contains the system. The carrying of thighs, carried out on

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an external belt carrier, at the exit and entry of the prototype, moved by a compressed air system and by an internal inox steel carrying chain, according to fig. 1 and 2. There are three cameras, two black and white ones and a colour one that transmit the images to a computer which processed and classifies them in actual time measuring shape, thickness and distribution of fat and colour. The thighs have usually been chosen at random, within batches coming from different genetic types and different farms, in order to obtain the maximum heterogeneity.

The thighs have been evaluated by a group of experts as to the characteristics late examined with the automatic system:

External shape: 1) shaped: middle dimension between the two classes; 2) normal: average dimension; 3) globular: too round a shape in the upper part of the thigh; *Fat:* 1) lean; 2) normal; 3) fat; *Colour, Tone:* 1) pale; 2) normal; 3) dark, *Uniformity:* 1) even; 2) uneven.

The research was carried out on two parallel lines. On one hand, the system was provided with a high number of information: on the other hand, thanks to expert technologists, a comparison between their subjective evaluations and the system objective ones was made, therefore creating an "intelligent" program able to express a qualitative assessment only based on the vision of the fresh thighs. During the processing of the results, a good consistency, equal to 85% as to shape, 89% as to fat and 78% as to colour was reached between the automatic classification and the expert subjective evaluation.

We tried to obtain a "comprehensive" classification of the fresh thigh, and not only a distinction on the basis of a single parameters. The objective was to obtain homogenous categories of thighs, similar as to a number of characteristics, frequently associated in the same category. To obtain this division a clustering procedure has been carried out on the basis of the human evaluations, acquired by the classification system itself. The human evaluations of the fresh product of the 7 testing slaughtering, for the total number of 1742, have been used.

The calculation of the first three principal components has been carried out in order to analyse the data graphically and to obtain a quantification of the above mentioned four qualitative variables more adequate to the following treatment of the data. The cluster analysis has been carried out through the SAS CLUSTER procedure, using the SAS version 6.08 for Windows.

Results and discussion: The parameter distribution within the clusters can be seen through the graphic representation in fig. 3, according to the subdivision sideways. The CROSS cluster gathers uniform thighs for colour (both tone and uniformity) but shaped and normal for shape and normal and lean for fat (table 1). The CUBE cluster gathers thighs not normal but uniform for colour, not fat and with a distribution for shape in all three classes. The PYRAMID cluster gathers thighs similar to CUBE ones but not uniform for colour. The STAR cluster gathers thighs more pale and uniform for colour, globular for shape and fat.

Conclusions: The prototype testing, both for the adaptation in the manufacturing environment and for the evaluation results according to human classification, has been very good.

So a significant discrimination among different thighs and a good classification of all the thighs according to the quality characteristics considered by a group of experts are possible.

The successive point, that is in development, is the evaluation of the final product (cured ham) according to the cluster situation choosed on fresh thighs.

Table 1 - Characteristics of each cluster (% of presence)

Cluster	Colour					Shape			Fat		
	Tone			Uniformity		Shaped	Normal	Globular	Lean	Normal	Fat
	Pale	Normal	Dark	Even	Uneven						
CROSS	/	100	/	100	/	63.6	36.4	/	28.2	71.8	/
CUBE	89.4	/	10.6	100	/	46.3	16.4	37.3	45.5	54.5	/
PYRAMID	83.9	/	16.1	/	100	56.8	21.4	21.8	53.9	46.1	/
STAR	92.9	/	7.1	100	/	/	/	100	/	/	100

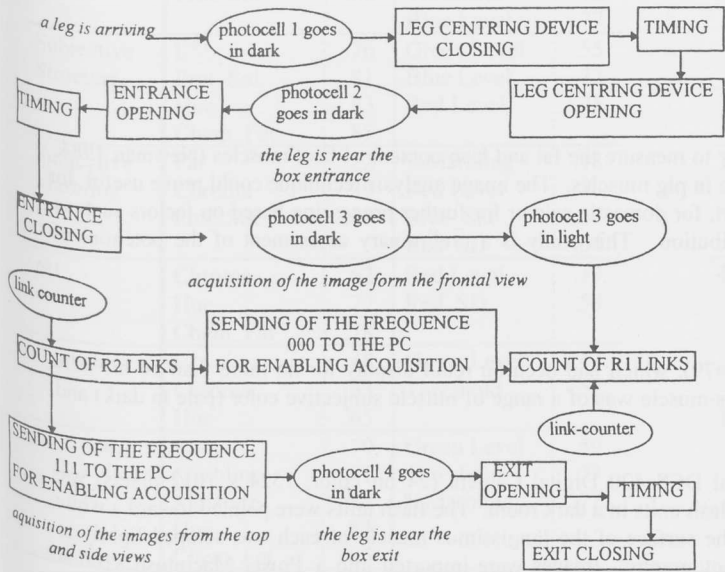


Figure 1 - Scheme of the working of the PLC

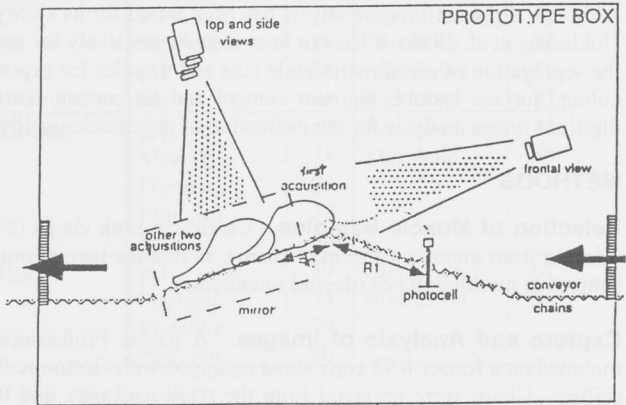
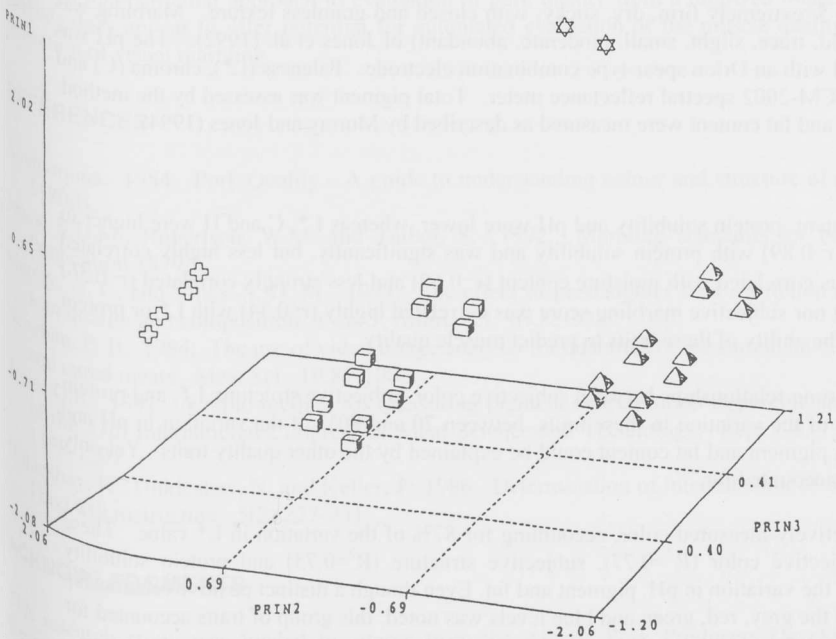


Fig. 2. The synchronization of the images acquisition by PLC.

Fig. 3 - VALUATION DISTRIBUTION



Legs distribution into clusters:

Cluster	Num.	%
CROS	220	15.93
CUBE	806	58.36
PYRAMID	243	17.60
STAR	112	8.11
Total	1381	100.00