A REAL-TIME COMPUTER VISION SYSTEM FOR THE QUANTIFICATION OF POULTRY BEHAVIOUR IN FURNISHED CAGES

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INTRODUCTION

Next to production, physiology and health, behaviour is an important issue with respect to animal welfare when evaluating novel housing systems. Behavioural characteristics are usually measured by visual observation, which is time consuming, subjective and prone to human error (Abrahamsson, 1996). Automated objective surveillance, by means of cheap cameras and image-processing techniques, has the ability to generate data providing an objective measure of behaviour, without disturbing the animals.

OBJECTIVES

The general purpose of this study is to develop an on-line image-processing technique to quantify the behaviour of laying hens as opposed to the current human visual observation. Such system can be used for on-line control of animal responses (Frost et al., 1997).

METHODS AND RESULTS

The experimental setup consisted of a furnished cage, divided into four compartments: one main compartment and 3 smaller laying nests. Each compartment was equipped with a camera, mounted on top to provide a top-down view of the cage. During the experiments, each animal was placed in the cage one at a time for recording. Audio-visual scoring of the hen's behaviour on the scene was performed by an experienced ethologist and used as a reference method for the automatic classification system.
The image-processing system is based on the principle that the classification of behaviour can be translated to classification of time series of different postures of the hen. The hen's postures can be recognised as different contours in the camera image. A fast and robust model-based segmentation method was used to extract the contour of the laying hen from each camera image (Leroy et al., 2003). The parameters from this model are stored as a description of the hen's posture in that image. As a next step, the parameters of the posture as a function of time are approximated by a model within a certain time window. The parameters from this model are then used to classify the hen's behaviour as e.g. egg laying, wing stretching, pecking…
A first implementation of the system was able to identify three different types of behaviour (standing, egg laying, pecking). The sets of parameters for each image showed 3 clear clusters corresponding to each behaviour class. The objective of further investigation will be the classification of up to fifteen different types of behaviour (eating, drinking, walking, wing stretching, etc…).

CONCLUSIONS

It was shown that a system which combines on-line image processing with simple classification of dynamic parameters can be used to recognize the behaviour of laying hens. The proposed system can monitor the hen's behaviour during unlimited observation periods to asses the hen's welfare in novel poultry housing systems.

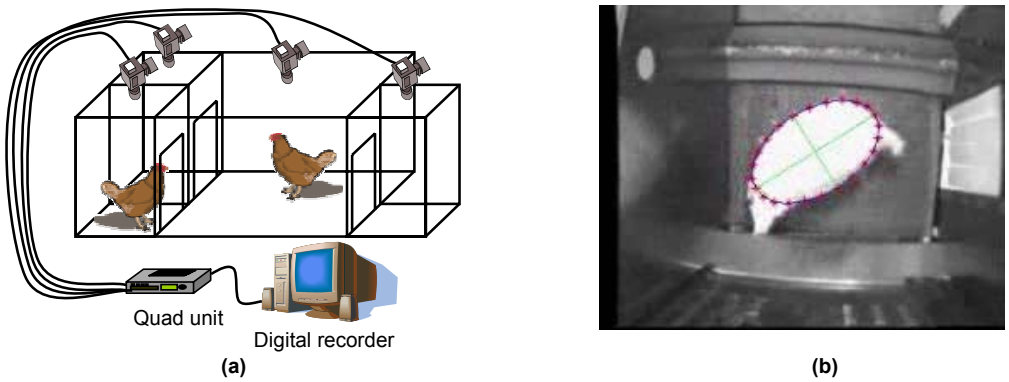

Figure 1. (a) The test cage showing the main compartment, the 3 laying hens and the video recording equipment. (b) One of the camera images after image processing.

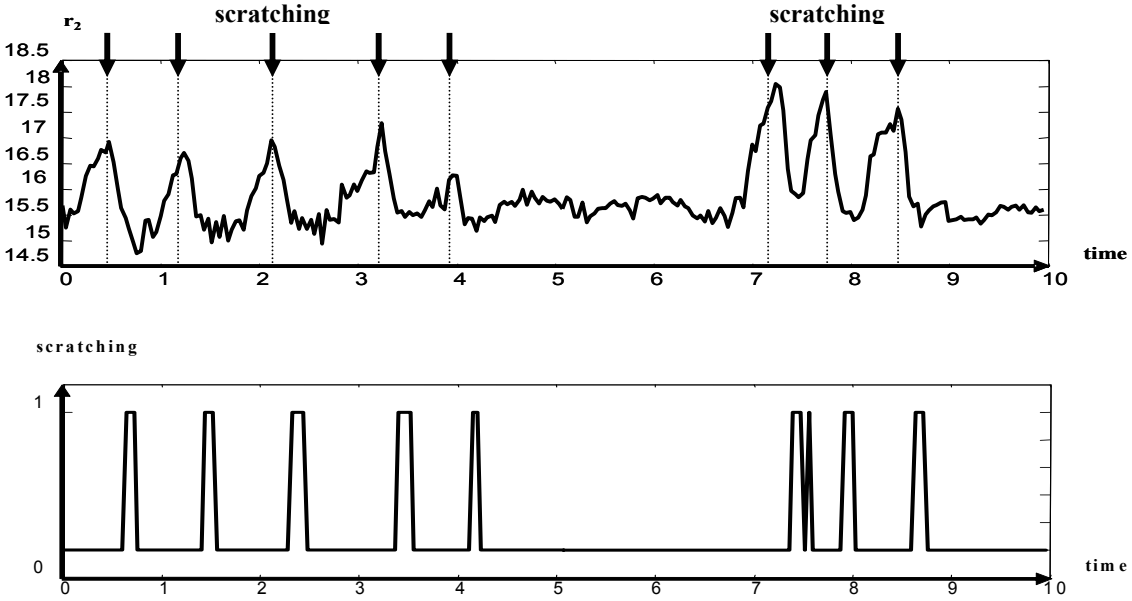

Figure 2. The plot of one of the posture parameters after image processing of a video fragment (top) and the result of the classification as a function of time (bottom). Each peak in the bottom graph corresponds to a recognised instance of scratching.

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