Chapter 3

Image Quality Assessment and Outliers Filtering in an Image-Based Animal Supervision System

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ABSTRACT

This paper presents a probabilistic framework for the image quality assessment (QA), and filtering of outliers, in an image-based animal supervision system (asup). The proposed framework recognizes asup’s imperfect frames in two stages. The first stage deals with the similarity analysis of the same-class distributions. The objective of this stage is to maximize the separability measures by defining a set of similarity indicators (SI) under the condition that the number of permissible values for them is restricted to be relatively low. The second stage, namely faulty frame recognition (FFR), deals with asup’s QA training and real-time quality assessment (RTQS). In RTQS, decisions are made based on a real-time quality assessment mechanism such that the majority of the defected frames are removed from the consecutive sub routines that calculate the movements. The underlying approach consists of a set of SI indexes employed in a simple Bayesian inference model. The results confirm that a significant amount of defected frames can be efficiently classified by this approach. The performance of the proposed technique is demonstrated by the classification on a cross-validation set of mixed high and low quality frames. The classification shows a true positive rate of 88.6% while the false negative rate is only about 2.5%.

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1. INTRODUCTION

Controlling the welfare of individuals, or a group of animal, is the main responsibility of an image-based animal supervision system (asup) (Khoramshahi et al., 2013). An asup, as an intelligent routine, seeks to provide an agricultural decision-support system (ADSS) with animal’s status information by analyzing diverse sources of inputs including image data. Image processing is gradually finding its rule in an asup as a result of decreasing in the processing cost. The state of the art image processing algorithms brings this opportunity to be more feasible and reliable than any other time. Many methods have been developed to use the power of image processing to measure the animal related parameters (such as the image-based movements) in order to give an estimation about a behavior coding (such as aggression, or farrowing).

Although the progress in the concepts of image-processing solutions, that are often acceptable for a controlled situation, is impressive, there is still a remarkable gap between controlled conditions, and real capturing settings that are under the effect of noise and many unwanted factors such as inconsistency in lightening condition or unwanted moving particle, which makes it a good target for developing methods that are more robust to noise, and less dependent on their training conditions.

Digital images, in a real capturing situation, are exposed to a variety of non-physical distortions during acquisition, such as the moving particles, or the poor-lighting condition, as well as the distortions during the processing, compression, storage, transmission, and the reproduction stages. Many of these factors can degrade the visual quality of an image (Wang et al., 2004).

The aim of a quality assessment (QA) research is to propose an algorithm to formulate the effective parameters in order to measure the quality of an image automatically and robustly (Sheikh et al., 2005), and take care or remove a LQ case from an image sequence.

According to the approaches that are employed to quantify the quality of an image as a numeric value, the QA methods are categorized into the following main groups:

- The full reference (FR) methods, which a set of reference images are processed to find the standards for checking the quality of an image.
- The non-reference (NR) methods, that try to find the quality measure with an unsupervised scheme (such as maximizing non Gaussianity by a tool such as kurtosis).

Between the parameters that affect the quality of a surveillance image, the effect of artifacts and the exposure change is covered in this article. The FR-QA methods for the effect of other factors, such as, sharpness, contrast, distortion, and exposure can be found for example in Sheikh et al. (2004), Saad et al.(2012), and Eckert et al.(1998).

The main physical factors, in an asup, that degrade the quality of an image can be considered according to the following categories:

- Changing and fluctuating in the lighting condition (e.g. changing a light switch).
- Small moving particles (e.g. mosquitoes, flies, and bugs).
- Unexpected movements in the borders. (e.g. opening/closing a pen’s door).
- Unwanted objects inside the scene (e.g. human worker).