Image Processing Algorithms to Identify Illness in Cattle

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1 Theoretical Framework

In principle, it is important to name some of the cattle diseases, especially the ones that affects the skin and that are clear in sight. Some of them are brucellosis, bluetongue, babesiosis and foot-and-mouth disease, which are extremely contagious through inhalation, ingestion, direct contact and it has high rates of mortality in every stage of the animal, and lifetime sterility.Metcalf *et al.* (1981) In extreme cases they can also affect humans, like Brucelosis through dairy products. Khan & Zahoor (2018)

On the other hand, image processing has become a powerful tool to treat this kind of problems. With the access to powerful personal computers and APIs (application programming interfaces) these techniques have become more accessible to a broader number of people. According to Burger & Burge (2009) the terms "image processing" and "image editing" are frequently used interchangeably.

Nonetheless, they define the latter as "the manipulation of digital images using an existing software application" and the former as "the conception, design, development, and enhancement of digital imaging programs". In this work we will focus on the former rather than in the latter, because it follows the contents of the subject we are interested in (numerical analysis). Specifically, the methods used to represent the information of images in an efficient computational way, and the more popular algorithms used to process images of any kind, require the theoretical basis of numerical analysis and the mathematical background corresponding to this process such as linear algebra, numerical derivatives and numerical optimization methods. Sra *et al.* (2011), Zinkevich *et al.* (2010).

1.1 Related work

Computer vision has made enormous advances in the past few years. In 2012, a large, deep convolutional neural network achieved a top-5 error of 16.4% for the classification of images into 1000 possible categories Krizhevsky *et al.* (2012a). In the following 3 years, various advances in deep convolutional neural networks lowered the error rate to 3.57% Krizhevsky *et al.* (2012b). While training large neural networks can be very time-consuming, the trained models can classify images very quickly, which makes them also suitable for consumer applications on smartphones.
In the field of disease identification, have been discovered many techniques, for example, decision

trees, K-nearest neighbors (KNN), support vector machine (SVM), and many others. Recently deep learning has gained a lot of recognition in image processing with models like convolutional neural networks (CNN's), which provides a map between an input to an output, but has been a challenge for computational efficiency, so in recent years the improvements in both conceptual and engineering breakthroughs.

Authors in Sujatha *et al.* (2021) Mohanty *et al.* (2016) apply different methods of ML and DL in plant disease recognition, which can be easily applied in other fields like cattle disease recognition. Is important to see how the pre-processing of images impacts the algorithm result but also its computational efficiency, in Mohanty *et al.* (2016) the author tries to change the dataset type by color, grayscale, leaf segmented.

2 Objectives

2.1 General objective

Identify illness in cattle using image processing algorithms.

2.2 Specific objectives

- Code and apply image processing algorithms to identify illness in cattle.
- Compare results obtained with different image processing algorithms in the identification of cattle illness.
- Analyze how the pre - processing of the data set affects the performance of the algorithms identifying illness in cattle.

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