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Comparison of seasonal differences in infrared thermal images captured through a intelligent pasture monitoring system

Iliyan Damyanov, Kalin Dimitrov and Tsvetan Valkovski

Technical University of Sofia, cvalkovski@tu-sofia.bg

GOAL OF THE STUDY

This article is a continuation of our study of pasture research using aerial photography, focusing on seasonal differences in infrared thermal imaging in order to obtain a large database and relationships between different seasons and pasture quality.

INTRODUCTION

In our initial research, we focused on approaches to solving problems such as biodiversity conservation and grazing livestock by introducing modern methods and systems for optimization, monitoring and management of pastures.

In this study we will use an identical method of data acquisition [1-6], applying statistical methods to compare and find the relationships between seasonal differences in the emission of infrared thermal images taken by an unmanned aerial vehicle equipped with a specialized sensor system. This allows us to obtain spatial data, flexibly and continuously, and it is possible to study large areas without significant influence of weather conditions.

MAIN RESULTS FROM THE STUDY

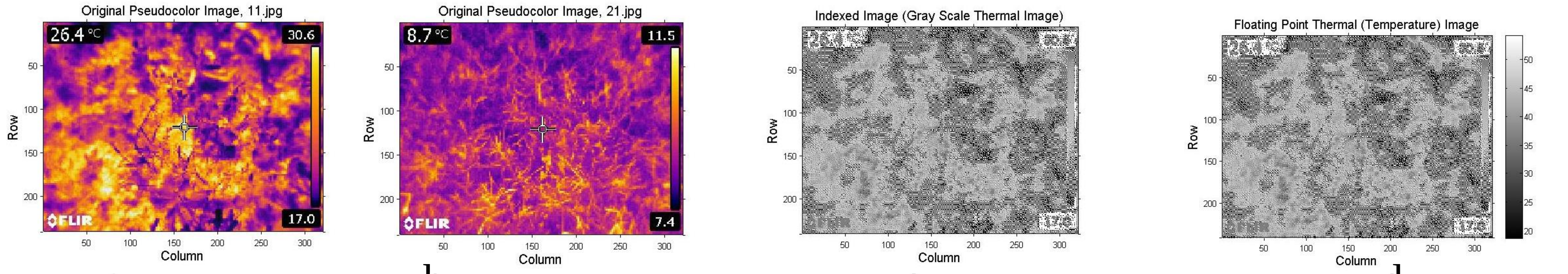
In view of the presented theoretical data, we focus on the study of an identical object in two different seasonal periods, summer and autumn, respectively. The purpose of this experiment is to see if there is a relationship between the emission of identical grazing mass in different seasons.

The selected image processing methods are visual and analytical. Figure 1 shows a picture of the studied pasture mass.

a b c d

Fig. 1. Location 41°29'39.7"N and 25°28'44.8 "E (a) and view of the studied pastures (b). The studied pasture mass during the first survey on 25.06.2021. (c) and during the second shooting on 21.10.2021. (d).

Figure 2 shows the thermographic images taken from the Flir E40 thermal camera for the two studied periods.

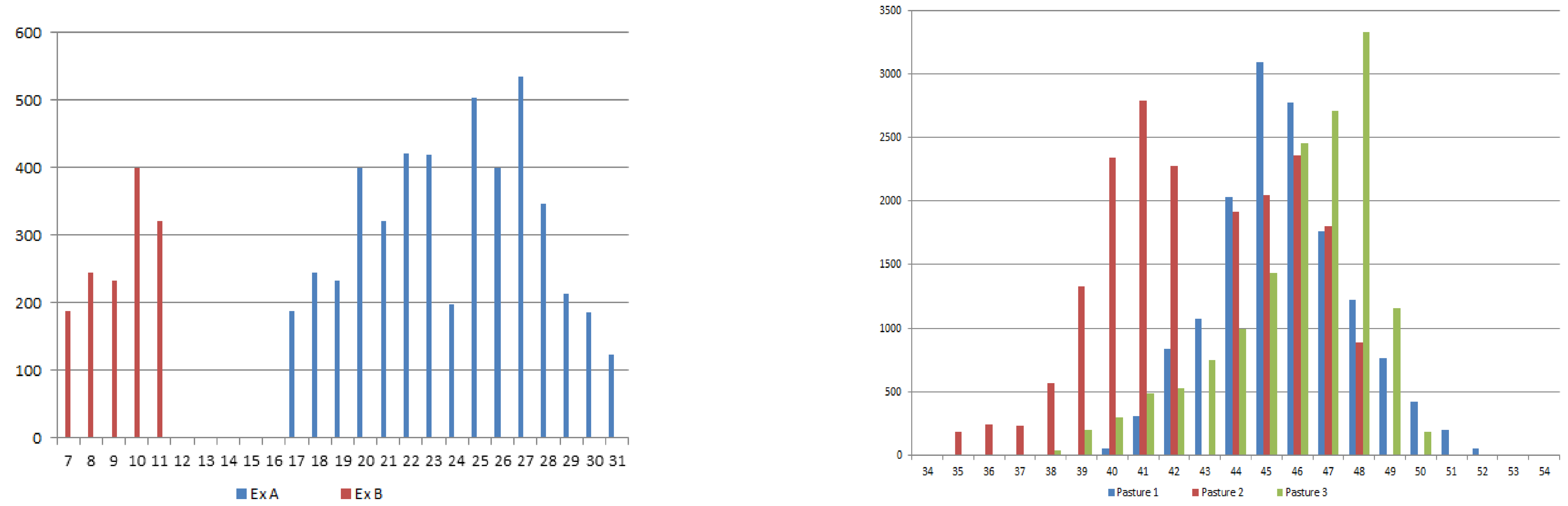


a b c d

Fig. 2. Thermographic images of the studied pasture mass during the first survey on 25.06.2021. (a) and during the second shooting on 21.10.2021. (b). Convert the thermographic image to halftone (c) and temperature calibration to extract the histogram (d).

After capturing the thermographic images, we perform processing by conversion to a halftone image and calibration of the converted halftone images in order to obtain correct histograms of the images. In FIG. 2 shows an example of the conversion of thermographic images to halftones and temperature calibration, respectively.

When processing the images and obtaining a histogram, we have the opportunity to conduct a mathematical analysis of the data obtained, from which it is possible to assess the quality of the pasture mass. Figure 3 shows a general histogram for the captured image from 25.06.2021. marked as Ex B and that from 21.10.2021. designated as Ex A.



a b

Fig. 3. Histogram of the obtained experimental images (a) and histogram of three different pastures from the data collected during the summer period.. (b).

As can be seen, these methods for visual and analytical assessment of pastures could be integrated into an intelligent system for monitoring agricultural activity in order to effectively use and maintain pastures.

CONCLUSIONS

In view of the results obtained, it can be said that these methods can be integrated into the so-called computer vision and machine learning, which are part of the main focus of Industry 4.0.

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