Data Article

Dataset for localization and classification of Medjool dates in digital images

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\textbf{A B S T R A C T}

Nowadays, harvesting, sorting, and packaging fruit and vegetables are still done manually, despite the hard work this represents. The features that experts commonly use to sorting the date palm fruit are size, color, shape, and texture. Recently, it has started to design and develop artificial vision systems that consider the criteria of size, color, shape, and texture to automate these processes. However, the development of these systems is complex due to the lack of labeled datasets that facilitate the creation of models to locate, recognize and classify palm date fruit. This dataset is entitled Medjool, an image dataset of different sizes and maturity levels of Medjool dates. Researchers may use this data to develop a model for automatic location, recognition, classification, and visual counting of the Medjool dates on trays taking into account their visual features such as shape, color, size, and texture. This dataset was collected from the first-round harvest at Palmeras RQ Ranch in Mexicali, Mexico. Images acquisition was performed in natural light. The dataset comprises 2,576 annotated images in two formats, YOLO and PascalVOC format.

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Specifications Table

| Subject                        | Electrical and Electronic Engineering |
|--------------------------------|---------------------------------------|
| Specific subject area          | Image Processing, Image Identification, Image classification, object detection, computer vision, artificial intelligence, deep learning and reinforce learning |
| Type of data                   | Images, and text files |
| How data were acquired         | Images were captured using three different cameras: Canon EOS Rebel T6, Samsung SM-N950F Wide-angle camera Dual pixel 12MP AF, and Samsung SM-N960F |
| Data format                    | JPG, TXT and XML |
| Parameters for data collection | Original data were collected by capturing photography of dates on trays with natural light between 8:00 am and 14:00 pm, in September 2020. |
| Description of data collection | The images were manually captured in the date palm plantation. The images belong to Medjool dates fruit ripped and unripe maturity level was previously sorted by experts. |
| Data source location           | Palmeras RQ Ranch (32°36′56″N, 115°15′36″W). Located in Colonia la Herradura, Mexicali Valley, Baja California, México. |
| Data accessibility             | Dataset can be accessible at Mendeley data: Pérez Perez, Dalila Blanca; García Vázquez, Juan Pablo; Salomón Torres, Ricardo (2021), “MedjoolDates_Dataset”, Mendeley Data, V1, http://dx.doi.org/10.17632/872xk9npzmz.1 |
| Related to research article    | Pérez-Pérez, B. D., García Vázquez, J. P., & Salomón-Torres, R. (2021). Evaluation of Convolutional Neural Networks’ Hyperparameters with Transfer Learning to Determine Sorting of Ripe Medjool Dates. Agriculture, 11(2), 115 [1]. |

Value of the Data

• The MedjoolDates dataset could be a useful resource for researchers in computer vision, image processing, machine learning, and deep learning. It can be used to test, compare or create new algorithms to locate, recognize, classify or count Medjool dates fruit, considering their visual features such as shape, color, and texture, which are very particular for this variety of dates. Currently, datasets are images of one date fruit or bunches of dates [2]. However, they are not Medjool variety and do not consider date images on trays. Medjool date has been considered as the King of Dates due to its large size, attractive appearance, soft flesh, and excellent taste, which no other type of date has in the world. There is no other date as large as this, nor of as much commercial value as the Medjool date.

• This dataset with images tagged, is a ready-to-use database that can directly be used to develop new algorithms or improve developed models. Since, the dataset can be used as part of transfer learning, in which instead of starting the learning process from scratch, we can make use of patterns or pre-trained models that have been learned by solving a different problem [3].

• The MedjoolDates dataset can be used to develop an artificial vision system that allows farmers the automatic selection, classification, and visual counting of the Medjool date on trays or conveyors, taking into account their visual features. To ensure the quality of date fruit considering its maturity and size and the quantity to be packed.

1. Data Description

The distribution of the image dataset is shown in Table 1. We have a total of 2576 images of different sizes (5184 × 3456, 4449 × 3071, and 4376 × 3375 pixels). All images are in JPG format and were annotated using two formats PascalVoc (XML) and YOLO (TXT). These formats were
Table 1
Medjool dataset structure.

| Folders Name | Images | Data | Total |
|--------------|--------|------|-------|
| PascalVoc    | Rip    | 501  | 501   | 1002  |
|              | Ripe_Unripe | 313  | 313   | 626   |
|              | Unripe | 501  | 501   | 1002  |
| YOLO         | Ripe   | 501  | 501   | 1002  |
|              | Ripe_Unripe | 159  | 159   | 318   |
|              | Unripe | 501  | 501   | 1002  |
| Test         | Ripe_Unripe | 100  | 100   | 300   |
| Total        |        | 2576 | 2576  | 5152  |

Fig. 1. Image of ripe dates and its annotation PascalVOC in xml file.

Fig. 2. Image of ripe dates and its annotation YOLO in txt file.

chosen since they are commonly used in object recognition tasks or to evaluate and compare the performance of different techniques [4,5].

The annotation provides information about the Medjool dates in the image. For instance, in pascalVOC, an XML file stores the file name, the address where the image is stored, the data related to the image size (height, width, and depth), the number of segments, object-class, and the bounding box information (xmin, xmax, ymin, and ymax) (Fig. 1). While in YOLO format, we have the following data: object-class, x, y, width, and height. Where: object-class is an integer number of objects from 0 to classes-1, and x, y, width, and height are float values relative to width and height of the image, it can be equal from (0.0 to 1.0) (Fig. 2).

The 1315 images in the PascalVoc category were divided as follows: 501 images of ripe dates, 501 images with unripe dates, and 313 images with both levels of ripeness. While in YOLO, we
have 1161 images divided as follows: 501 images of ripe dates, 501 images with unripe dates, and 159 images with both levels of ripeness. Additionally, we have 100 images with annotation PASCAL VOC and YOLO for testing. In Fig. 3, we present a sample of images with ripe and unripe Medjool dates. The category ripe includes only the mature stage, Tamar. The category unripe includes dates in the color green to greenish-yellow, which are in the stages of maturity Khalal and Rutab. These fruit date pictures were captured in different positions or angles. The dataset includes images with tray sections, half tray, and full tray. The date fruits in the tray were randomly rotated.

The nomenclature used in the name of the images is the following: U followed by the image number in parenthesis for the unripe class, for instance, U (101). The ripe class was followed by the image number in parenthesis, for instance, R (101). For the images that contain both levels of maturity, the nomenclature used was 0, followed by the image number in parentheses, for instance, 0 (101). The files containing the annotation information have the same name as the images but with the extension of the format used, for example, U (101).xml for PascalVoc.

2. Experimental Design, Materials and Methods

2.1. Camera specification

The acquisition of images was done with three different cameras. A camera Canon EOS Rebel T6, and the cameras of the smartphones Samsung SM-N950F and SM-N960F. The camera specifications are presented in Table 2.
2.2. Building dataset

In Fig. 5, we present the processes involved in building a dataset. The images of Medjool dates in trays, were taken in September 2020, during the first round of harvest of Medjool dates in the plantation located in Colonia La Herradura (32°36′56″ N,115°15′36″ W) in the Mexical Valley, Mexico. The acquisition of images was done with three different cameras, using natural light between 8:00 a.m. and 2:00 p.m. A camera Canon EOS Rebel T6 of 18 megapixels, and the cameras of the smartphones Samsung SM-N950F and SM-N960F, which are a double camera of 12 megapixels. The camera specifications are presented in Table 2. After capturing images, these were organized by classes ripe and unripe and renamed as described in the last paragraph of section 1. Finally, the images were annotated using LabelIMG version 3.6.3, which is written in Python. LabelIMG tool uses the PASCAL Visual Object Classes (VOC) and YOLO format. These formats enable us to save annotations related to the objects on images and all stored in TXT or XML files. All annotations are saved in separate annotation files for each image.

CRediT Author Statement

Juan Pablo García-Vázquez: Conceptualization; Dalila Blanca Pérez-Pérez: Data curation, investigation, resources; Dalila Blanca Pérez-Pérez and Juan Pablo García-Vázquez: Writing - Original draft preparation; Juan Pablo García-Vázquez and Ricardo Salomón-Torres: Supervision; Ricardo Salomón-Torres: Writing - Reviewing and Editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

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Table 2
Camera specifications.

| Features     | Canon EOS Rebel T6                  | Note 8 model SM-N950F                  | Note 9 model SM-N960F                  |
|--------------|-------------------------------------|----------------------------------------|----------------------------------------|
| Resolution   | 18 megapixels                       | Double 12-megapixel cameras            | Double 12-megapixel cameras            |
| Pixel Unit   | 4.30 μm square                      | 1.0 μm square /Telephoto camera         | 1.0 μm square /Telephoto camera         |
|              | square                              | 1.4 μm square /Wide-angle camera        | 1.4 μm square /Wide-angle camera        |

Fig. 5. Process flow diagram in developing a dataset.
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