RODOR algorithm for the identification of irregular surfaces with circular contours applied to the recognition and counting of coins

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Abstract

Precision in the identification of objects contained in an image is a fundamental task in computer vision used in practical applications, an activity that has been simplified with the use of neural networks which have a high cost to be implemented because they require access to large amounts of data, considerable training time and resources. In the present work we explore the possibility of using the RODOR algorithm, without the use of neural networks, which requires a minimum amount of data and resources for training. It is based on the generation of a matrix of features that allows us to identify circular contours with irregular surfaces and we have applied it in the recognition of coins from 4 countries, identifying the irregular surfaces of each coin at any angle of rotation. The RODOR algorithm trains a data set using several algorithms, including Canny for identifying edges, the Sunken function for locating sunken reliefs accounted for by the Hamming distance, the Hough transform in the recognition of circular areas, the radio search and diameter. The algorithm was developed in Python and allows the evaluation of images with individual or grouped coins on a white background, the source code can be consulted in the Links section of this work.

Keywords— *Matriz de rasgos, algoritmo Rodor, función Sunken, distancia Hamming, bordes Canny, transformada Hough.*

Introducción

Computer vision is a field of artificial intelligence that is being implemented in many areas. For example, for diagnosis in medicine, in industrial processes, in astronomy, in psychology and business for the recognition of emotions, among others. Being a tool that allows you to detect, identify and classify objects, which makes it a very accurate option to be applied to the counting and control of coins.

Currently, computer vision is based on pre-trained systems that rely on the use of artificial neural networks to achieve the identification and classification of objects. This type of implementation is high cost and requires a considerable amount of infrastructure resources. data and time to be used in practical applications. Likewise, neural networks involve hidden layers that add complexity to the process and make auditing processes difficult.

This research proposes the RODOR algorithm, which aims to be a tool that can recognize and classify circular areas with irregular surfaces without the use of neural networks, applied to coin recognition seeking a high capacity for accuracy in identification. It is based on training from an image for each coin to identify its most differential features without resorting to weighing or physical measurement procedures. The innovations that the RODOR algorithm proposes are the following:

1. Requires few images for training per coin.
2. Does not use neural networks for coin recognition.
3. Validates the features defined in the highlighted and sunken reliefs.
4. Increases the possibility of validating any circular currency from any country.
5. Implements a new function called Sunken to recognize sunken reliefs on the coin.
6. It does not require validating both sides of the coin, only the one that corresponds to the reliefs that distinguish it from the rest.
7. Correctly identify 2 or more coins that are of the same diameter or radius.
8. It can recognize the coin even if it is turned to any degree.

These innovative characteristics of the RODOR algorithm can be seen in Table No. 1.

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