

Identification of Geometric Shapes with Real-time Neural Networks

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ABSTRACT

This article presents the implementation of an identification system of geometric figures and their respective colors, this made with neural networks by using Backpropagation control implementation. This paper describes the process of extracting characteristic patterns of images, with the help of Artificial Neural Networks. The information Neuronal Network along with additional data of images and colors, will be stored in a database which will be put dynamic that will evolve with the figures they will be learning this by implementing a PID created in MATLAB Software. Subsequent to perform image capture with an independent PC WEBCAM. This processes the image and along with the data acquired and processed by the neural network in the pattern of shapes and colors. For image processing libraries MATLAB be used both in the implementation of a system acquisition by WEBCAM.

Keywords - Artificial Neural Network, Pattern Recognition , Artificial Intelligence.

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I. INTRODUCTION

Artificial Neural Networks (ANN) have become very important in recent years derived multiple applications with respect to digital signal processing, thereby performing a variety of implementations without the need for an operator for decision-making. The ANN are a set of rules designed for the purpose of learning and automatic processing inspired how biological central nervous system functions, thus being a system interconnect neurons that work together to produce a stimulus output thereby giving a result and the interpretation thereof to learning.

The progress made between hardware and software for methodological developments around learning algorithms for ANN and new techniques used for learning artificial intelligence favored decision-making approaching the central nervous system which has more than one hundred billion neurons.

Derived following the development of applications for pattern recognition has its tricky part since the entrance to the ANN will be composed of an array of information which can damage the sample to be processed occupying more memory and therefore sorting speed [1].

One of the ways to speed up the processing of information without much loss is to capture all possible samples and store them in a single matrix input to the ANN.

In the work of Ramirez et al [2]. Make a study of the different techniques used in image processing with ANNs from the pre-processing, segmentation, object detection and classification. Of the techniques mentioned in the previous work Alfonso et al [1]. Use segmentation and binarization of the images for the detection of static faces in a controlled environment. There are jobs like Aurelio et al [4]. Where they perform recognition of alphanumeric

characters with the possibility of presenting a "twist" increasing the difficulty of the ANN.

The present work includes the use of a previous management ANN training to improve information database consequently increased response thereof and minimizing an error margin for identifying geometric figures; by processing software allow real-time check the number of iterations or neurons to perform to get the required results given thus higher learning ANN for decision -making. With regard to the work mentioned in this where most of the acquired samples are static and controlled, this does not apply in real time samples where almost nothing is controlled and static.

2. DEVELOPMENT

The need arises for the identification and classification of images in the field of acquisition and interpretation of data in real time but with shapes, colors and characters in particular in the content thereof, and taking into account the stated above, it would be desirable create a generic infrastructure that is able to recognize images of any kind with a minimum cost of resource utilization. Therefore, the proposed solution must be independent of the type of image to study. That is why the following infrastructure is proposed to solve the problem (see Figure 1).

Geometric figures used as ideal samples were created in the software COREL DRAW 14 for its simplicity and you do not need much elaboration with dimensions of 255x255 pixels, the elections were the figures: square, circle and triangle; with its variants in colors: red, blue and green. The choice of these samples is more diversity of shapes that can be generated from them, as an example with a square can get to generate a rectangle. And the choice of colors is the combination of these three colors generates most of the full range of existing perceptible to the human eye colors.

These images alone are ideals which do not represent any deformity or a variation range of color intensity by area, which does not happen in the real world where situations are changing only the fact of changing the lighting indirectly affect the results.

2.1. MATLAB Simulink / GUI

Today, most systems are going through a process simulation before actual implementation physical and with this providing a range of comprehensive and clear results about what the actual operation of the system modeling and behavior that may have. Using MATLAB / Simulink is growing in teaching and research because the software tools it offers, besides allowing easy and visualization of it in particular implementation in this implementation work interface image acquisition and patterns tools Simulink / GUI used this to perform modeling systems data acquisition, linking acquisition through Webcam, as well

as the process of mathematical modeling through the resulting of this ANN derived matrices data acquisition through the toolbox of Neuronal Network. The main problem arises because the elements acquired in the Simulink / GUI itself are in some cases incompatible image acquired real form in which it exists as a comparative system for the initial test. In the following sections we will deal in detail what processes and operational methods used for proper operation are. With samples ideals of acquisitions ANN trains in MATLAB processing software for verification of results (see Figure 2).

As we can see in the figure above as input data acquisition we have 9 inputs and output data we have 9, this means we have 9 inputs and 9 outputs. It should be 255 inputs and 255 outputs the aforementioned dimensional images "ideal"; this is due to prearrangement of images (see Figure 3) where each image is considered as an information matrix, this matrix can be considered as a vector with a length of 255x255 data information, the result of combining each image with colors previously discussed which are three squares (red, blue and green), three circles (red, blue and green) and three triangles (red, blue and green); 9 generating information vectors now grouped into a new array of information 9x65025 data, this in order to be able to perform the training of ANN.

2.2 Multilayer Perceptron (MLP) and Backpropagation (BP)

In this part of the development we can refer to multilayer perceptron networks with sigmoidal activation functions are trained by BP learning algorithms. Because MLP was among the first models of neural networks arise in many works to compare the performance between a model and a proposed perceptron training algorithm or BP. Other authors like Narasimha MLP used to validate the development of optimization algorithms ANNs [6].

From the search results, Crespo makes a modification which proposes a MLP with sigmoidal activation function and weights as Gaussian functions trained with a variant of BP for setting gaussian weights and performed well in multispectral images [7]. Shiblee suggests a variant network with sigmoidal activation but aggregations of weights and input vectors are based on the algorithm of generalized weighted average (GMP) [8]. Rajini in 2010 publishes a performance evaluation of training algorithms neural networks for object recognition. For them, different training algorithms based on BP were used. Variations studied are BPmom (variation of momentum), Through Time, Resilen and Quick. Of these, the algorithm was able to converge faster the BPmom. To test the algorithms several images [9] were used. The rest of the works studied, focus on sorting applications where the network is assisted techniques as Hough transform, cosine transform and FCM.

Taking into consideration the above and on completion of training the ANN these results are stored as a variable in the MATLAB environment for analysis and appropriate use, these are the first steps performed in the simulation of ANN with images ideal for watching their behavior and verify correct operation of the software as well as the ANN under optimal conditions (see Figure 2, Figure 3 and Figure 4).

MATLAB in your development environment GUI allows a PID to manipulate ANN and to add to it a webcam which will serve as the system data acquisition visually this for testing in real time (see Figure 4), it mention that once trained the ANN does not have to retrain only send call as a variable, such GUI already programmed has the options of searching the webcam that is assigned for use, this referred to the multiple range formats data acquisition these being possible to use, the operator must choose the format and then to Start for the PID take catches in a loop closed until a detection or identification of the observed shape is made through the webcam.

While the button ID so you do not press the PID only shows what the webcam is capturing, once pressed the button and the PID identifies a form the same as noted in a text data to define who has found such form and to identify the color of said figure.

2.3. Results

By running the GUI of MATLAB that was created and go performing the procedures mentioned in the development, choose format to use, start the webcam and post it to identify form; when one of the figures is passed GUI reacts depending geometric figure and displays its result (see Figure 5). To verify the results of the code throws percentage values compared to the ideal (see Figure 6), taking into account that there is much difference with what the webcam is capturing and the database that was used to train the ANN (see Table 1).

As with the squares is implemented with circles (see Table 2), just as results are obtained in proportion with the comparison with their respective neuron and annex bar with no compatibility with other neurons to which they were not trained to detect circles (see Figure 7).

The code has no delays to react to have a tenuous presence of a near geometric figure image that is being evaluated (see Figure 8), as is in the case of the circles that even if more appearance of an oval by Webcam positions, the ANN reacts to the closest being programmed depending on the percentage values that were assigned to that function.

Finally, the triangles have their peculiar form (see Table 3) the user holding the image in front of the webcam makes late the code to detect that is a triangle, testing in stable condition arrogate good results (see Figure 9) although the adjacent bar comparison with respect to the reaction of

the ANN to neurons that were not trained to triangles have a very high percentage implies that can be confused with other geometric figure. This is meant for the reason that a triangle can be contained within a circle or a square without difficulty making the ANN doubt their answer.

II. FIGURES AND TABLES

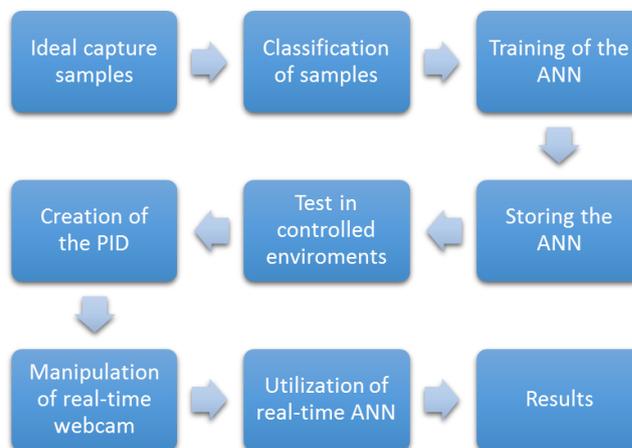


Figure 1. Making of the process research

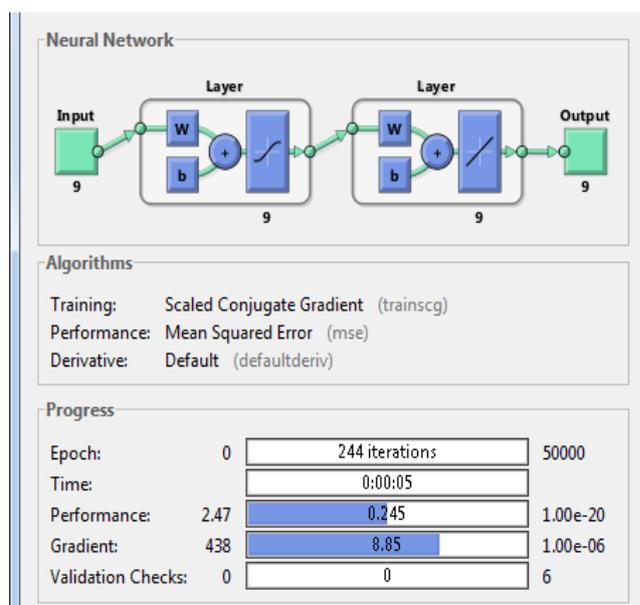


Figure 2. MATLAB Toolbox for training of the ANN.

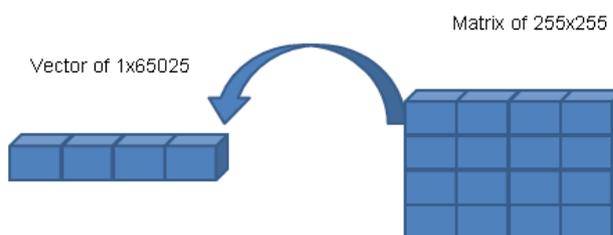


Figure 3. Converting an image to vector matrix form

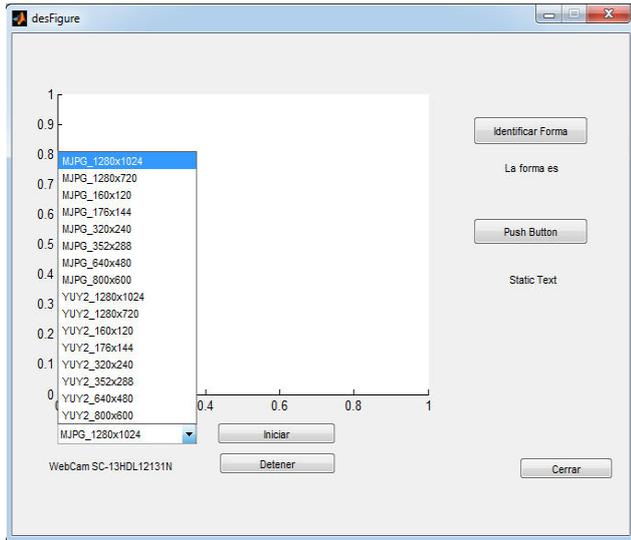


Figure 4. PID for data acquisition and ANN testing in real time with MATLAB GUI.

Figure 5. Comparative results when testing for square figures ANN.

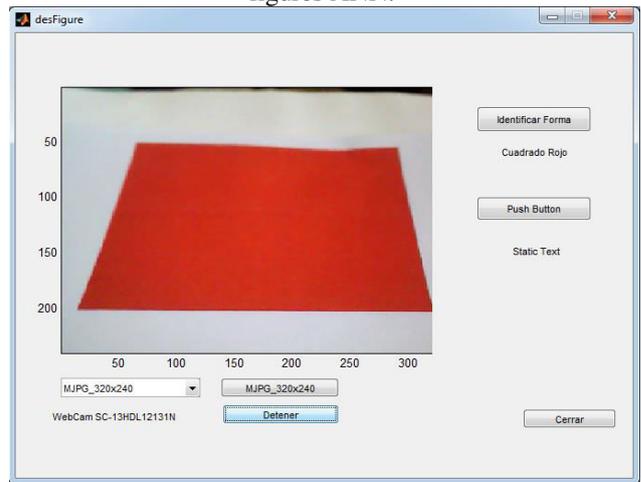


Figure 6. Result to display an image on the webcam (Red Square).

Real image	Ideal image

Table 1. Square images used for testing.

Real Image	Ideal Image

Table 2. Images circles used for circular figures

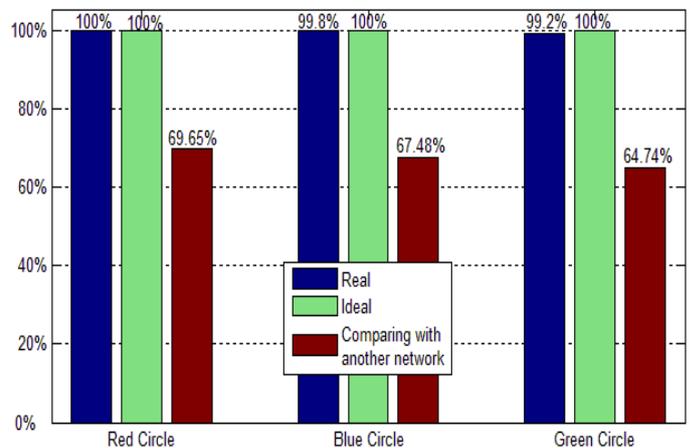
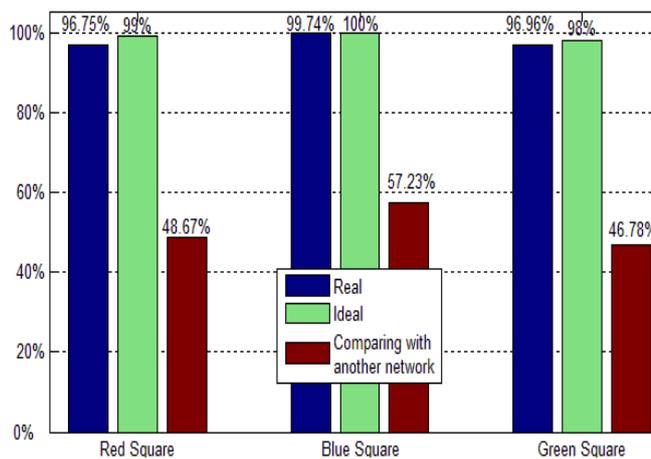


Figure 7. Results ANN thrown when testing for circles

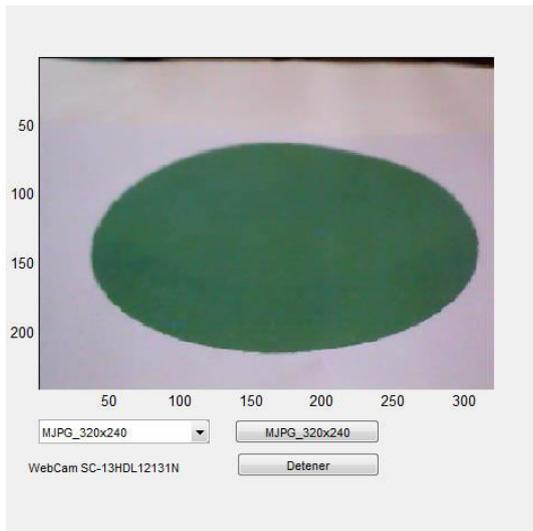


Figure 8. Result to display an image on the webcam (Green circle).

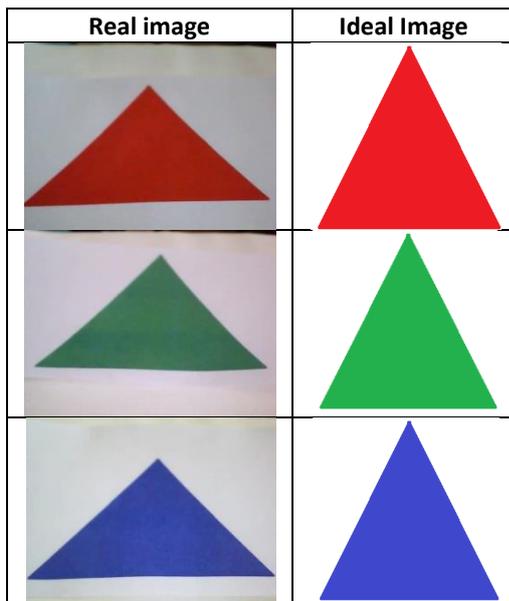


Table 3. Images of triangles used for testing.

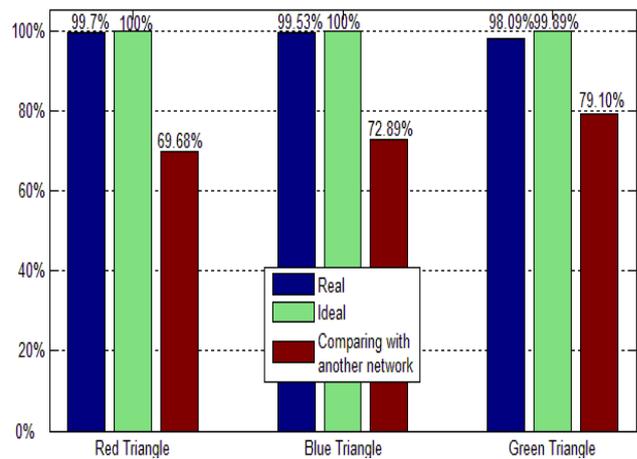


Figure 9. Results ANN thrown when testing for triangular figures.

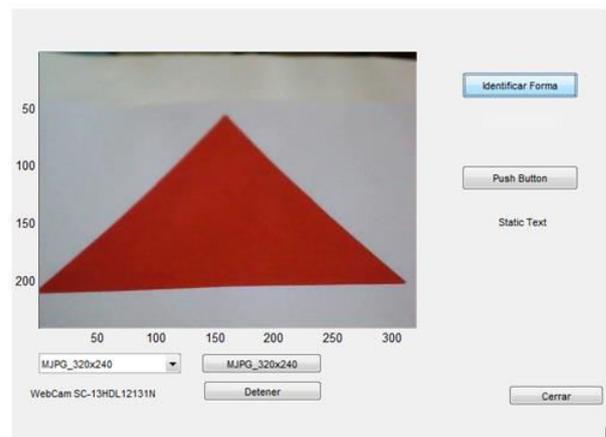


Figure 10. Result to display an image on the webcam (Red triangle).

III. CONCLUSION

Considering the difficulty of identifying images based on their content, pattern and colors, we can conclude that the results reported in this research have been acceptable as it is able to identify the shapes and colors that are caught in good terms. It was also able to show that the infrastructure for assembling data acquisition equipment Webcam created was adequate for the purpose of research.

Although it was shown that the system works, it seems obvious that it is improvable since often data acquisition figures are not sufficient for proper classification of the type of geometric figure. Furthermore it was shown that the established infrastructure was adequate, so was achieved one of the objectives.

As future work, it would be ideal to have a large database with many images of different shapes, colors and thus be able to groupings of characteristics of each type of shapes, colors and feed the neural network, thus possibly the results would be improved notably.

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