Algorithmically Finding Waldo

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*Abstract*—The child’s book where’s Waldo has readers scan through pictures to find a specific person (Waldo) in a sea of noise. This paper will discuss possible methods computers can sift through this same noise to find Waldo in any picture he is in.

# Introduction

First published in 1987, Where’s Waldo is a widespread children’s book depicting a character named Waldo hiding in a variety of scenes. However, from scene to scene Waldo may be performing different actions and holding onto various objects. Waldo is also hidden in plain sight, amongst a sea of activity. This noise consists of many other people and animals performing silly actions. It is up to the reader to sift through all this noise, and figure out in what part of the image Waldo is hiding.

# General Approach to Find Waldo

It was decided to use algorithmic approaches to try to find Waldo in images. Waldo has common features among scenes, and these features can be searched for in an image. These features include:

* Waldo is always wearing red and white striped shirt and hat
* Waldo is always wearing glasses
* Waldo may or may not be carrying books or reading a book
* Waldo’s face is skin colour
* Waldo’s hair is dark brown

The general approach to find Waldo algorithmically is by two steps. First step, apply colour thresholding to the image to highlight colours that Waldo is commonly known to consist of in any image. Also use this colour thresholding to down play colours that Waldo is not know to consist of. Second step, use simple pattern matching to pick the area that most resembles patterns common to Waldo. In this case a stripy pattern was used to try to match to his red and white stripy shirt.

# Colour Thresholding To Bring Waldo out of Hiding

To begin the hunt for Waldo, each pixel of the image is gone through multiple times. If a pixel is reddish, that pixels colour gets pushed all the way to the reddest a pixel can be. If a pixel is whitish, that pixel gets pushed to the whitest a pixel can be. If a pixel is neither reddish or whitish, then that pixel gets set to black. Reddish for this paper, is defined as having Red Green Blue component values of: (211..255, 0..139, 0..139). Whitish for this paper is defined as having Red Green Blue component values of: (231..255, 231..255, 120..255).

The simple step of thresholding reddish and whitish colours is usually enough to bring Waldo out of hiding for the human eye to quickly find. This step highlights the colours that are most like Waldo, while usually also reducing the sea of noise a reader would have previously had to comb through to find Waldo.

# Pattern Mactching To Pick Waldo

Now with Waldo out in the open from the previous step of color thresholding, it is easy to pick up on the pattern of his striped shirt. To perform this action, the mahotas image library was used to create a stripe pattern, and then skim the image, looking for a location of the image that best fit the pattern. [1] This search is done using a combination of the pattern, and the difference between the red of each pixel with the average white of the total image subtracted. This subtraction is to make the skimming pick up on areas of the image that contain red and white more readily. The previous step of changing all colors to red, white or black helps this stripe search, as there is less noise in the image that can be identified as a stripe.

# Results of This Approach to Find Waldo

The results of this approach to finding Waldo isn’t overly promising. Mysteriously on some image the stripe pattern matching can identify a mostly solid color patch of image as Waldo. On other images these two steps can be tricked into picking a person wearing a striped red and white shirt, that isn’t Waldo.

In other words, this paper does claim to solve the finding Waldo problem in convincing manner. The color thresholding does make it very simple for a human to solve this problem, and the pattern matching step seems within the grasp of completion, but it is not complete.

1. 2012 01 13th, “How do I find Wally with Python?” http://stackoverflow.com/questions/8849869/how-do-i-find-wally-with-python,