EVOLUTIONARY COMPUTATION

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Submitted by

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Topic

Solution for Robbery with Differential Evolution

(Image Processing Based)

ABSTRACTION

Today, if we look at the point where technology has come, many innovations have been made in the field of security. In addition to web and application security, there are algorithms that will provide serious benefits in the field of physical security. There are also very useful studies for the robbery, which is the problem of this project. For example, suppose you will be out of town for a while, what would it be like if you received a notification of a burglar breaking into your home? You would definitely have time to take action and call the police. Today, we will code this issue, which is one of the working areas of image processing, using the differential evolution algorithm and set up a system that will warn us during a physical security breach. The main purpose of this system is to notify you about violations that may occur while you are not at home. The rest, of course, up to you. As we will discuss in the results and discussion section, you may have questions marks in your mind. What about the algorithm? Will we get notifications every time our pet enters the camera angle? The answer to all of them is in the article described in the presentation, in this report and in code files.

INTRODUCTION

With the application we will use in this project, we will try to create a solution so that we can respond to the robbery attempts that may occur when you are away from your home for a certain period of time. For this, we need to put ip security cameras in the parts of your house that see the parts of your house where thieves can enter.The reason these cameras are ip is because we need static ip for remote monitoring. For this reason, cameras must have static ip. In fact, even a single camera may be sufficient for this project. If your house has only one entry point that thieves can enter, it will be enough to use a camera that only sees that entrence. Although, it is very difficult to realize, I would like to talk about a small detail. The angle the camera sees can also confuse the algorithm if there are long curtains swaying in the wind. Of course this means an open window to get in but I wanted to point it out anyway. Then we start to write our application that we will use the differential evolution algorithm. I will explain the technical details on the next page. For now, I want to talk about our solution method. We will detect the robber by performing image detection, which is often done in the image processing area.

METHODOLOGY

In this section, we will talk about image processing and how to do image detection over live video. As you remember, since the equations and calculations are at the article so I will not write them again. In this project, we will write 3 pieces of code (3 separate files): Camera implementation, image detection and segmentation. As you can understand from the names, we will implement our security camera at the beginning, for this project the security camera is my webcam. Then, as I will tell you in a moment, we are going to take a reference snapshot and process it. In the last part, we will wait for someone to enter the screen, detect it and give error message. Let's start with image processing part.

As I explained in my presentation, before we can process the images, we need to convert them to black and white. Our security camera will take and process a reference screenshot when there is no one on the screen the first time it runs. Since we will do this processing in live view, the algorithm will start doing this process continuously. And it will subtract each image it takes from the previous image. When you say it will subtract, it will do matrix subtraction as we know it. If it sees a difference, it will give us a warning. You can find the codes of these processes in the documents. You might be thinking: I have a pet at home, will I be constantly alerted if it passes by the camera? For this, we will apply a height filter. In other words, we can set a minimum diameter limit for objects entering the screen. In this way, as your cat/dog enters the screen, it will not give a warning because the object size is below the minimum limit. Let's take a look at the results now.

EXPERIMENTAL RESULTS

When we look at the outputs of the project, the application gave a warning because there was a difference between our reference image and the new image created by the person entering the image. It also marks the person entering the image with a different color for us.
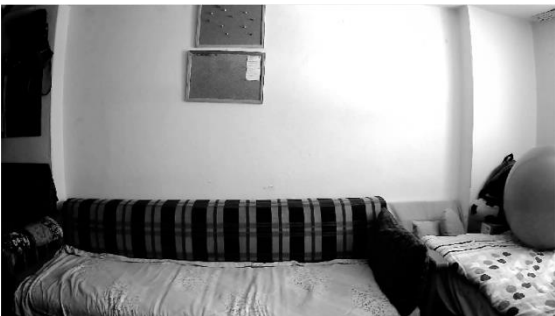
EXPERIMENTAL RESULTS

As you may have noticed, it first converted it to the binary version to be able to process between images. The thresholding process started at the difference threshold and detected the object in the image.
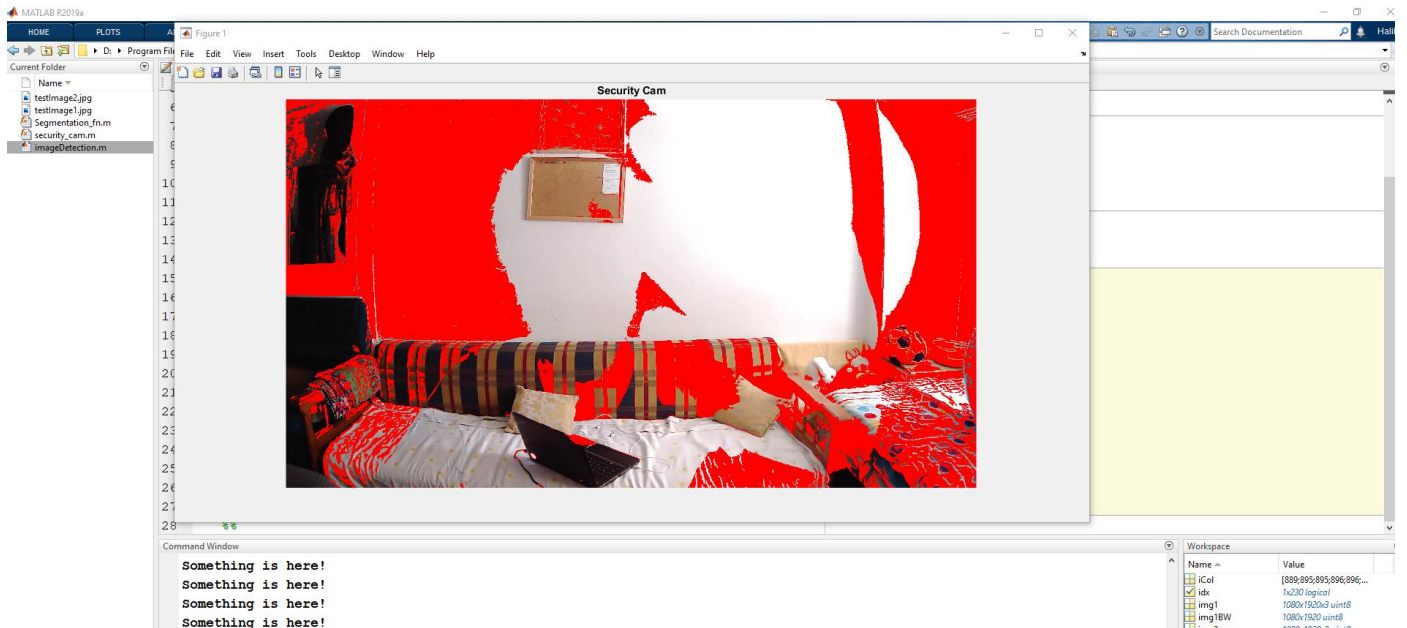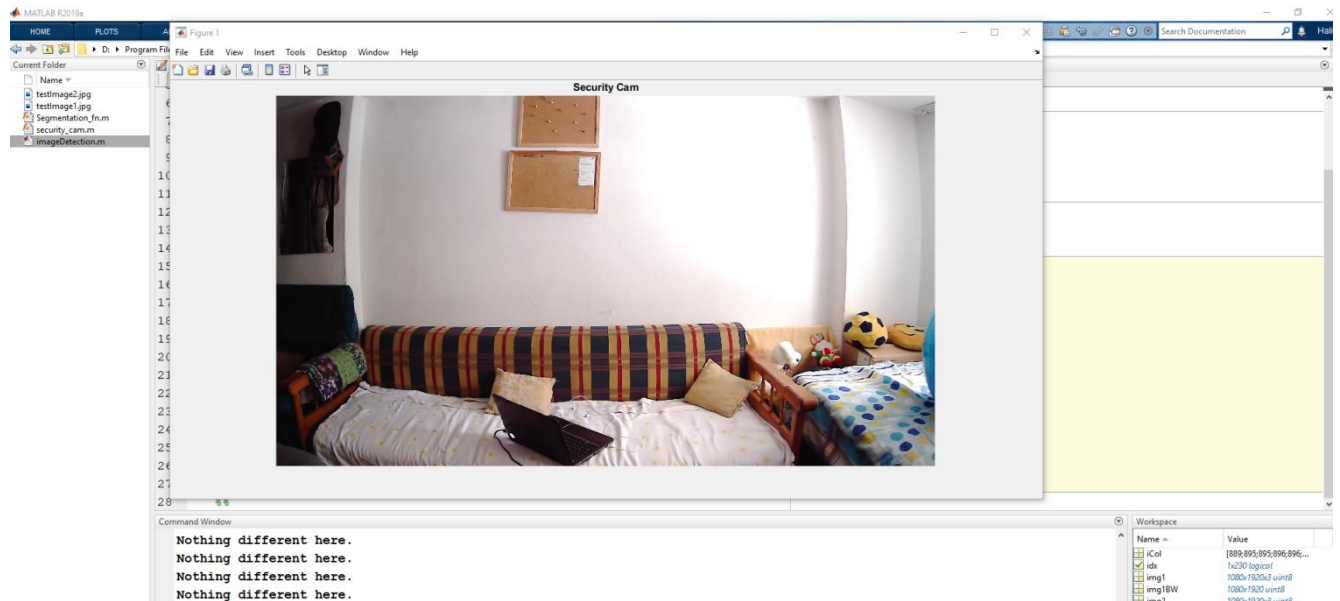
RESULTS AND DISCUSSION

As a result, it can be used as a very productive application for the security industry. As you can see, we have taken a serious security measure with very little material. So what are the deficiencies in this system and which parts can be improved? First of all, applications of differential algorithms, as I said in the presentation, require more computation than normal, so the compilation time will be different compared to other algorithms. This is our main disadvantage. So what can be done differently? As you can see, we have given the warning in writing. It will be much more efficient if this alert is turned into a mobile application notification. An audible notification is much more noticeable than text. On the other hand, the system can be developed by working with fields such as artificial intelligence and deep learning. Software applications of these fields are also made with Python intensively. MatLab also includes tools that allow us to collaborate with Python. Therefore, we will not have integration problems.

To look more generally, although the differential evolution algorithm is efficient for this application, other ways could be developed. You may be thinking: Our goal is detect if someone is there. Does thresholding value need to be this good? Cannot the Kittler Algorithm do the same? Maybe it can. I want you to think about this: A brain tomography was taken and the tumor was detected. As you know, even milimeters are very important in medicine. The true size of tumor can only be determined by successful algorithms such as differential evolution algorithms that can perform precise thresholding and segmentation. I think now we understand how effective even small differences can be. For this reason, I have seen how comprehensive the evolutionary algorithms class actually covers. The way, it was handled and the ordering of the topics were very efficient.

Thanks for everthing.

Best Regards.

RESOURCES

https://matlabacademy.mathworks.com

https://yarpiz.com/231/ypea107-differential-evolution

www.mathworks.com/matlabcentral/fileexchange/18593-differential-evolution

https://dergipark.org.tr/en/download/article-file/333653