Unmanned security system through a person recognition based Jetson Tk1

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Abstract

In this paper, transfer the image to the phone of the owner of the house when the man would have been recognized in the inputed video image form a camera connected to the Jetson Tk1 board. After determining whether or not you want to be an outsider and to take quick action.

I. Introduction

A growing number of double-income couple recently, students by going to school, there are many cases where there are no people in the house. There are many cases that happens sneakthieving between 7:00 am to 4:00 pm. Therefore, in many houses use the security systems. But Existed security system, there are some drawbacks.

First of all, most of the unmanned security systems are using heat rays sensor. Since heat rays sensor is operated by heat, there are lot of possibilities that happens malfunction. And it cost lot of maintenance expenditure with expensive installation charges. In this paper , To solve this problem, while taking a video through installed camera in the house, by the images that got from camera as doing image processing, extract the feature about people. When comparing the samples educated before and judging as a person, save the picture in a server and then send the picture to the host's cellphone application. After that, the transmitted image owner confirms and when it is determined that outsiders, it sounded the alarm on the server and can be quick reporting and response.

In this way, to complement the disadvantages of the existing security systems and to solve the problem as quickly as possible at a reasonable price.

II. Related Works
2.1 Related Work 1 (Related Standards)

1. HOG(Histogram of Oriented Gradient)
HOG is to divide the cell to a predetermined size in the region. After obtaining a histogram of the direction of edge pixels for each cell, these histogram bin values are connected vector in a row.

So, HOG can be seen in histogram template in the direction of edge.
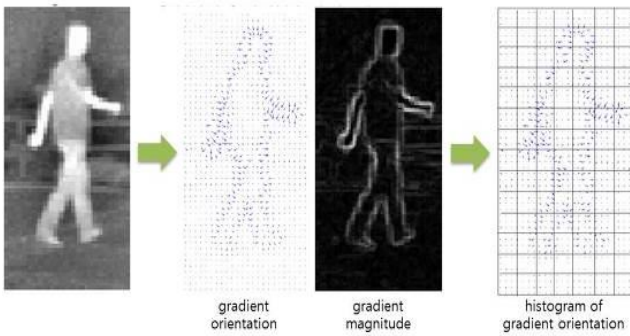
The template matching, the geometric information of the original image intact and able to match, but a little changed shape or position of the target should not have problems matching this well.

On the other hand histogram matching is able to match even though the object's form has changed. But, Because it lose the geometric information of the target and remember the only distribution (ratio) information, There is a problem that matching with wrong objects. HOG, which is basically just a matching method in the intermediate stage of the template matching and histogram matching and In block units that maintains the geometrical information, inside of each block by using the histogram has a somewhat robust about local change.

In addition, because HOG uses the direction information of edge, it can be seen a kind of edge-based template matching method.

Because Edge is basically less sensitive to brightness changes, lighting changes, HOG can also be thought having a similar feature. Also, HOG is appropriate video feature for distinguishing the objects that has not complex inner pattern like people, car and also has unique outline on its own because it's using the object's silhouette information.

When HOG is compared with the SIFT(local feature), HOG is a kind of template matching. So, HOG is difficult to detect if there is a change in the form or if the object is rotated. However, SIFT is matched feature points units about feature points of the models and input image. So, the matching can be made independently of shape changes, size chances and the rotation. As it is seen in these characteristics, Hog is suitable that it is not severe changes form of the object, internal pattern is simple and the object is identified by the object contour. And SIFT is suitable method if the Internal is complicated patterns such as picture frames.

gradient orientation   gradient magnitude   histogram of gradient orientation

frame pixel which got if from camera, then judge if it is a person or not.

1)Positive : 2417(48x96)   2)Negative : 12180(48x96)

1)Positive : 사람 이미지
2)Negative : 사람 이외의 일반이미지
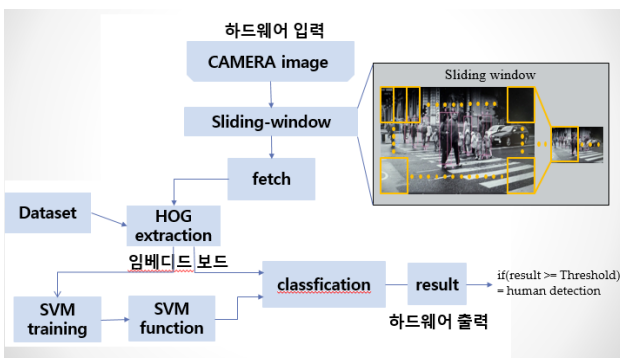
<Using Inria dataset>

2.2 Related Work 2

1. SVM(support vector machine)

SVM is one of machine learning. Pattern Recognition, a supervised learning model for data analysis, mainly used for classification and regression. Between two categories when a set of data is given, SVM algorithm is making nonprobability binary linear classification model that judge which new data is going to be belonged on the basis of a given set of data.

Created classification model is represented as a boundary in the data mapping space. SVM algorithm is an algorithm used to select the boundary having the largest width of the models. SVM can be used in non-linear classification with linear classification. This operation to map the high-dimensional feature space to the given data is necessary to the non-linear classification. Sometimes, the kernel trick used in order to do this efficiently.

TEMPLET(48x96)
CELL(8x8)
BLOCK(16x16)
Total BLOCK 220
BIN 9(0° ~ 180 °)
Number of feature 1980(220*9)

HISTOGRAM

size regulations on the Cell, block, templet

III. Main Idea of This Work

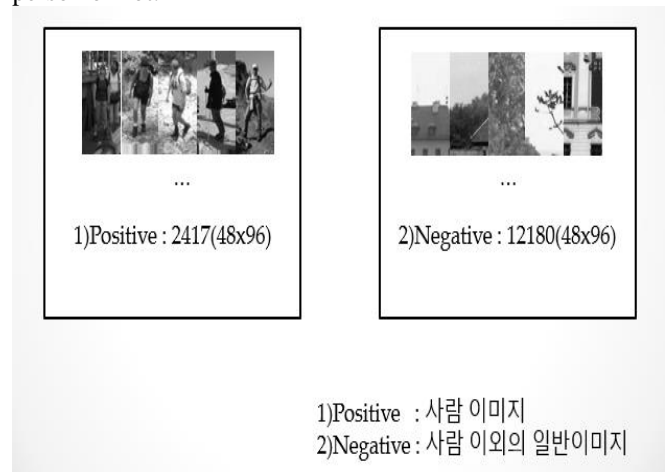**3.1 Submission of Thesis**

The system consists of the image processing with the network. Image processing proceeds in the following process.

BLOCK(16x16)   Divide   CELL(8x8)

HISTOGRAM   L2 normalization

for(i to 36)
   sum = bin(i)*bin(i)
for i to 36
   bin(i) = bin / sqrt(sum)

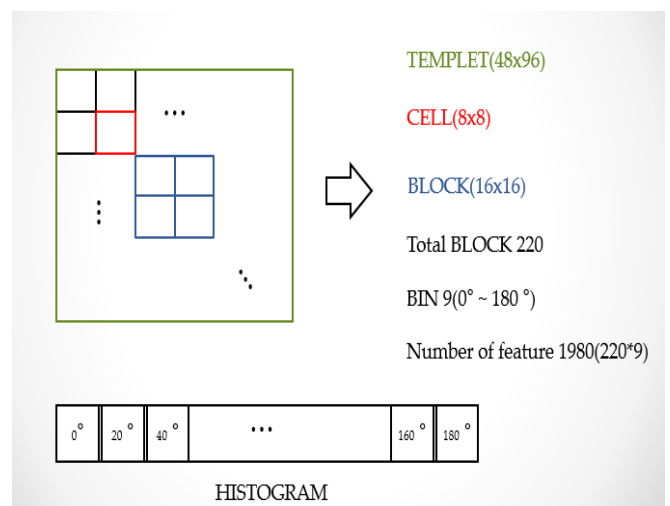After L2 normalization, 4 cell makes a single block.

First, by utilizing HOG techniques from the dataset input magnitude for each pixel. After utilizing SVM generates the xml file to classify the class. While recording a video from the camera each frame converts the image. After the conversion to gray images by utilizing the sliding window technique repeat learning until less than template size (48x96). After, Compare xml file that generated before and
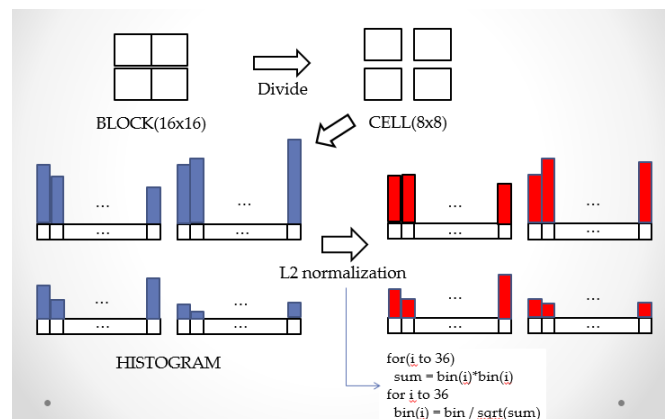
HISTOGRAM implementaion

CELL(8x8)   X축기준 편차(x)   Y축기준 편차(y)

각 픽셀마다

$기울기 = atan\left(\frac{y}{x}\right)$
$크기 = \sqrt{(x^2 + y^2)}$
$bin[기울기/(180/9)] += 크기$

HISTOGRAM

After obtaining the x,y-axis deviation for each pixel, using deviation is obtained magnitude and gradiant.

In the network track, server is implemented in Jetson Tk1 board and use a multi thread. a photo of the person stored in the send thread of the server send to receive thread of the client. When the application sends the pictures show the photo on imageview.
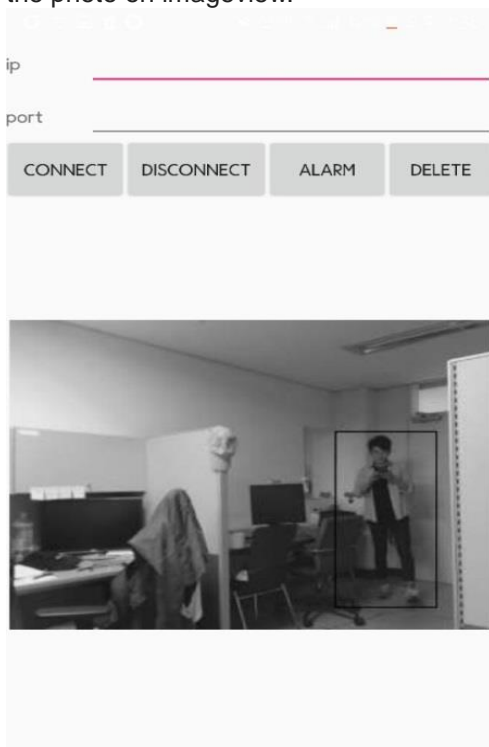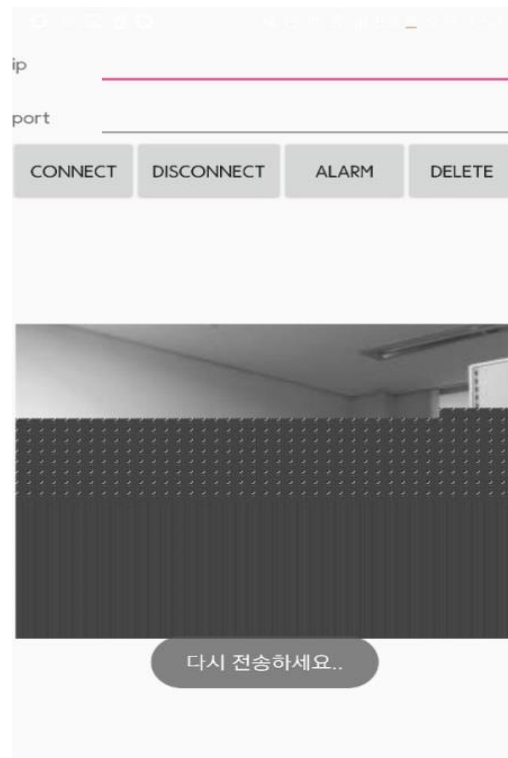
Send by attaching the flag to the final value of the picture data. When you receive the value from the client, check the value of the data from the back. Then, if it is not recognized the flag value, it is judged that pictures do not receive. So, retransmit ACK is sented server. And it retransmits the pictures. The following is a case of retransmission.

IV. Evaluations
### 4.1 Simulation, Measurement, Test
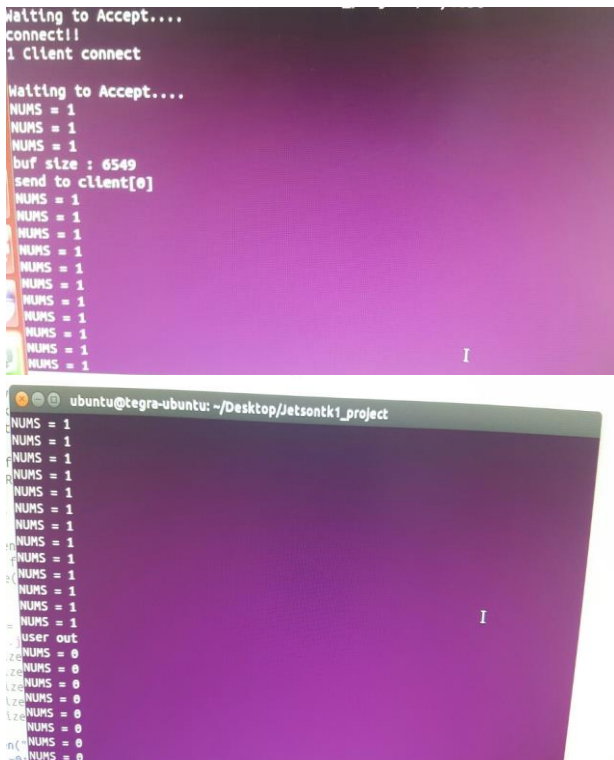
4.2 Analysis of the Results

Overall, the conventional security system has two problems..

1. Conventional hot-wire detector operates by heat. So, it often happens a malfunction.
2. Expensive installation costs and maintenance costs.

This paper is to solve the problems of the existing security systems, a real-time detection through the person recognition using a camera. And it is available through a cheap installation. The overall system configuration is as follows.
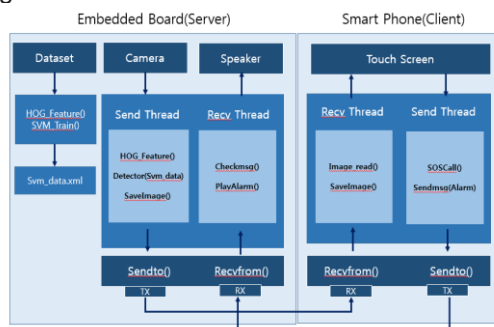
it was the input magnitude for each pixel using HOG techniques from a dataset. Utilizing svm by using the pixel values results It suggests that more than 90% value. Next, it is received image from the camera and when frame is handled, it is inputed magnitude about each pixel through HOG. And, Compared to existed xml file, if it is realized as a person it sends picture from server's send thread to client's receive thread. The Receive thread of the client is received pictures and show the pictures in imageview. In the recognition

phase it showed 80% performance. When receiving the picture, the reception performance showed 80% or more. Check the images received to the phone application. And if image is judged outsider, press alarm button. so, it transfer the alarm message for jetsontk1 board and ring at jetson tk1 board. This way, if an outsider intrusion, we can respond quickly and fast. And Security systems can be built using a board without the need to install expensive systems.

V. Conclusion

This paper, the person is recognized by a camera installed on JetsonTk1 board. Also, if the person is recognized, image is saved at server and send image from server to connected phones. And it is a system for determining whether or not an outsider. HOG techniques and learning data were used to recognize the person. And Using the TCP protocol via a connection with a server board and a mobile phone client was to verify the person.

According to the result from the research's implementation function, while taking a video if a person haa recognized 1 or 2 can be perfectly recognized. However if there is more than 3 people, it shows 80% of recognition rate. And when a camera is taking a video of similarity of human silhouette, it is recognized as a human. With this, a method that develop or acquire learning data which consider people's feature will going to head toward additionally especially on supplementation about algorithm. This result of research could be applied with security system and diverse contents develop research basis of recognition technology. Furthermore, it could be widely utilize in several different area.

Acknowledgement

References

[1] N.Dalal and B.Triggs, "Histograms of oriented gradients for human detection, "In Proc.of CVPR 2005

[2] T.Joachims.Making large-scale svm learning practical. In B.Schlkopf, C.Burges, and A.Smola, editors, Advances in Kernel Methods – Support Vector Learning. The MIT Press, Cambridge, MA, USA, 1999.

[3]Inria dataset : http://pascal.inrialpes.fr/data/human/