A Preliminary Study on Human Attribute Classification in Thermal Image

Brahmastro Kresnaraman, Daisuke Deguchi, Ichiro Ide,
Hiroshi Murase

Nagoya University, Japan
brahmastrok@murase.m.is.nagoya-u.ac.jp
ddeguchi@nagoya-u.jp
{ide, murase}@is.nagoya-u.ac.jp

Tomokazu Takahashi
Gifu Shotoku Gakuen University, Japan
ttakahashi@gifu.shotoku.ac.jp

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I. INTRODUCTION

Nowadays, security surveillance systems are implemented in various location. A basic surveillance system usually employs camera that works in visible spectrum, where human can see. During nighttime or in poorly lit areas, thermal camera can be a better option, as it can capture images without relying on illumination. Figure 1 shows the examples of images taken in different spectra.

Regardless of the camera choice, a person captured by the surveillance camera is not usually easy to be identified. It is also quite common to see people wearing accessories such as masks, glasses and hats, making the identification process harder. Therefore, it is useful to classify these visual attributes to find a certain person in surveillance footage.

Attributes of a human include facial expression, age, gender, race, hair types and many others. Classification of these attributes is a growing field of research. Most of the studies are in visible spectrum, such as [1], [2] and [3]. This research focuses on worn attributes and their classifications in thermal spectrum.

The purpose of this research is to classify the attributes being worn, providing information to security personnel so they can monitor individuals accordingly based on his/her attributes.

Figure 1 Image examples. (a) Visible image. (b) Thermal image.

II. METHOD

The method used for this research is as follows. First, a person is detected in a far-infrared image. With template matching using silhouette created from training data, person in the thermal image can be detected easily. However, other detection method might be better in different capturing conditions.

Next, features are extracted from the detected areas. For simplicity, dense-SIFT (DSIFT) is the chosen feature in this paper. For attribute classifications, multiple SVMs are created. Each SVM is trained to classify the presence of one attribute.

III. EXPERIMENT

The database contains 110 images of 5 persons in both visible and thermal spectra. There are 5 worn attributes in the data; glasses, surgical mask, hat, shoulder bag and backpack. The experiment is done to compare classification performances in visible and thermal spectra.

The results can be seen in Table 1, which values are the average F-Score of all attributes. For attributes used in this study, classification in thermal spectrum gives better results. The only exception is the hat attribute. The reason might be because the hat information is more apparent in visible spectrum.

Table 2 F-Score results in different spectra.

Spectrum	Glasses	Mask	Hat	Shoulder	Backpack	Average
Thermal	**0.80**	**0.87**	0.65	**0.67**	**0.67**	**0.73**
Visible	0.44	0.85	**0.83**	0.53	0.58	0.65

IV. CONCLUSION

This research presents preliminary results on attribute classification in thermal spectrum. The results shows that the classification is feasible with better results than in visible spectrum. However, the size of the database is still small.

It is important to expand the database with more people and attribute variations for future research. Additionally, a more sophisticated classification method needs to be done to further improve the classification performance.

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