IMAGE SEPARATION BETWEEN NATURAL AND
ARTIFICIAL OBJECTS USING FRACTAL DIMENSION

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ABSTRACT

This paper describes the preliminary work of image separation between natural and artificial objects using fractal dimensions by noting that most of natural images have non-integer dimensions while artificial ones have integer dimensions.

KEYWORDS

Image Processing, Segmentation, Natural Images, Artificial Images, Fractal Dimensions

INTRODUCTION

This paper describes our preliminary attempt to separate artificial images from natural ones using fractal dimensions by noting that most artificial images have integer dimensions while natural ones do not.

OBJECTIVES

If we can separate artifacts from natural images (Fig.1), then we will find it more easier to identify the environment because natural objects more often than not change from time to time. For example, trees may change their shape from season to season, but buildings do not (Fig.2). Thus, a robot may find its path more easily even among widely changing natural scenes from season to season.

Or, it may be very useful for non-destructive inspection, because failures such as cracks on the building wall (Fig.3), etc can be easily identified without any knowledge about what kind of cracks they are.

Most of the convetional approaches of image processing or non-destructive inspection have put emphasis on detailed processing of the
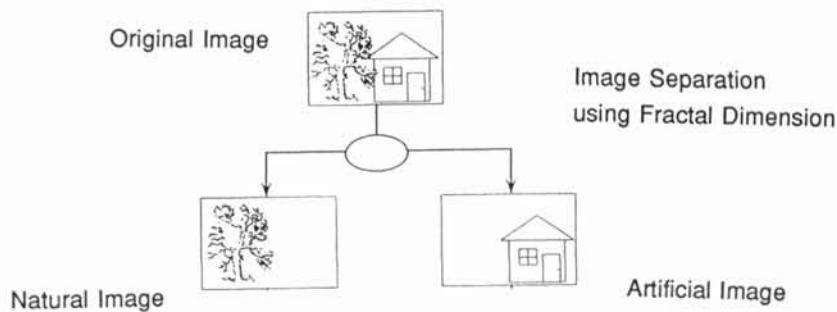

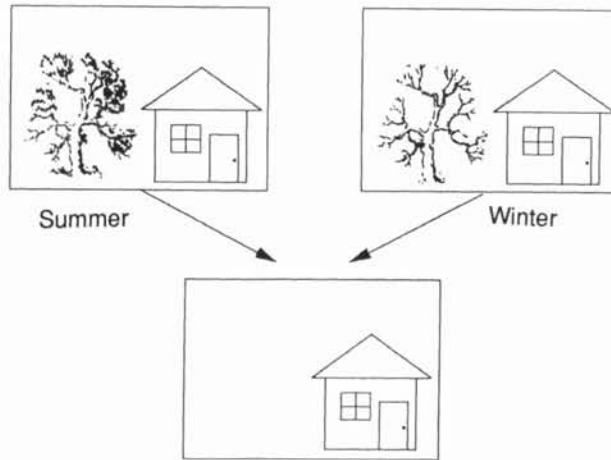Fig.1 Separation of Natural and
Artificial Images
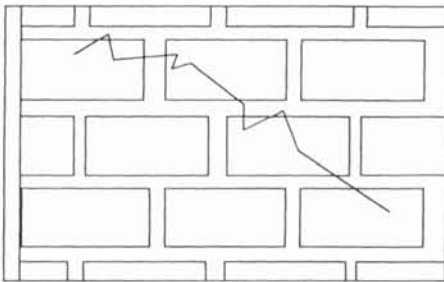
Fig.2 Elimination of
Seasonal Variation

Fig.3 Detection of Crack on the Wall

object, but with the increasing diversity and complexity of objects, more rough processing is becoming more and more important. In fact, visual inspection or walk through is getting more important these days for roughly identifily the failed locations in non-destructive inspection. The conventional methods cannot provide any capability for such purpose.

In our method, we can roughly classify the image into segments so that we can use this technique for pre-processing the images for the later more detailed processing using the convetional approaches.

EXPERIMENTS

We examined the effectiveness of the approach by simulation. SUN SPARCstation 2 was used and fractal images are generated on CRT using IFS (Iterated Function System). The sizes of the original images are 512 x 512 pixels and the grid sizes are either 4, 8 or 16 pixels. Those images with non-integer dimensions are deleted as natural objects and those with integers remain as artifacts. Fractal dimensions are counted using the box counting technique. As there are some computational errors, tolerances are set for integer dimensions.

Fig.4 and Fig.5 are samples of experimental results. Altough some parts of the edges are missing, we believe that we have demonstrated the effectiveness of our approach.

We have reported elsewhere [1] that we can successfully reconstruct the artificial image by using a geometry model we have developed [2]. As this is a work of model based vision, we have to know the image of the object beforehand. But in the case of a non-destructive inspection, we can utilize a design information and even if we do
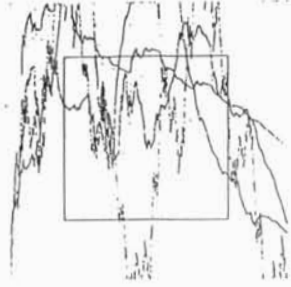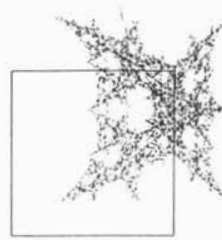
Fig.4 Experiment 1

Fig.5 Experiment 2

not have such apriori information at all, we may reconstruct the image of the artifacts by extending this geometry model approach.

REFERENCES

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