Marker-less Object Recognition for Surface Computing

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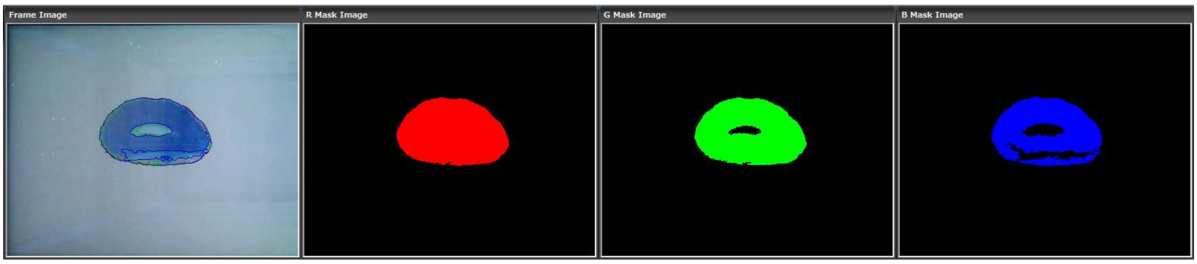

Figure 1: *From left to right: result image, mask image of red, green and blue channel.*

1 Introduction

In surface computing, one of the most important requirements is tracking an object placed on the surface and manipulating information related to that object. To recognize objects, the most popular technique is marker tracking using techniques such as RFID, tag-like TarckMate[Kumpf 2009] and so on. The issues with marker tracking are the effort required to paste the tag and the existence of objects that are difficult to mark with a tag. To recognize objects without tags, feature point tracking on the image plane is one of the most effective ways in the area of the computer vision[Lowe 2004]. Unfortunately it is difficult to extract features from images taken through the frosted glass that is often used in surface computing. In addition, one cannot extract the feature points from objects without strong texture. In this paper, we present a marker-less object recognition system using multi channel silhouettes and quantized polar coordinates.

2 Our appoach

Our system has "Feature Extraction Phase" and "Discrimination Phase." Figure 2 shows the flow of the phase of the feature extraction. In the feature extraction phase, the input image is first segmented into gray-scale, red, green and blue channels. Then background subtraction extracts silhouettes from each channel. The edges of pore spaces in the object are detected and extracted from each silhouette. Finally, all of the silhouettes edges and pore spaces in the object are converted into quantized polar coordinates and layered with the gray scale channel's center of gravity as the origin. This phase can express the feature information of the frosted glass image and self-colored objects. In the discrimination phase, the feature information of the object are compared with other feature information in the database. The computational complexity of this process is not so high since it can be implemented with a numeric string comparison.

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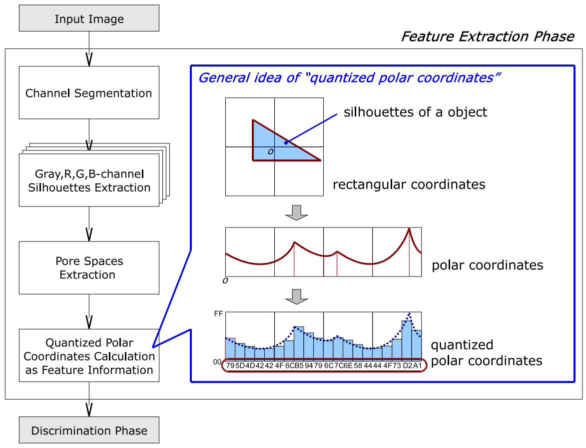

Figure 2: *Flowchart of Feature Extraction Phase.*

3 Result and Future work

Figure 1 shows a result. The object is a sliced blue agate. The red, green, blue lines in the resulting image show the edges of silhouettes and the pore spaces of each channel. There is a pore space in the green channel, and there are two pore spaces in the object in the blue channel. In this case, the discrimination accuracy is about 98%. Further, the average processing time is 15.4 ms and the discrimination accuracy with 15 flat-bottom objects through 20 trials is 95%.

We are evaluating the range of the objects that our system can detect. Moreover, we plan to expand our system to track moving and rotating objects.

References

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