Towards Automated Defect Detection in Porcelain Industry

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Summary: In this paper we have investigated the use of integral Robot Vision (iRVision) technology for defect detection in porcelain industry. iRVision is a ready-to-use robotic vision package available for FANUC robots. We investigated defects which are located on the back of the plate. Here, we present an updated version of [1].

Keywords: defect detection, computer vision, porcelain.

Motivation

Defect detection is an important problem in the porcelain industry which is currently performed by employees. In this work we investigate a solution that will lead to the automatization of the defect detection in a porcelain factory. The types of defects that we investigate in this work are defects which are located on the back of the plate on the middle circle (some examples are shown on Figure 1). This is a more difficult problem than the defects that we investigated in [1] since here the contrast is not very strong.

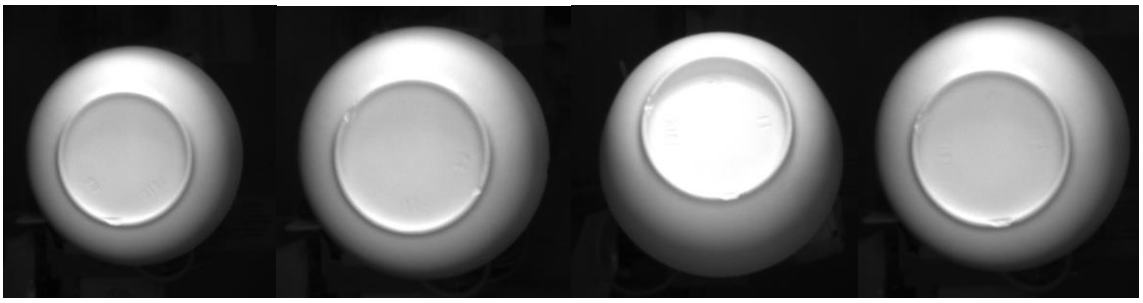

Figure 1: Sample of defects that we investigate in this work.

Results

The first step for the automated inspection is the preprocessing phase. Figure 2, left and middle images show an example of the results of applying different type filters. Using Image Preprocess Tool we applied *Sharpen* and *Blur* filters, each one for 5 times (the number of times a filter is applied influences the degree of preprocessing).

The second step is to select the best iRVision tools for our problem. We used *GPM locator tool* and *Surface flaw inspection tool*. *GPM locator tool* was used to detect the plate regardless of its position in the image and *Surface flaw inspection tool* was used to detect cracks on the surface of the plates.

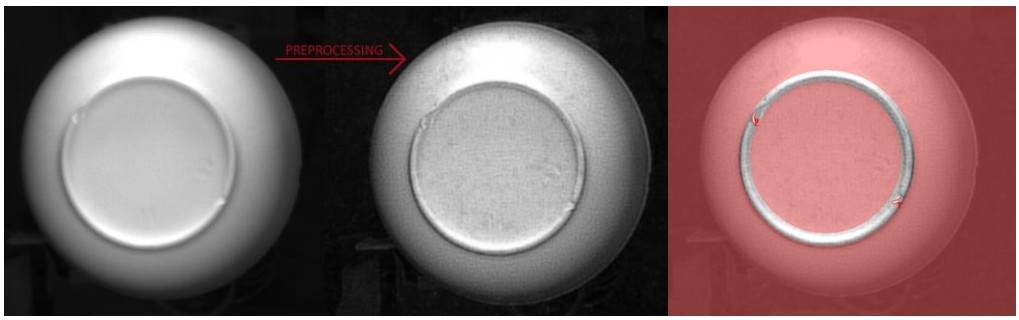

Figure 2: Left and middle image: Preprocessing phase. Right image: Mask applied for hiding uninteresting areas.

In order to automatically select the region of interest, we used a mask for hiding the areas that are outside the plate and also for masking the areas around the middle circle on the back of the plate (Right image in Figure 2).

Surface flaw inspection tool has several parameters that we used:

- *Run-time mask*: specifies an area of the search window that is not of interest for inspection.
- *Flaw color*: shows the color of the flaw in the surface. For flaw color parameter we used *white* value because the cracks are white in the plate surface.
- *Contrast threshold*: specifies how clearly the contour is perceivable in order to be considered as a flaw. We set it as value of 28.
- Two filters: *Blur* for 8 times and *Sharpen* for 3 times.

Figure 3 shows a passed and two failed inspections. For evaluation tool we set as variable the number of defects returned by Surface flaw inspection tool. If the number of defects is equal with 0 then the target passes the inspection, else it fails the inspection.

Figure 3: Detecting cracks on the back of the plates. Left image: Passed inspection. Middle and right images: Failed inspection.

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References

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[2] R. Baeta. Automated Quality Control in Ceramic Industry. Dissertation. Mechanical Engineering Department, Instituto Superior Tecnico, Lisboa, Portugal, 2013.

[3] FANUC Robot series R-30iB/R-30iB Mate CONTROLLER iRVision Inspection Application Operator‘s Manual