Towards Automated Defect Detection in Porcelain Industry

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Motivation

❑ optimize the manufacturing process of porcelain

❑ reducing the manufacturing time at each processing phase

❑ optimizing the production efficiency by eliminating defective products

❑ improving the monitoring and control system of the entire flow by adding new functionalities to the current computer vision system

❑ increasing the innovation capacity of the economic agent
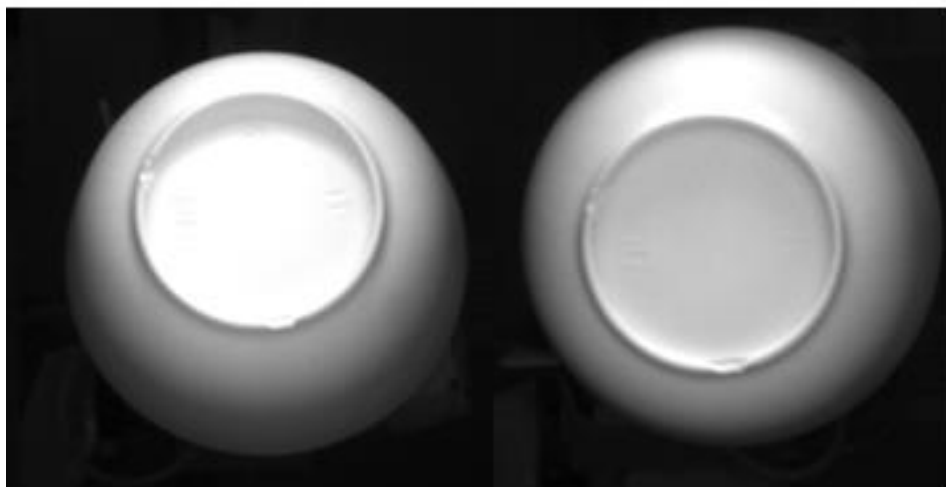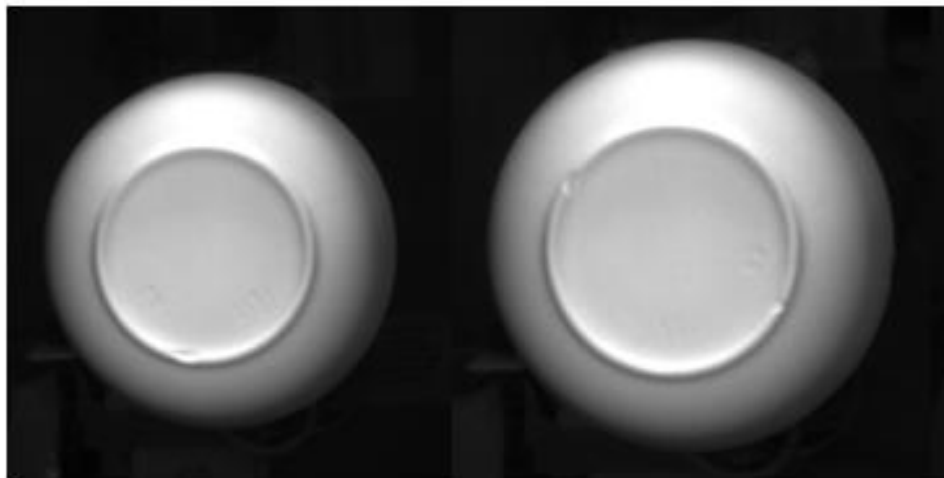
Inspection phases
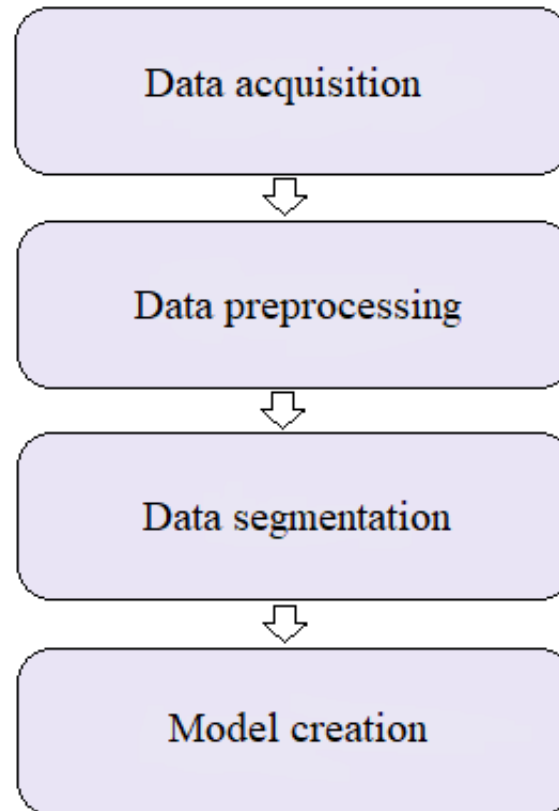
Robot manipulation
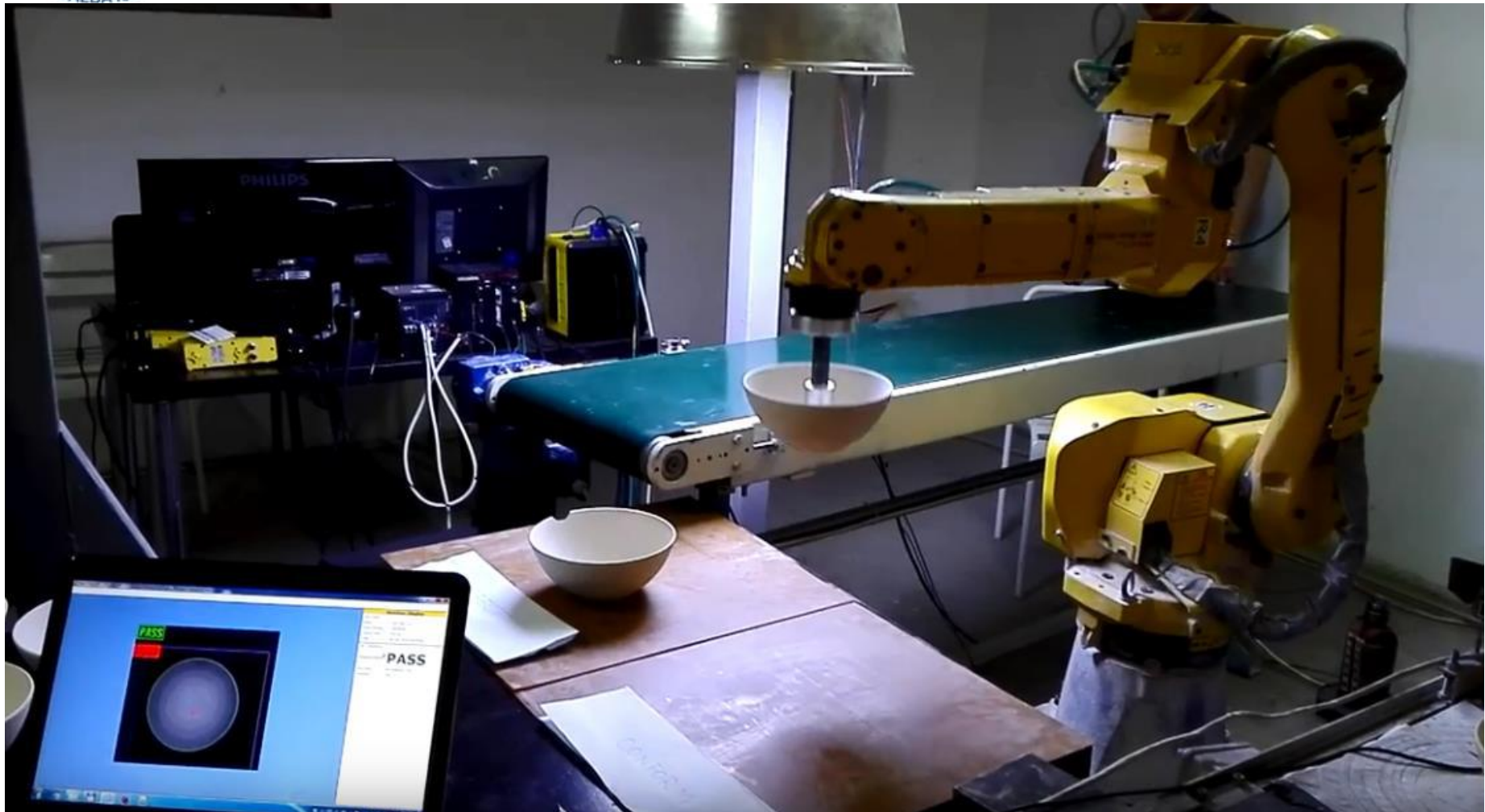
iRVision

❑ ready-to-use robotic vision package available on FANUC robots

❑ components: camera and lens (or 3D laser sensor), camera cable, lighting equipment and camera multiplexer

❑ includes a function named iRVision Inspection

❑ iRVision Inspection tools: GPM Location tool, Blob locator tool, Surface flaw inspection tool, Histogram tool, Evaluation tool.
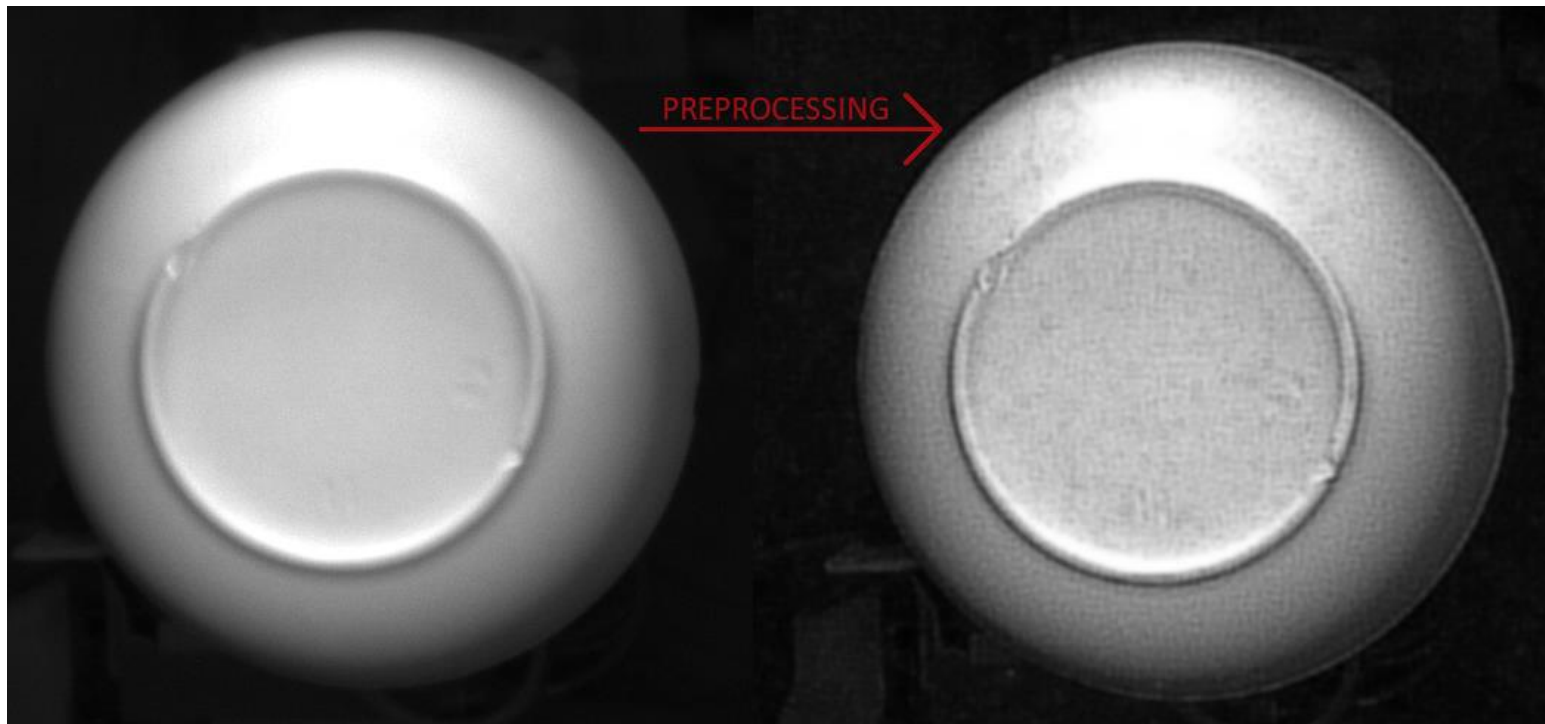
Dataset

Inspection model

1. Images acquisition.

2. Preprocessing techniques.

3. Image segmentation – training/ run-time mask.

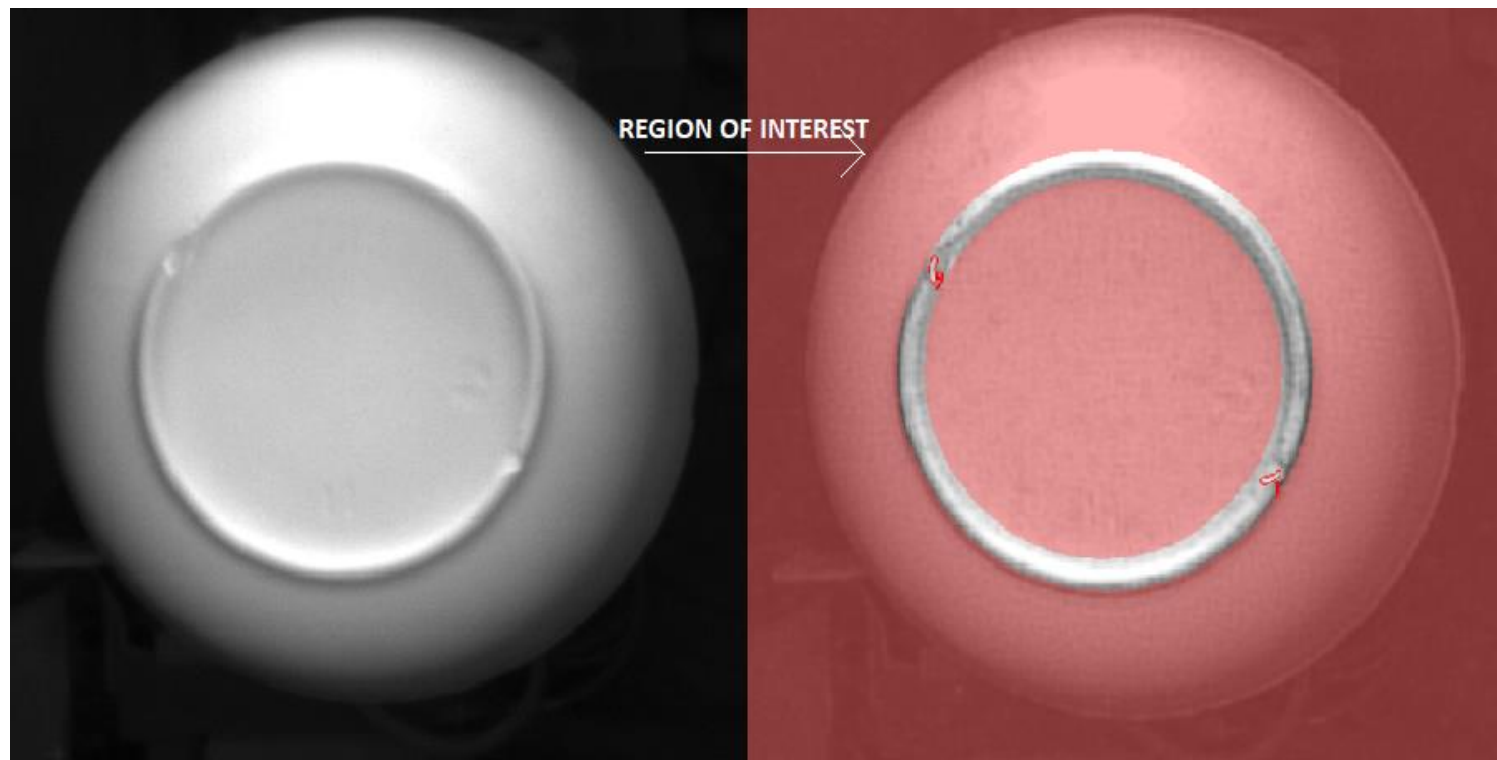4. Model evaluation – variable and conditions.

Preprocessing phase I

❑ Blur + Sharpen;

Preprocessing phase II

❑ Mask – applied for hiding uninteresting areas.

iRVision inspection

- ❑ GPM location tool – detect the plate regardless of its position in the image, detect cracks defects
- ❑ Surface flaw inspection tool - detect fissure on the surface of the plates
- ❑ Blob locator – for bumps defects
- ❑ Combined inspection

Cracks and deformations – GPM Locator Tool

- ❑ Training mask

- ❑ Elasticity- 0.6 pixels

- ❑ orientation and scale boxes – parameters unchecked

- ❑ Aspect - parameter checked

Surface flaw inspection tool – parameters

❑ *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.

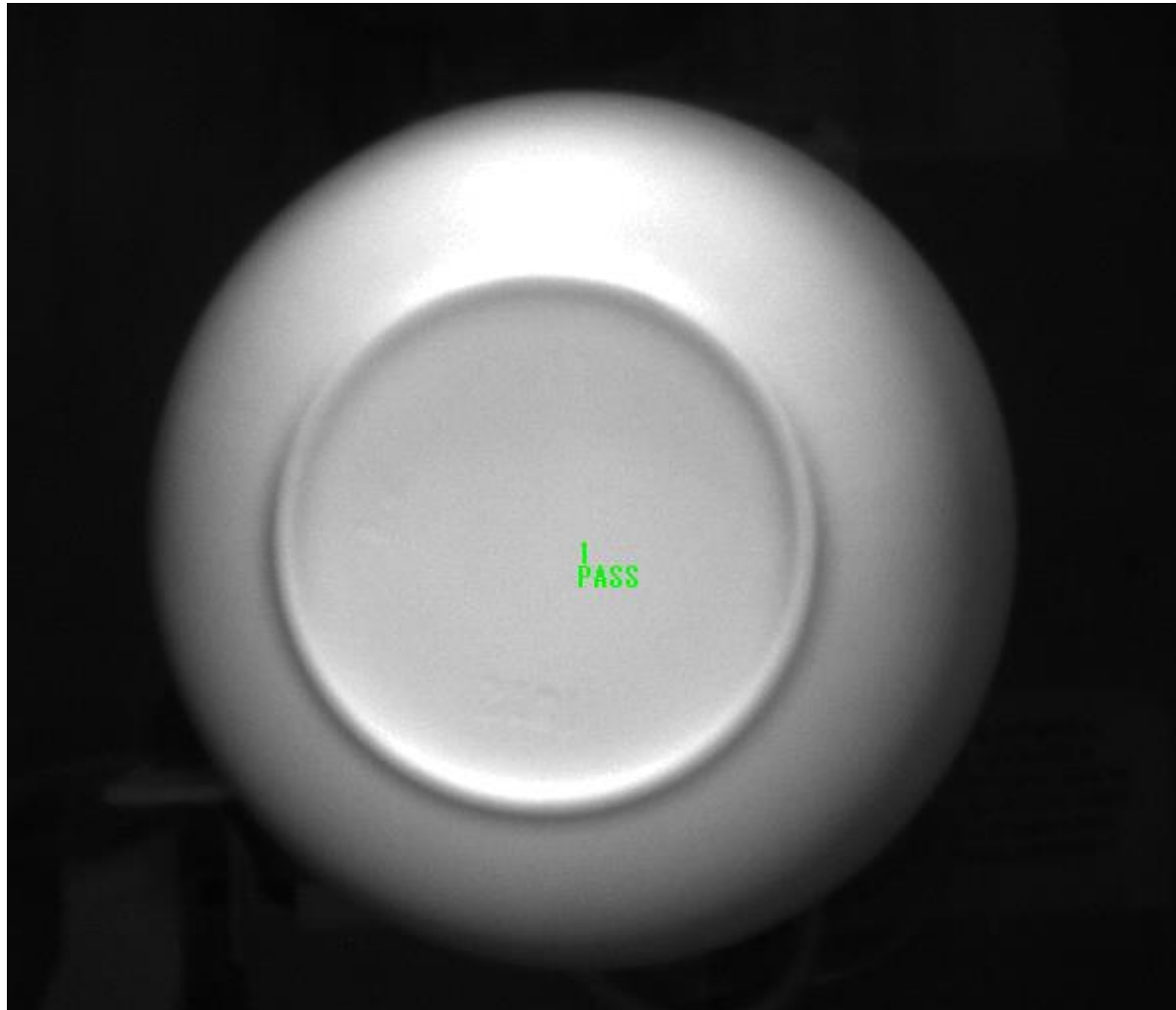❑ Two filters: *Blur* for 8 times and *Sharpen* for 3 times.

Bumps defects - Blob locator tool

- ❑ Image binarization(black-and-white image);

- ❑ Threshold parameter;

- ❑ If bumps ➔ a circle will be drawn around them.

Results – passed inspection

Results – failed inspection

Results – failed inspection

Conclusions

❑ Quality monitoring system based on computer vision;

❑ Positive economic impact;

❑ iRVision Inspection tools – detecting surface defect, cracks and deformations and for texture defects. .

References

- D. Onita, N. Vartan, M. Kadar, A. Birlutiu. "Quality Control in Porcelain Industry based on Computer Vision Techniques" YEF-ECE 2018 - 2nd International Young Engineers Forum on Electrical and Computer Engineering, 4th May 2018, Lisbon, Portugal.

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

- FANUC Robot series R-30iB/R-30iB Mate CONTROLLER iRVision Inspection Application Operator's Manual

Thank you for your attention!