



Quality Control in Porcelain Industry based on Computer Vision Techniques

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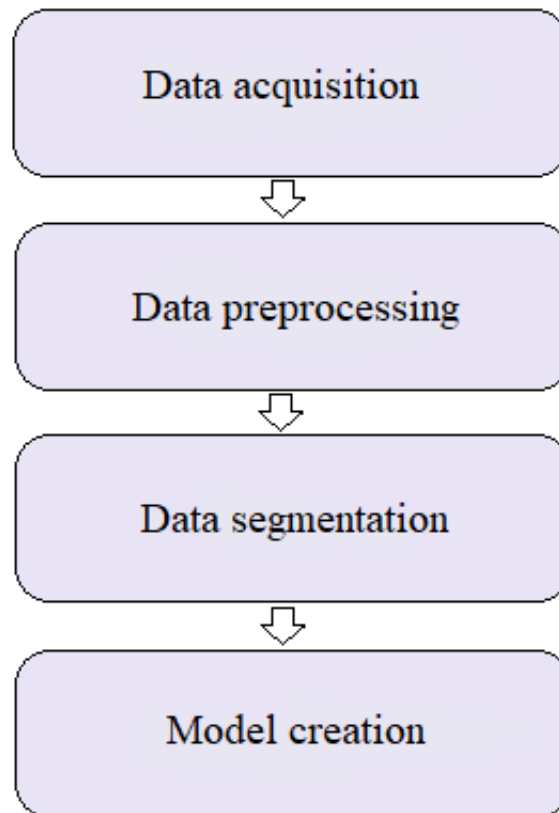
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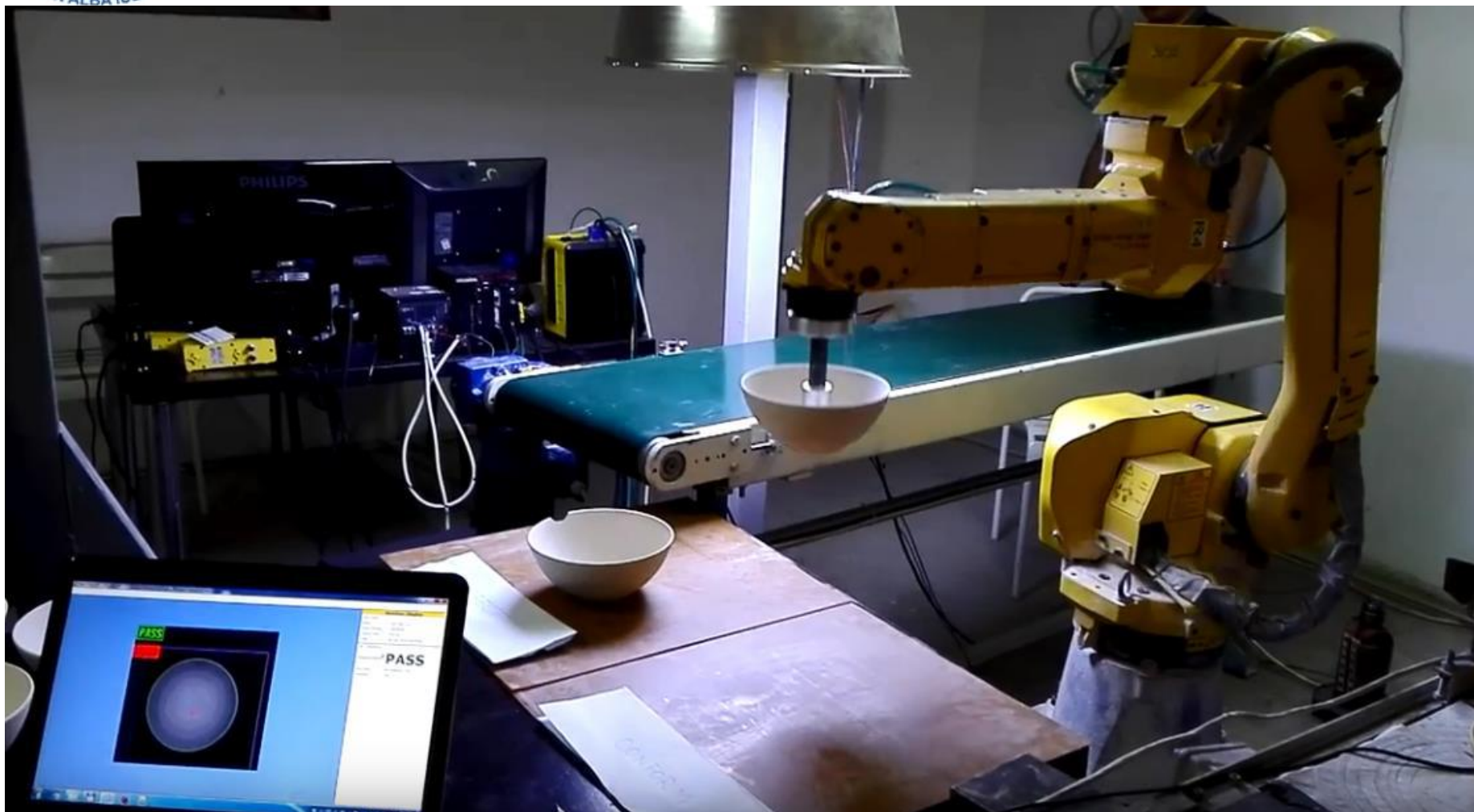
Motivation

- 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

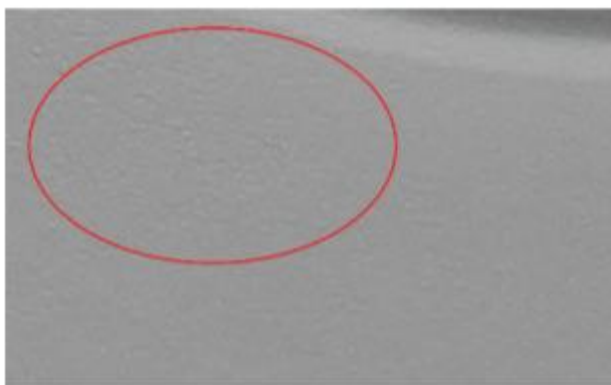
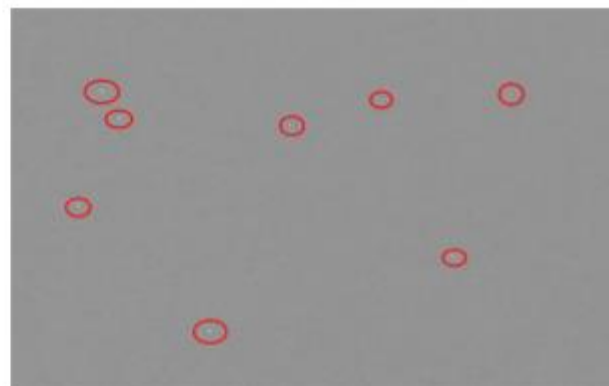




iRVision

- ❑ 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 – training/ run-time mask
3. Image segmentation
4. Model evaluation – variable and conditions



Cracks and deformations

- Training mask
- Elasticity- 0.6 pixels
- orientation and scale boxes – parameters unchecked
- Aspect - parameter checked



Surface defects

- Run-time mask;
- Flaw color – black value;
- Contrast threshold - 1;
- Magnitude range – default value.



Bumps defects

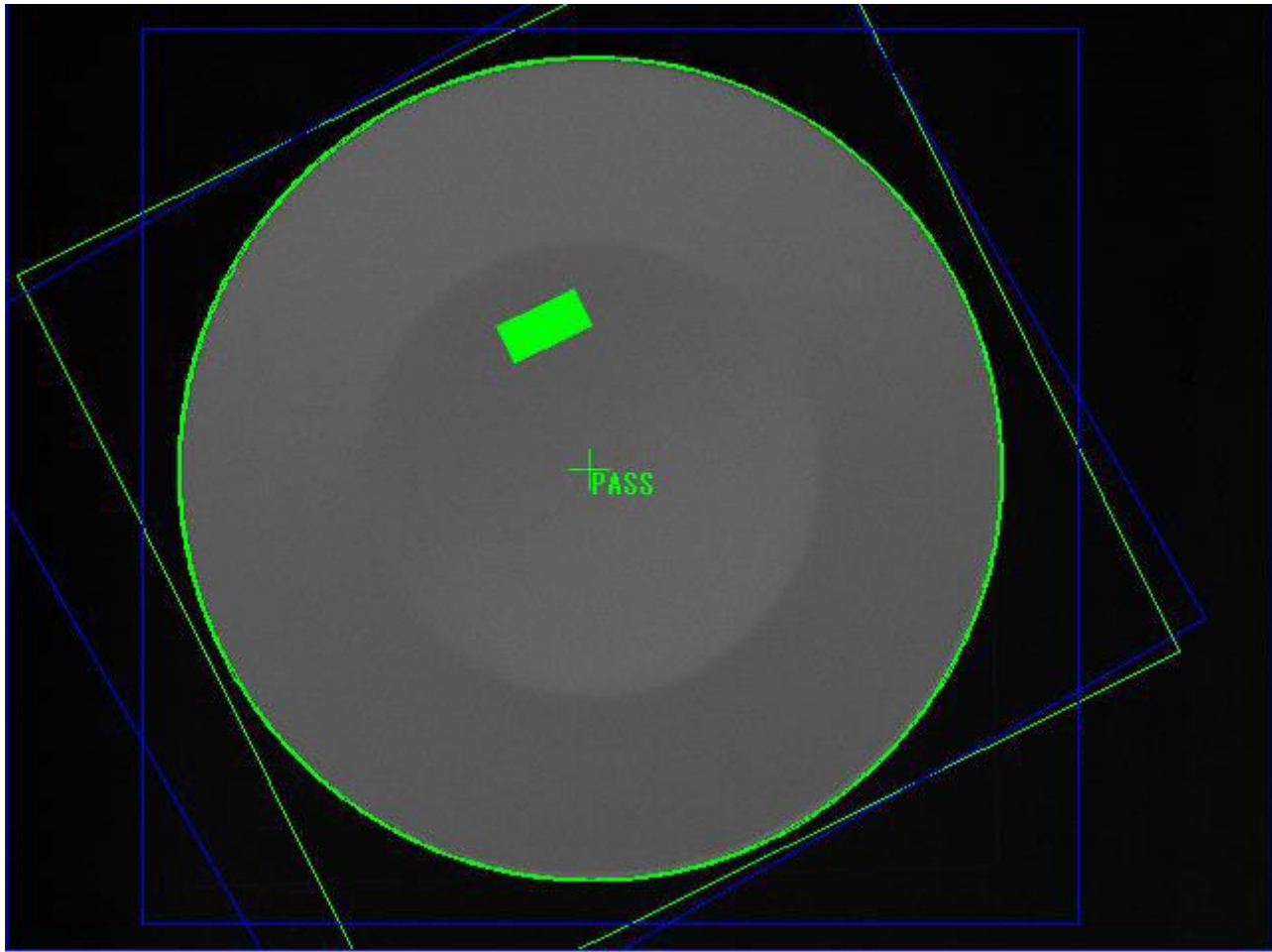
- Image binarization(black-and-white image);
- Threshold parameter;
- If bumps → a circle will be drawn around them.



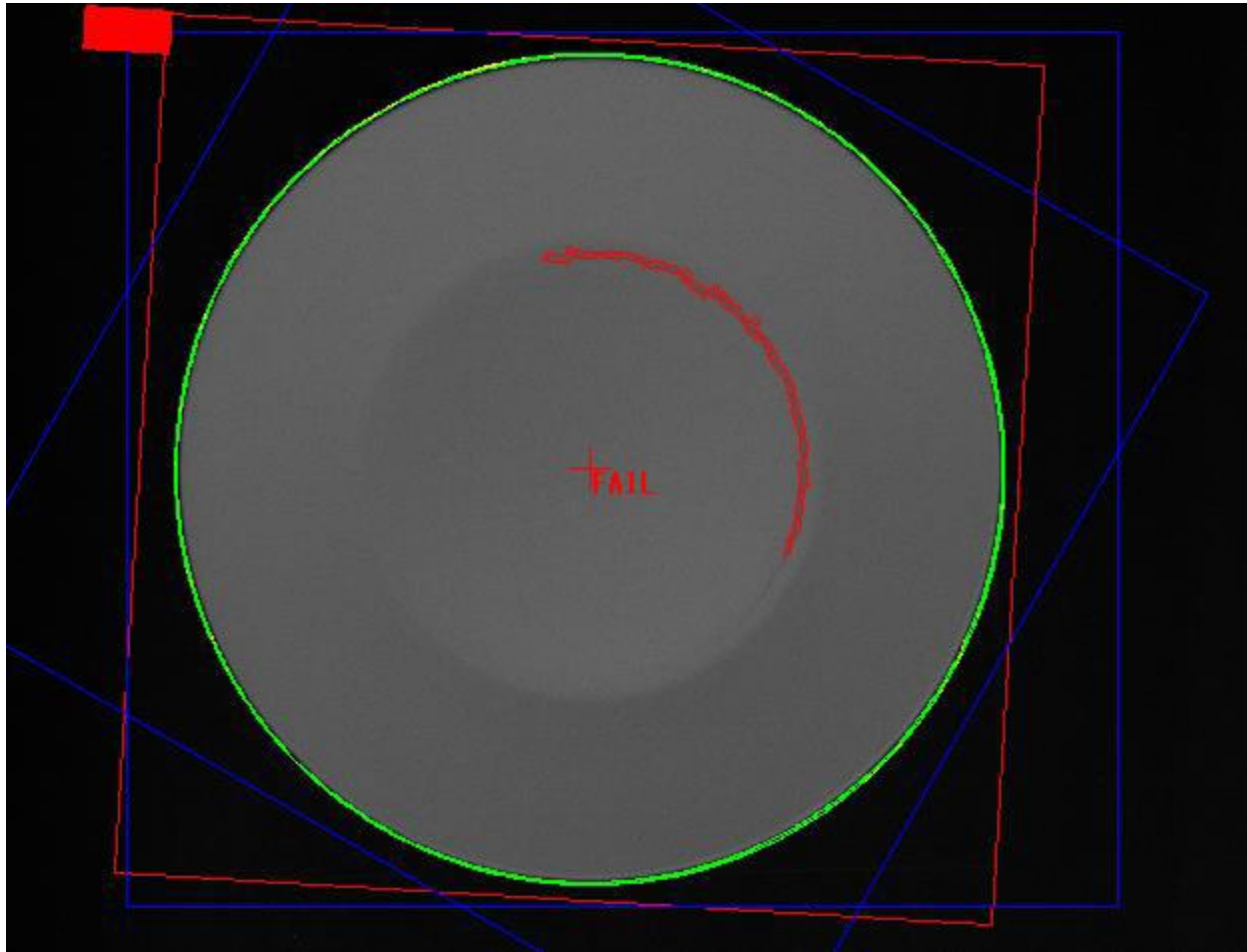
Combined inspection

- GPM location tool – detect the plate regardless of its position in the image;
- Histogram tool – detect the cracks;
- Surface flaw inspection tool - detect fissure on the surface of the plates.

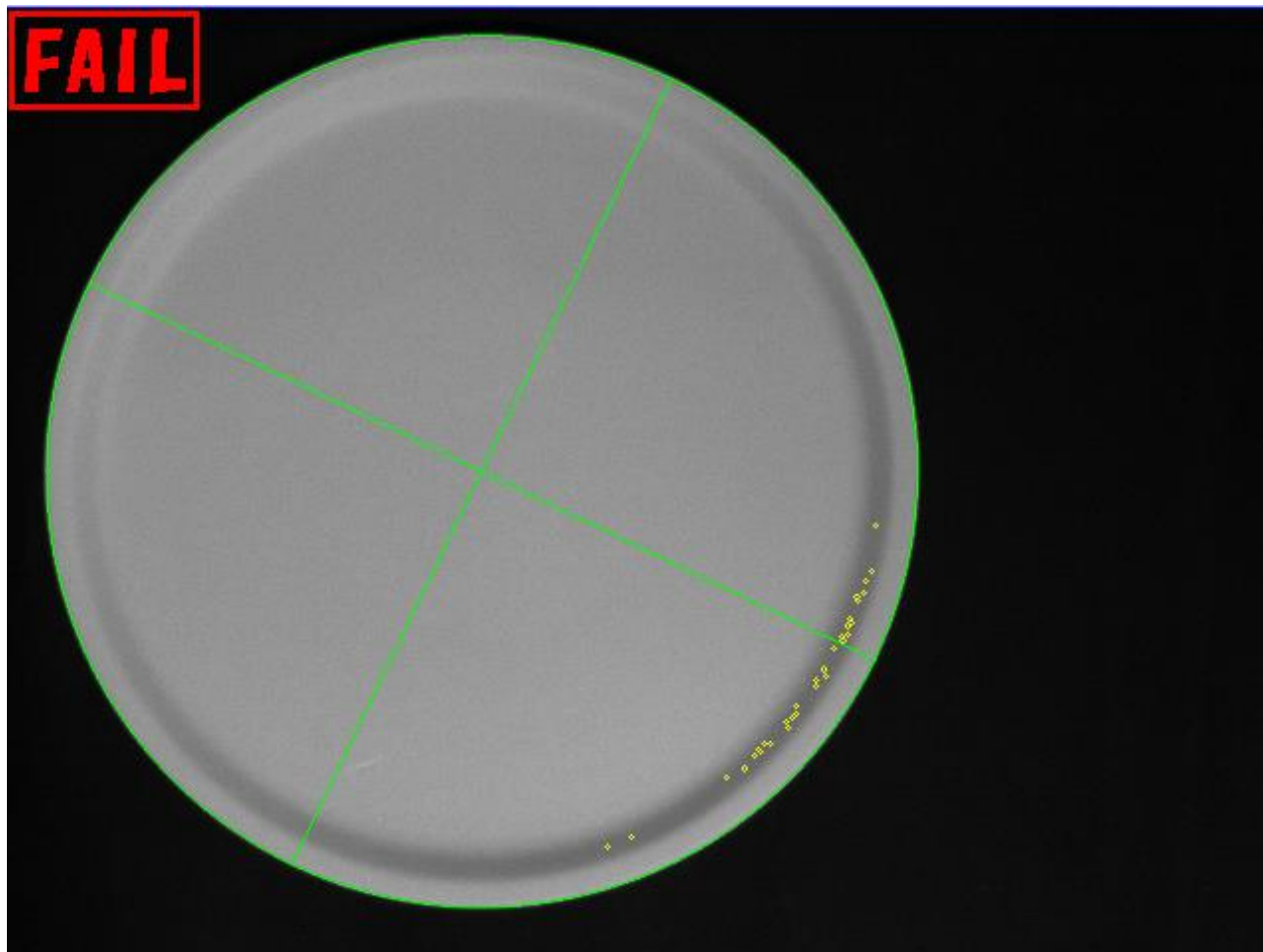
Results – passed inspection



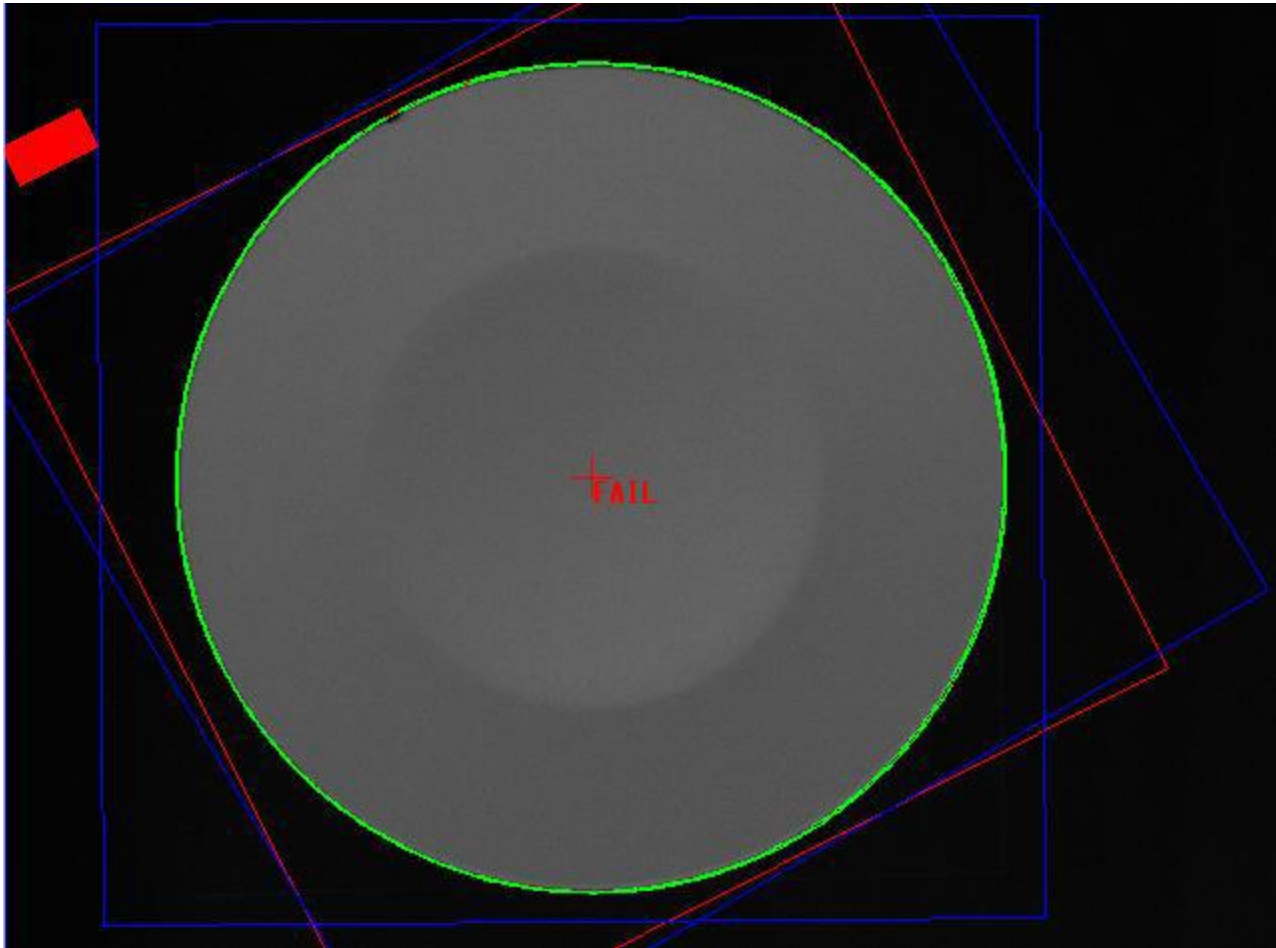
Results – failed inspection – surface defects



Results – failed inspection – bumps



Results – failed inspection – cracks





References

- Birlutiu A., Burlacu A., Kadar M., Onita D.. Defect Detection in Porcelain Industry based on Deep Learning Techniques. 19th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing, Timisoara, September 21-24, 2017.
- Hosseinia S.J., Khalilia K., Emam S.M. Flexible Automation in Porcelain Edge Polishing Using Machine Vision. 9th International Conference Interdisciplinarity in Engineering, INTER-ENG, Procedia Technology 22 (2016) 562 – 569, Elsevier.
- He D., Li R., Zhu J., Zade M. Data Mining Based Full Ceramic Bearing Fault Diagnostic System Using AE Sensors. IEEE Transactions on Neural Networks, v. 22(12), pp. 2022-2031, 2011.
- Silveira J., Ferreira M.J., Santos C., Martins T.: Computer Vision Techniques Applied to the Quality Control of Ceramic Plates. Journal of Physics Conference Series, p. (2009)
- FANUC Robot series R-30iB/R-30iB Mate CONTROLLER iRVision Inspection Application Operator`s Manual
- Baeta, R. Automated Quality Control in Ceramic Industry. Dissertation. Mechanical Engineering Department, Instituto Superior Tecnico, Lisboa, Portugal (2013)