Mura Defect Detection Automation via Anomaly Detection (PaDiM)

● Period : Jul. 23 – Jun. 24

As-is

Taking Panel Screen Images

Process 1

Process 2

Inspection Process

PXL Defect

Mura Defect

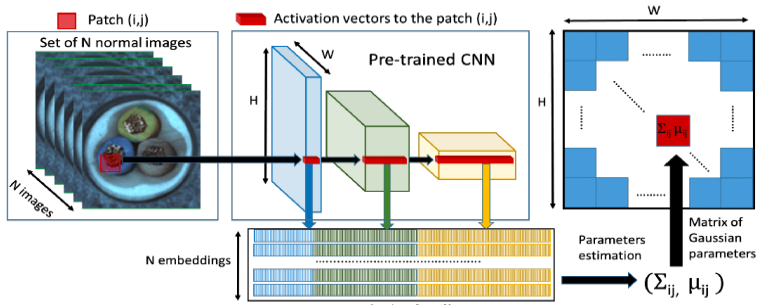
Currently under Manual Inspection

Shipment

Breakthrough Idea

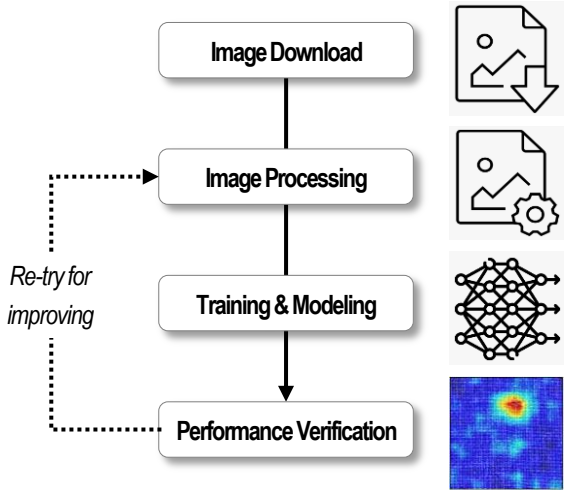
Apply Camera Images taken by previous process to PaDiM.

Fig. 2. For each image patch corresponding to position (i, j) in the largest CNN feature map, PaDiM learns the Gaussian parameters (μ_{ij}, Σ_{ij}) from the set of N training embedding vectors $X_{ij} = \{x_{ij}^k, k \in [\![1, N]\!]\}$, computed from N different training images and three different pretrained CNN layers.



※ Source : PaDiM : a Patch Distribution Modeling Framework for Anomaly Detection and Localization

Proceed with the following process to conduct Feasibility Test



To-be

Process 1

Process 2

Automation

Inspection Process

Shipment

Image Upload

Server

PaDiM Result Transfer

Optimizing Image Processing for Improved Anomaly Detection Performance

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Flow Chart

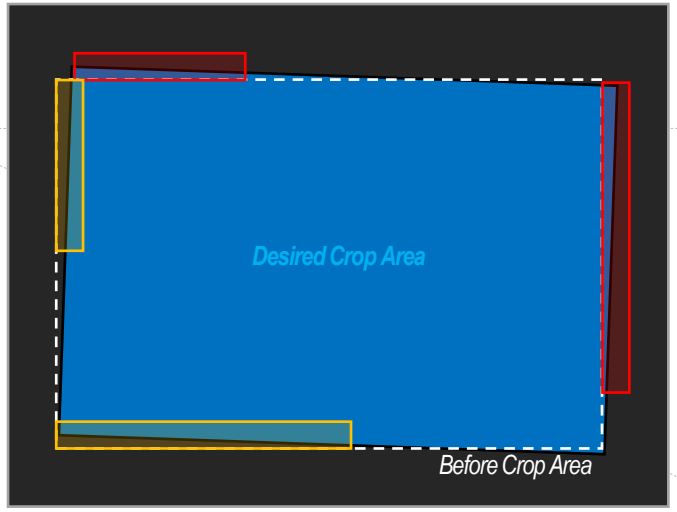
Before

- change the extension (.bmp → .jpg)
- Lower Image Quality Lv.
- Find the center and crop by a fixed size

Problems

: Cropped Area → makes Miss-Detect

: Residual Black Area → makes Over-Detect



After

- change the extension (.bmp → .jpg)
- Lower Image Quality Lv.
- Contour Approximation for Edge & Crop
- Find four vertices & Perspective Transform
- Adjust the target luminance based on the central position
- Enhance Image Contrast (Histogram Equalization)

Result

		Predicted Class: Positive	Predicted Class: Negative	
Actual Class	Positive	True Positive (TP)	False Negative (FN) Type II Error	Sensitivity $\frac{TP}{(TP+FN)}$
	Negative	False Positive (FP) Type I Error	True Negative (TN)	Specificity $\frac{TN}{(TN+FP)}$
		Precision $\frac{TP}{(TP+FP)}$	Negative Predictive Value $\frac{TN}{(TN+FN)}$	Accuracy $\frac{TP+TN}{(TP+TN+FP+FN)}$

Sensitivity (OK Judge Accuracy) : 11% → 69%

Specificity (NG Judge Accuracy) : 29% → 93%