Defect Detection on Glossy Surfaces using the Deflectometry Data

CSE 495

4^{th} Meeting

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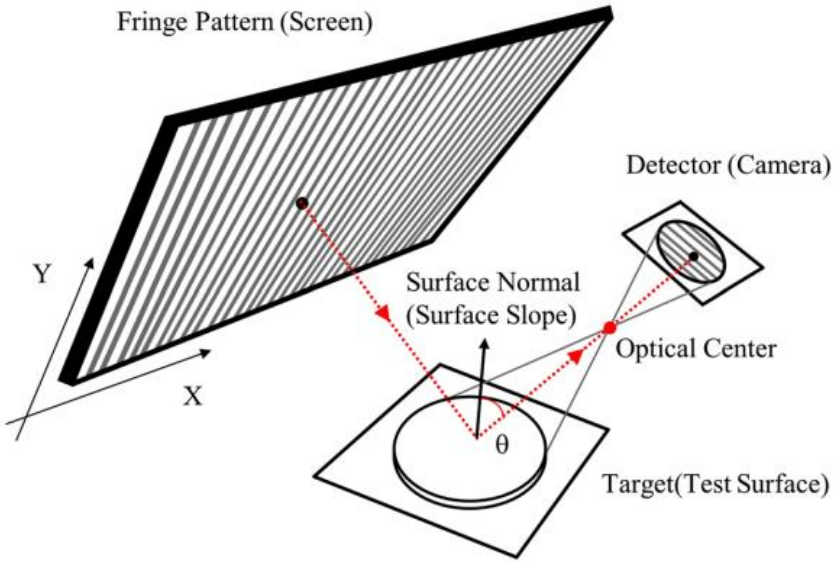
Project Scheme and Description

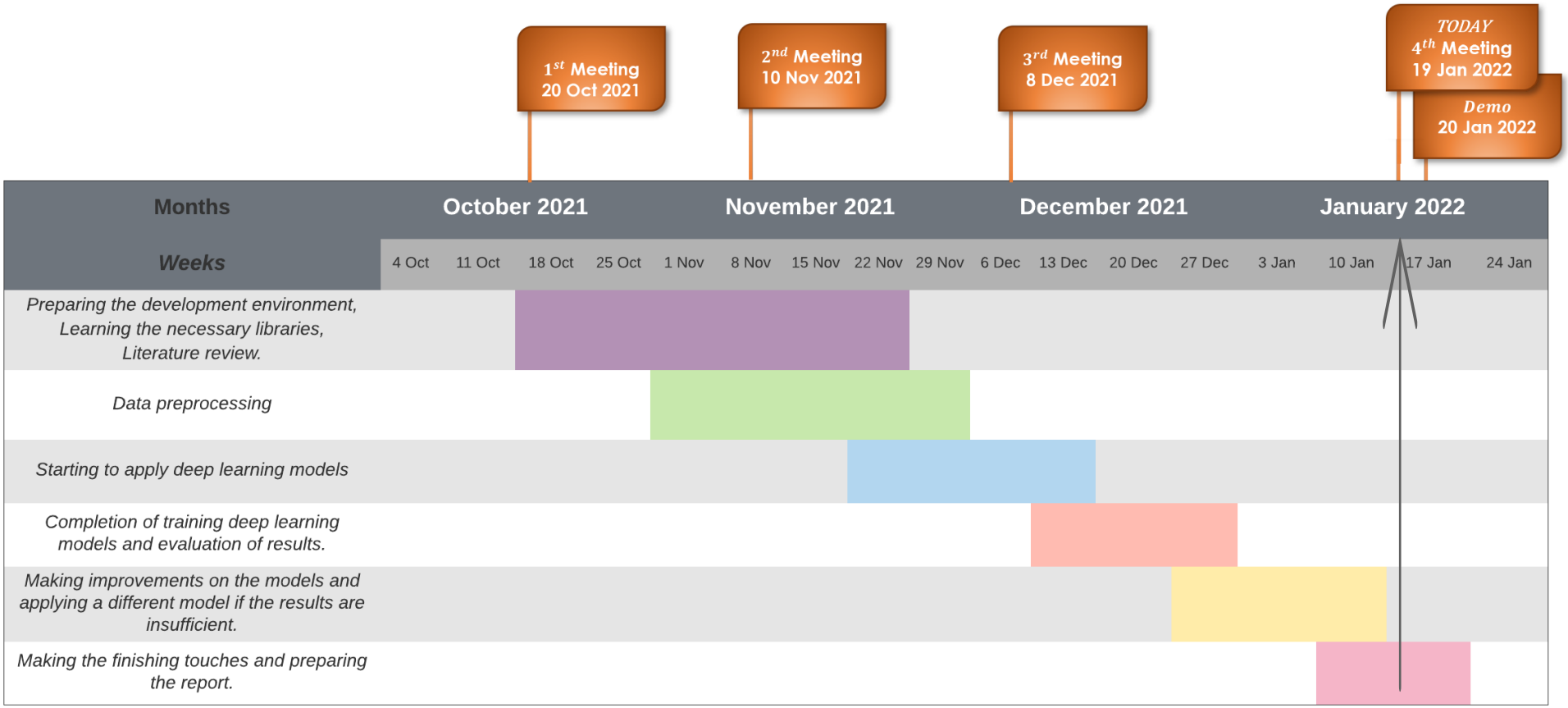


- **Description :**

Defect detection project on glossy surfaces using the deflectometry data.

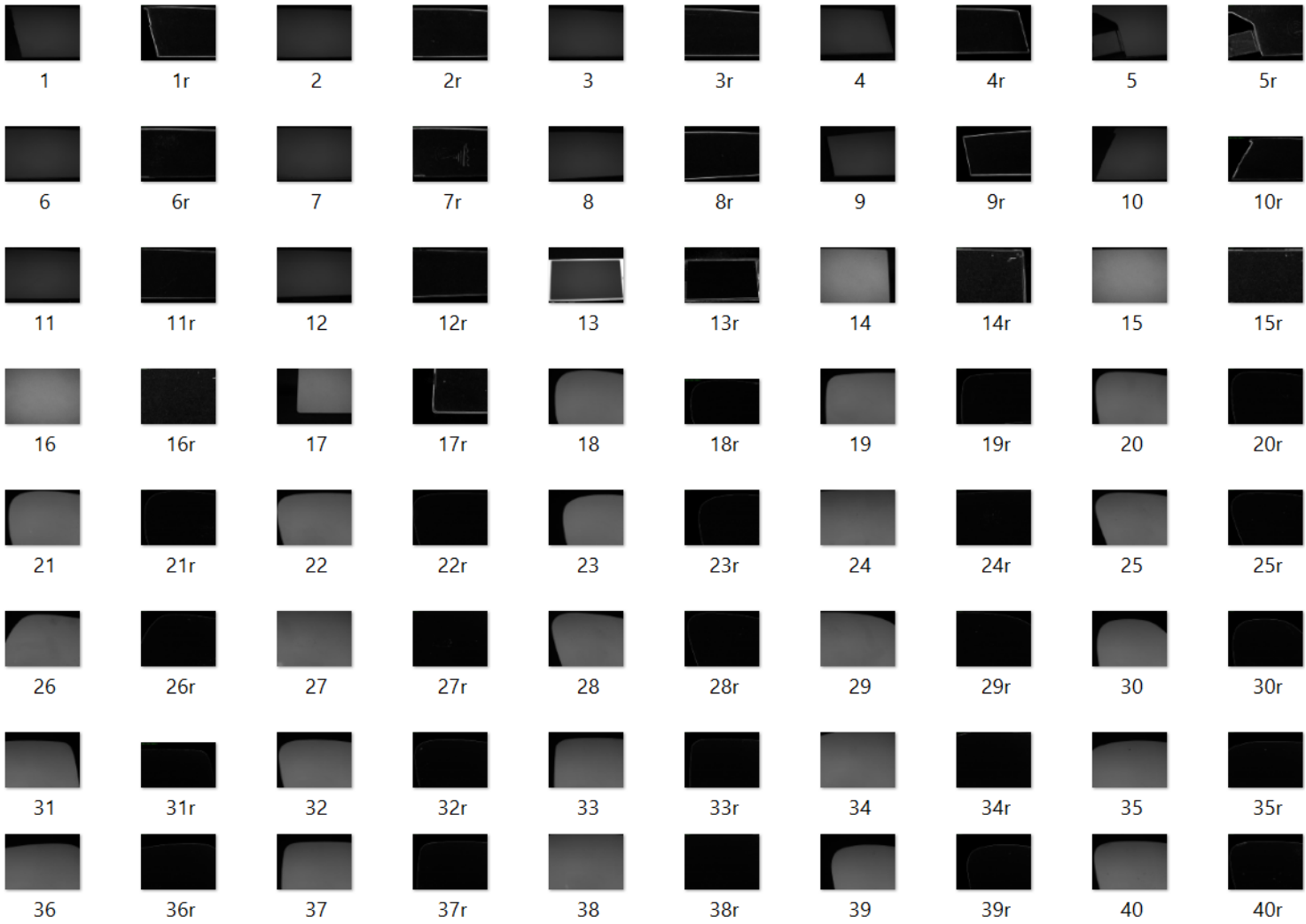
- **Project goals :**
  - Industrial products with glossy surfaces such as refrigerators and cars may have faulty productions. These mistakes cause financial damage to the manufacturer.
  - Our aim is to reduce the waste of time and effort in detecting these defects.

Project Design Plan



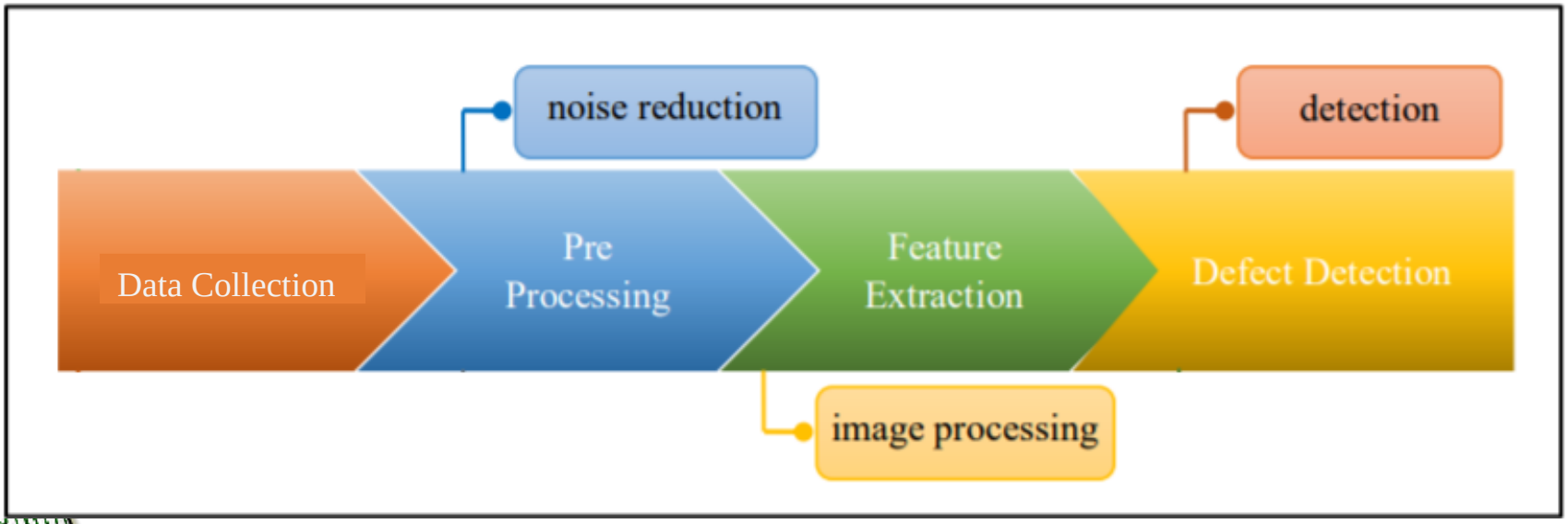
Dataset

50 pairs of images

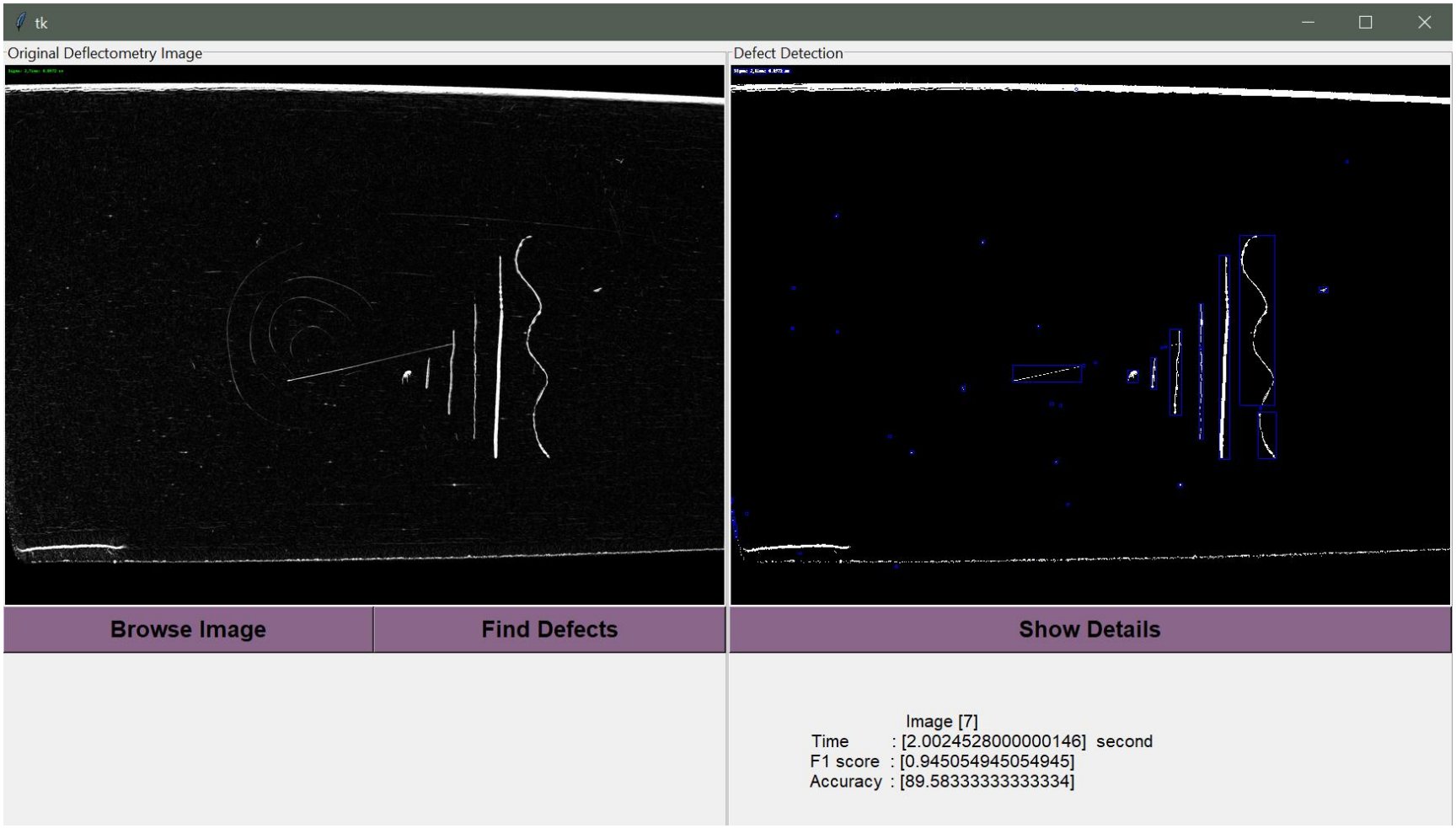


What has been done?

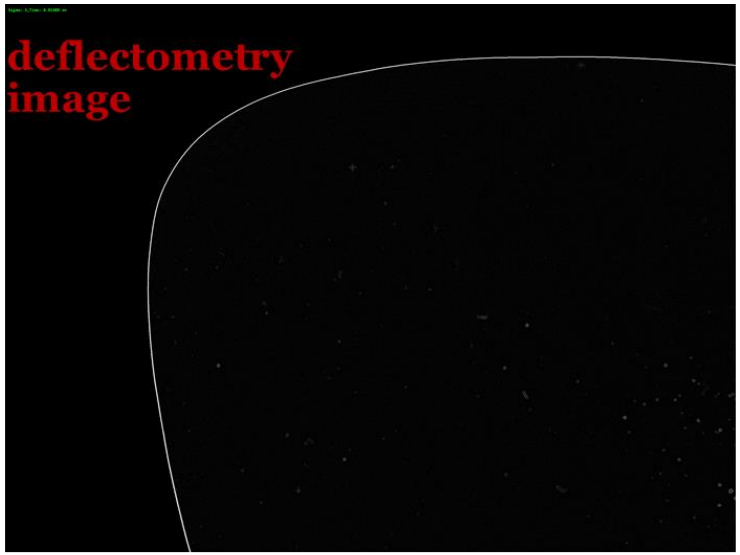
- At first I used Otsu's Thresholding algorithm.
- I changed my algorithm and I decided to use statistical method.
- On the first practises, I was manually marking defects and try to find those ones.
- While removing the edges, I was removing the connected pixels which are next to each other .
- I created CAD models of the images. Then the CAD models and the noise-reduced images were compared. The edges of the objects coming from the CAD models are removed and the remaining white areas are counted as defects.

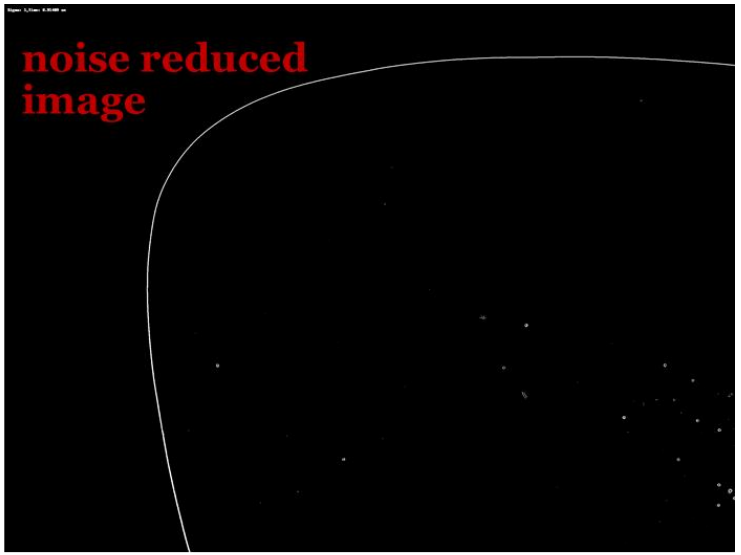


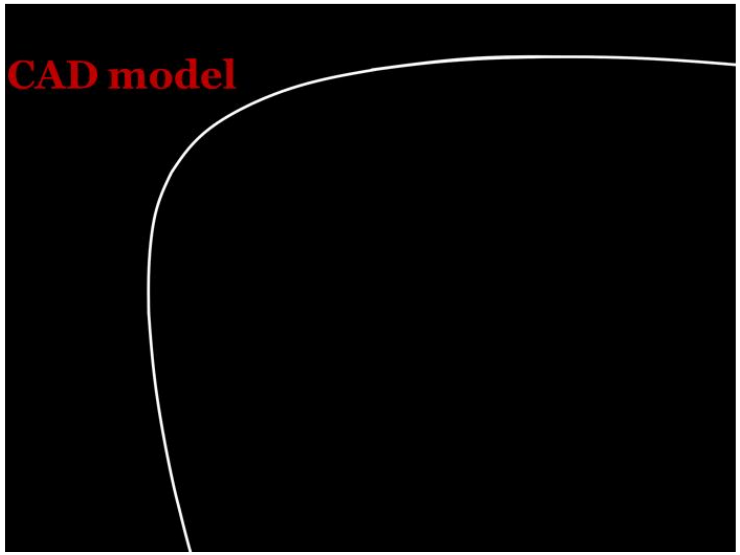
User Interface

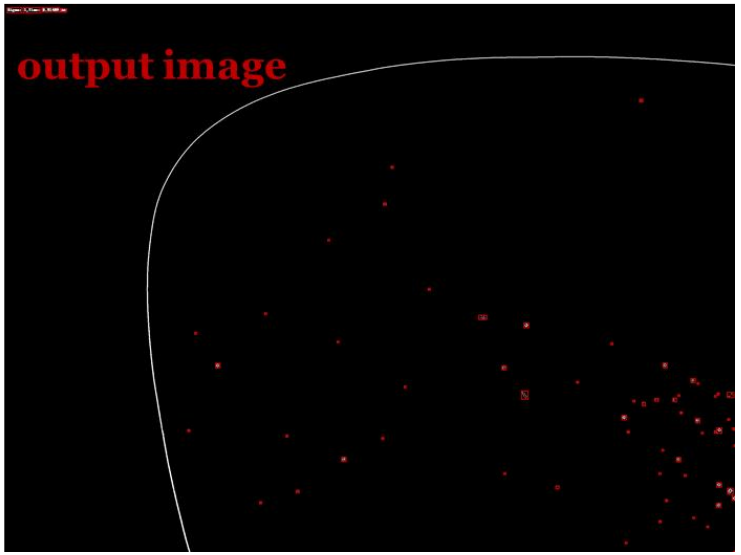


Some outputs

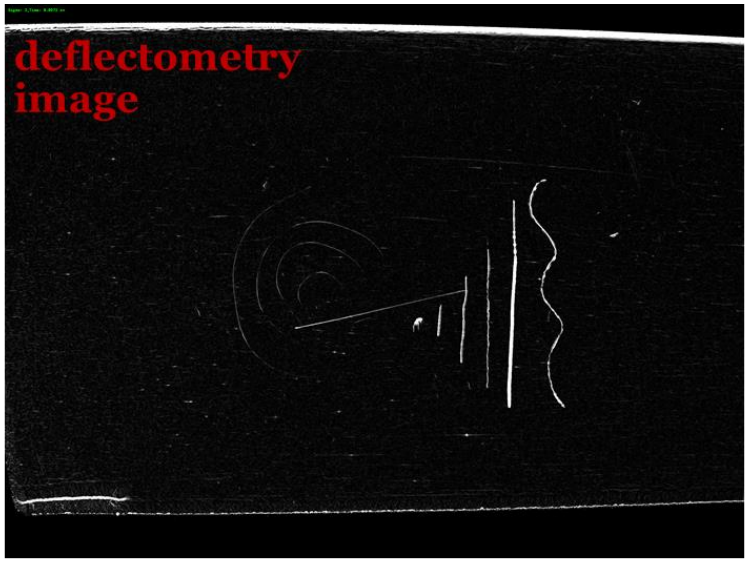


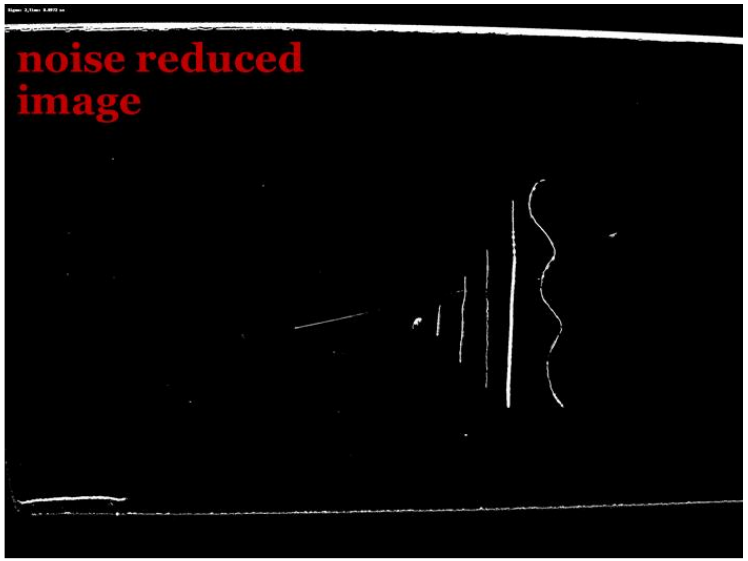


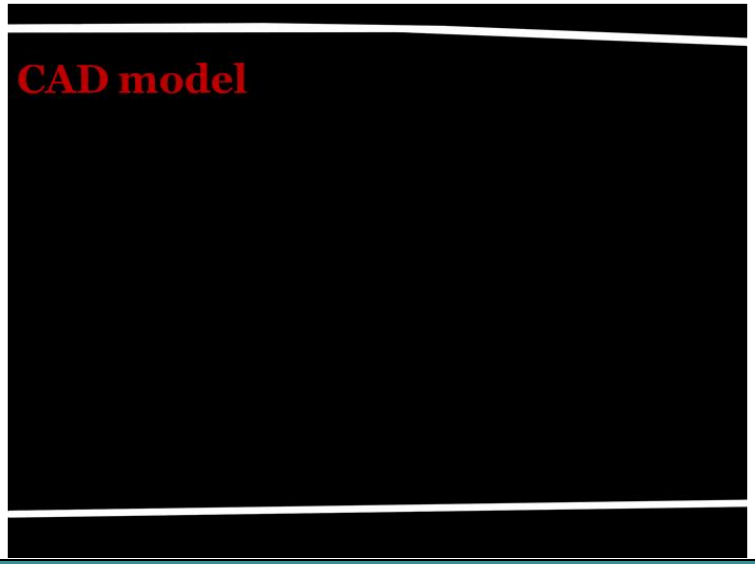


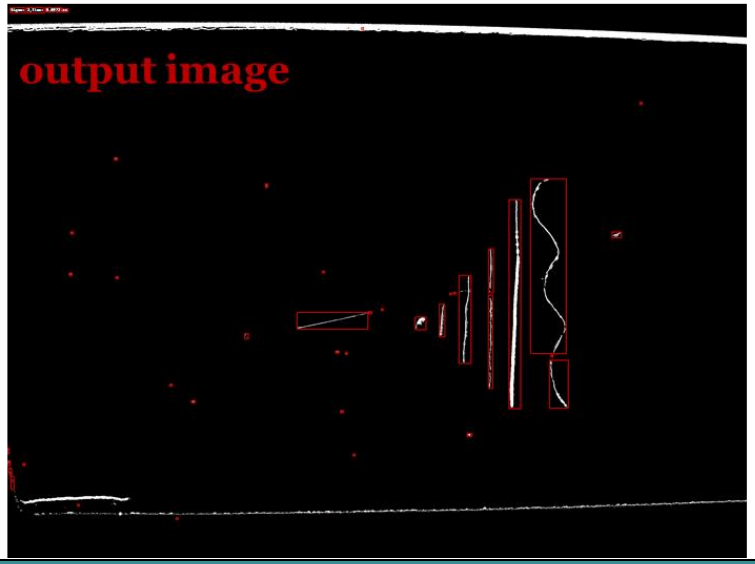


Some outputs









Success Criterias

1. Catching at least 85% of surface defects.

2. Fault detection time should be 0.1 seconds at most.

3. Dataset should be collected from at least 10 different physical parts. The number of images will be around 50.
   (47 image dimensions : 2592 x 1944 pixels)
   (3 image dimensions : 1000 x 600 pixels)

Average F1 Score	:	0.90
Average Accuracy	:	83.33 %
Average Time	:	1.95 second

Resources

- [1] Multiview specular stereo reconstruction of large mirror surfaces - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Basic-principle-of-deflectometry-The-specular-surface-is-quasi-invisible-to-the_fig1_221363507 [accessed 19 Oct, 2021]

- [2] Zhang, Z.; Wang, Y.; Huang, S.; Liu, Y.; Chang, C.; Gao, F.; Jiang, X. Three-Dimensional Shape Measurements of Specular Objects Using Phase-Measuring Deflectometry. *Sensors* **2017**, *17*, 2835. https://doi.org/10.3390/s17122835

- [3] M. H. Karimi and D. Asemani, “Surface defect detection in tiling industries using digital image processing methods: Analysis and evaluation,” ISA Transactions, vol. 53, no. 3, pp. 834–844, 2014, issn: 0019-0578. doi: https://doi.org/10.1016/j.isatra.2013.11.015. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S001905781300205X.

- [4] T. Özseven, “Surface defect detection and quantification with image processing methods,” pp. 63–98, Mar. 2019.

- [5] N. Nacereddine, M. Zelmat, S. S. Belaifa, and M. Tridi, “Weld defect detection in industrial radiography based digital image processing,” Transactions on Engineering Computing and Technology, vol. 2, pp. 145–148, 2005.