



# Defect Detection on Glossy Surfaces using the Deflectometry Data

**CSE 495**  
**4<sup>th</sup> Meeting**

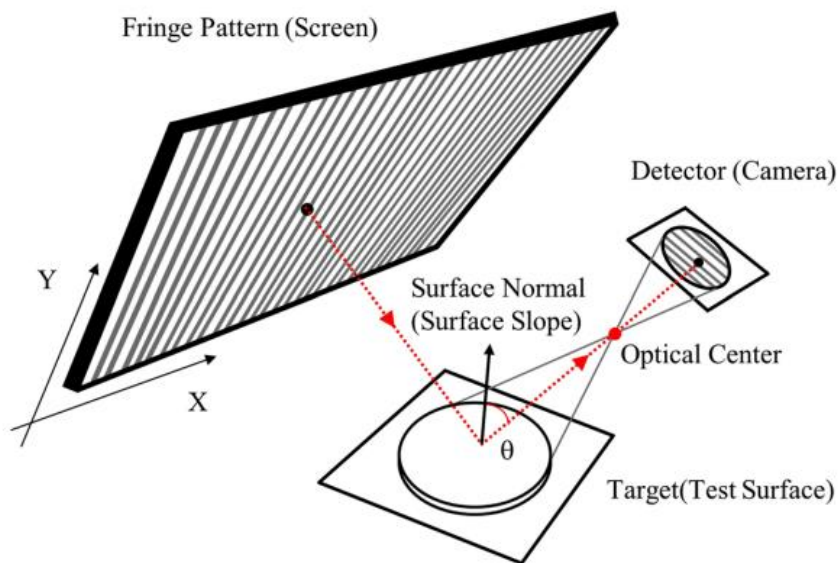
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**Project Advisor: Prof. Dr. Yusuf Sinan Akgül**  
**January 2022**



- Project Scheme and Description
- Project Design Plan
- Dataset
- What has been done?
- User Interface
- Some outputs
- Success Criterias
- Resources





- **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

1<sup>st</sup> Meeting  
20 Oct 2021

2<sup>nd</sup> Meeting  
10 Nov 2021

3<sup>rd</sup> Meeting  
8 Dec 2021

TODAY  
4<sup>th</sup> Meeting  
19 Jan 2022

Demo  
20 Jan 2022

Months

October 2021

November 2021

December 2021

January 2022

Weeks

4 Oct 11 Oct 18 Oct 25 Oct 1 Nov 8 Nov 15 Nov 22 Nov 29 Nov 6 Dec 13 Dec 20 Dec 27 Dec 3 Jan 10 Jan 17 Jan 24 Jan

Preparing the development environment,  
Learning the necessary libraries,  
Literature review.

Data preprocessing

Starting to apply deep learning models

Completion of training deep learning  
models and evaluation of results.

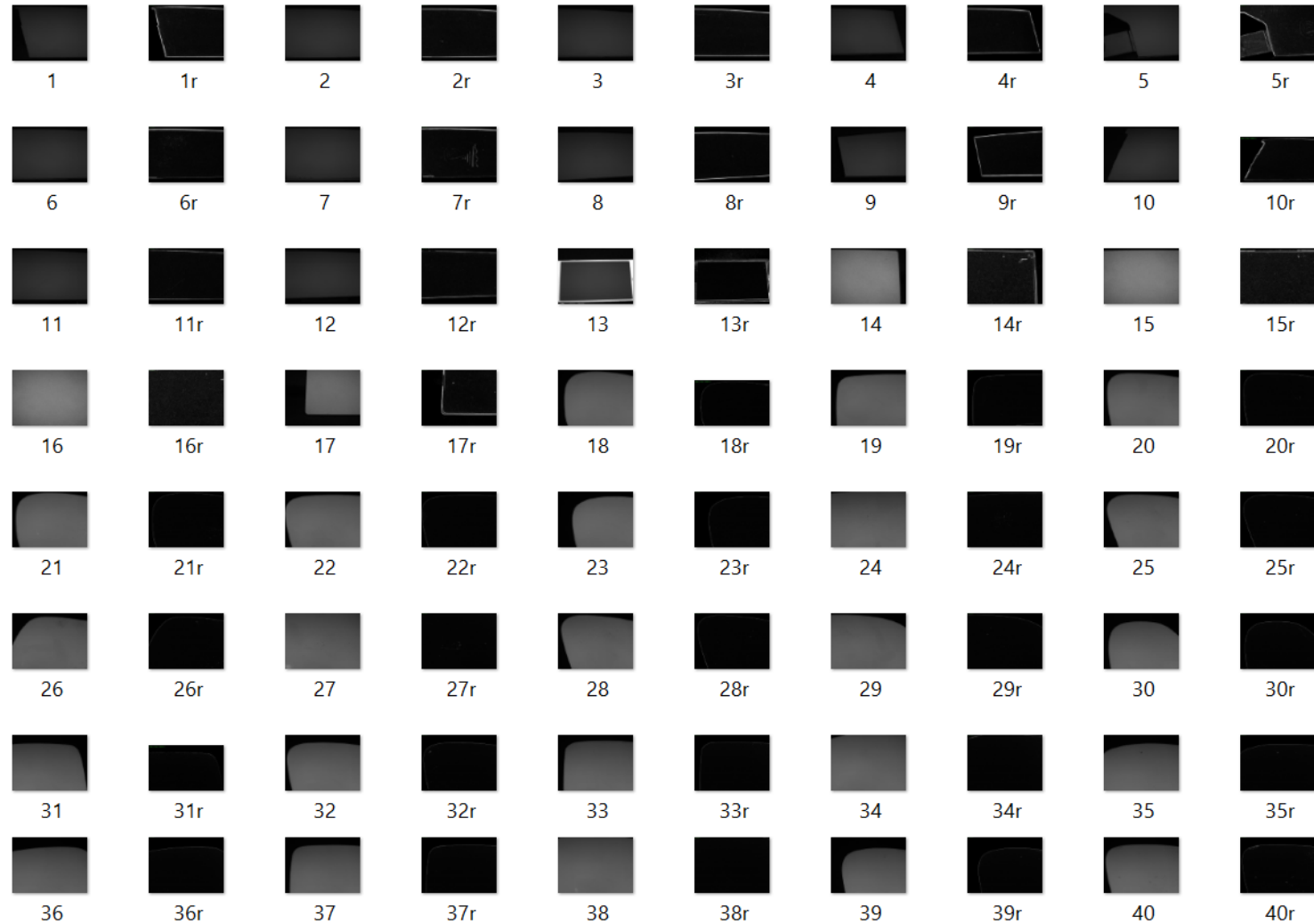
Making improvements on the models and  
applying a different model if the results are  
insufficient.

Making the finishing touches and preparing  
the report.



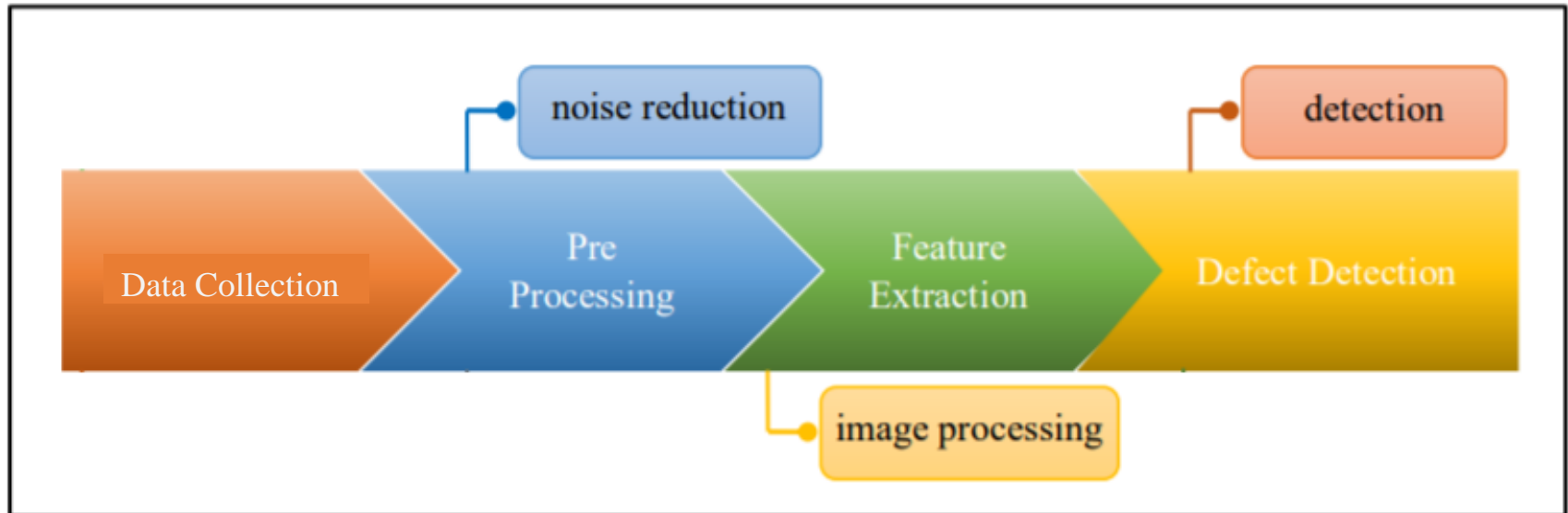
# Dataset

50 pairs of  
images

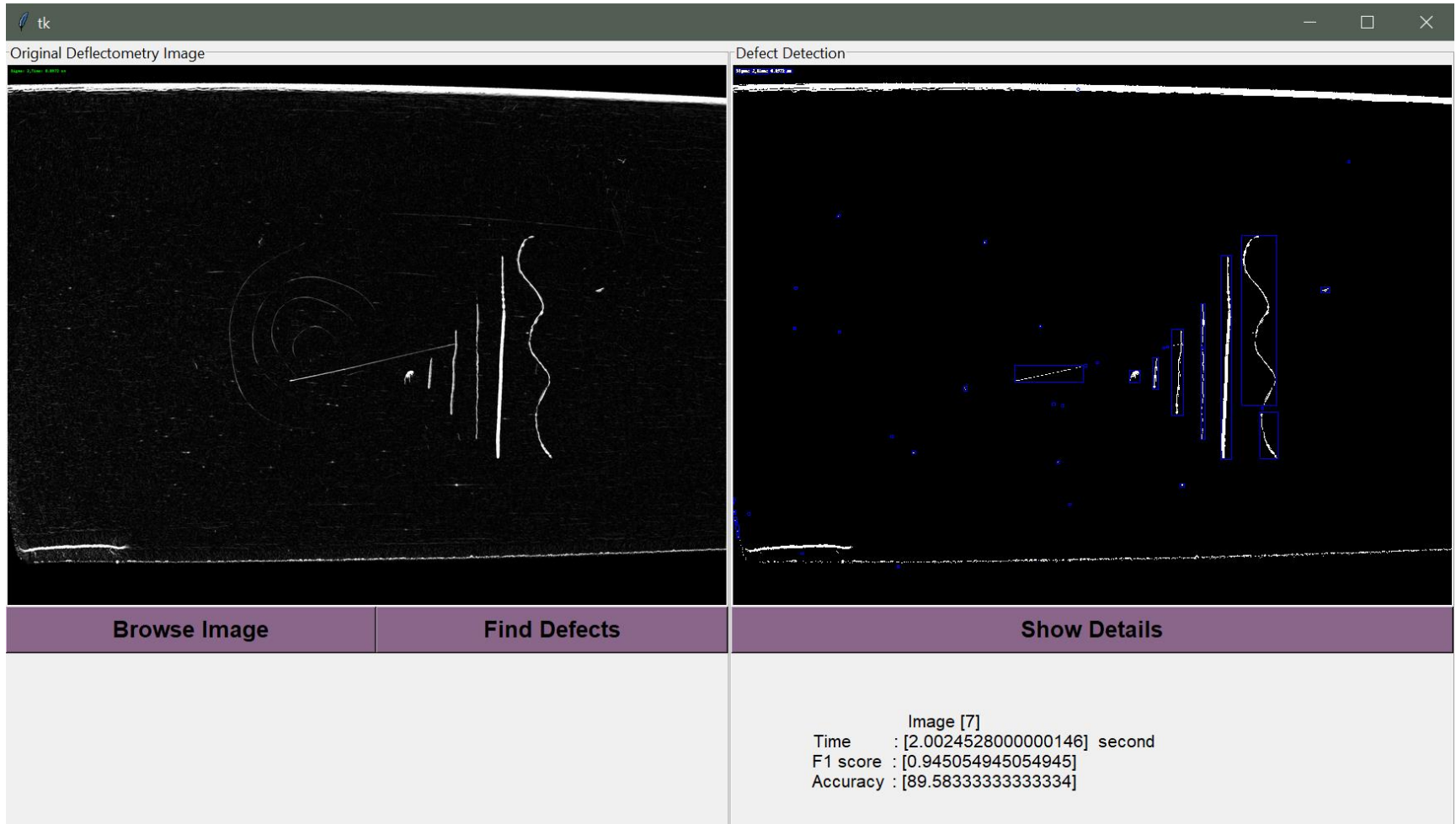


# What has been done?

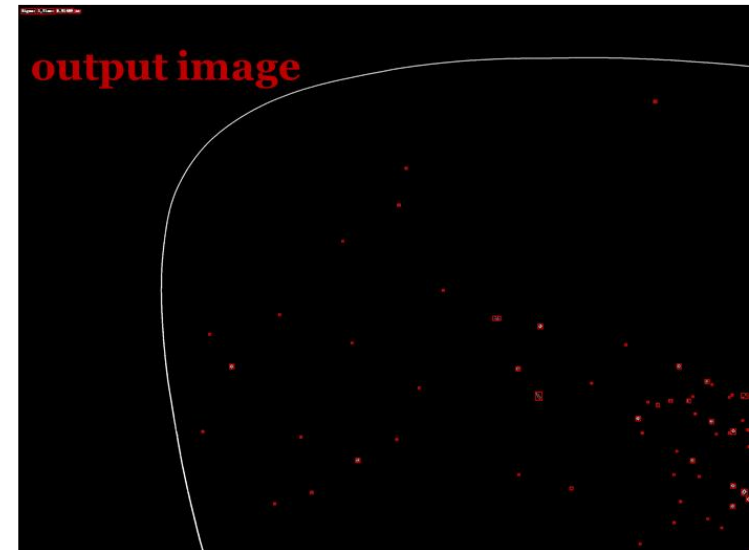
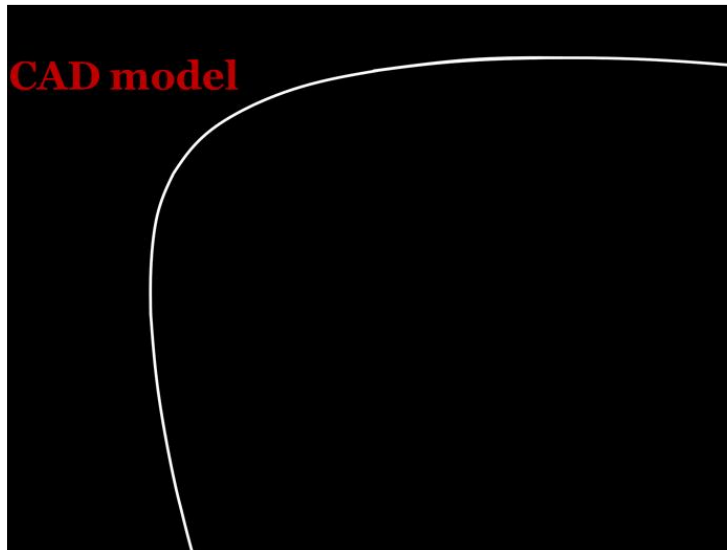
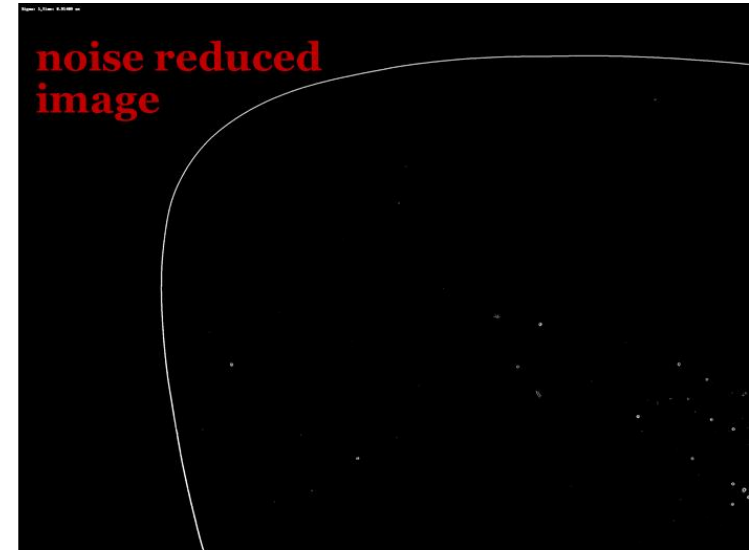
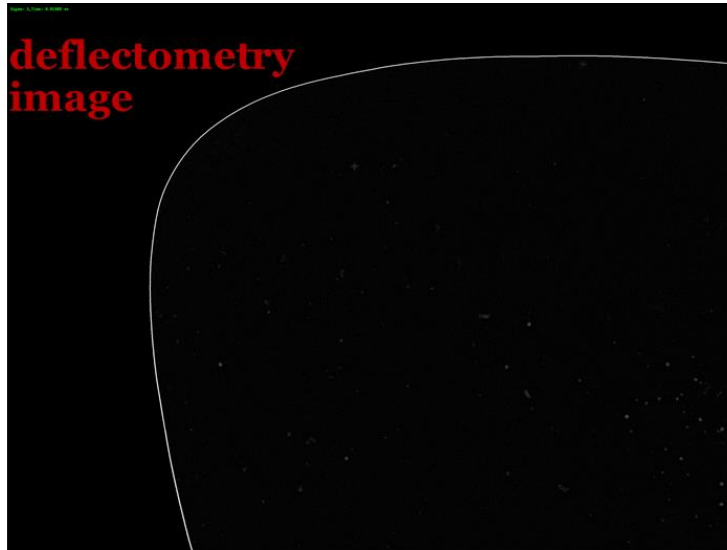
- At first I used Otsu's Thresholding algorithm.
- I changed my algorithm and I decided to use statistical method.
- On the first practises, I was manually marking defects and try to find those ones.
- While removing the edges, I was removing the connected pixels which are next to each other .
- I created 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



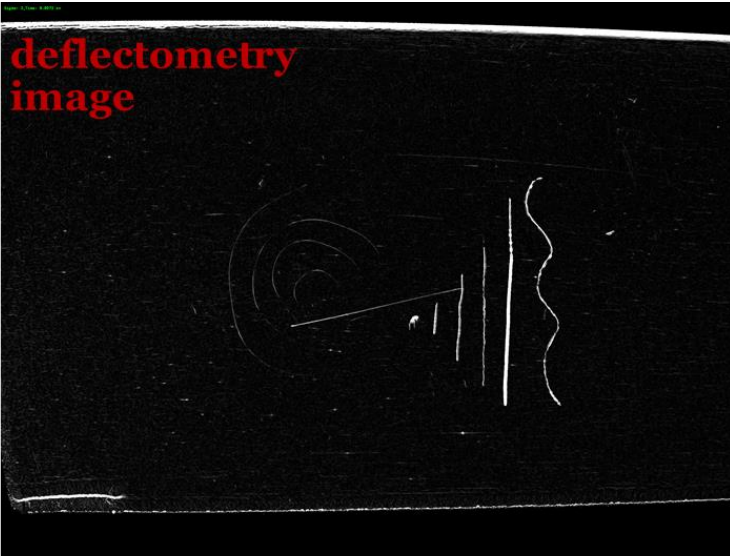
# Some outputs



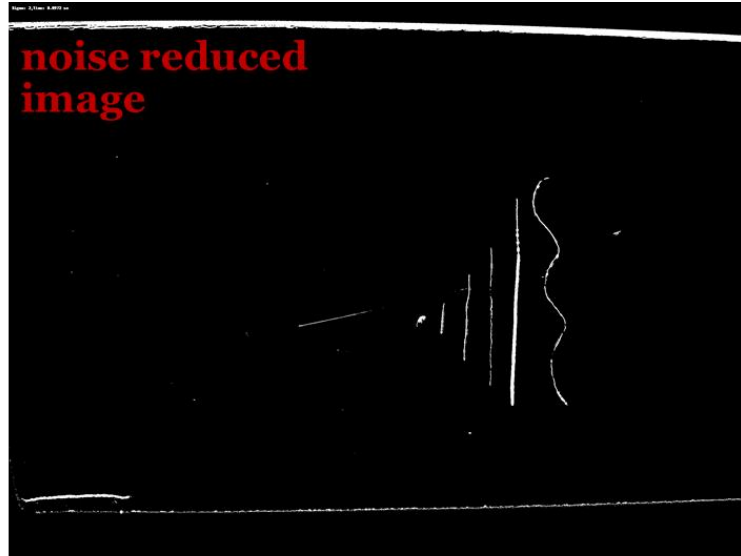


# Some outputs

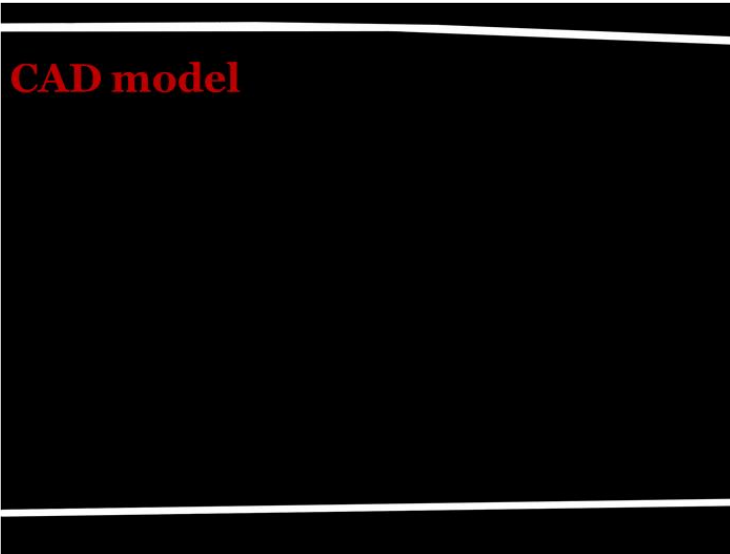
**deflectometry  
image**



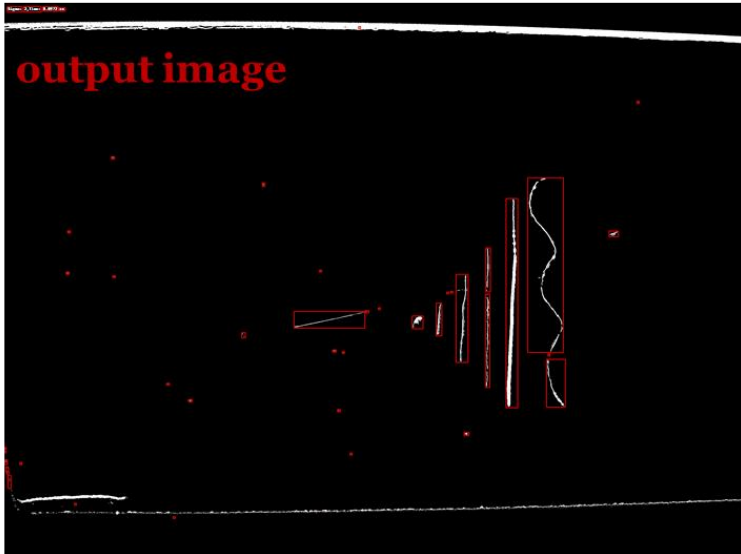
**noise reduced  
image**



**CAD model**



**output image**



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



- [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](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.

