THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

MATH6380P - Project 2: Anomaly Detection using Transfer Learning in Semiconductors

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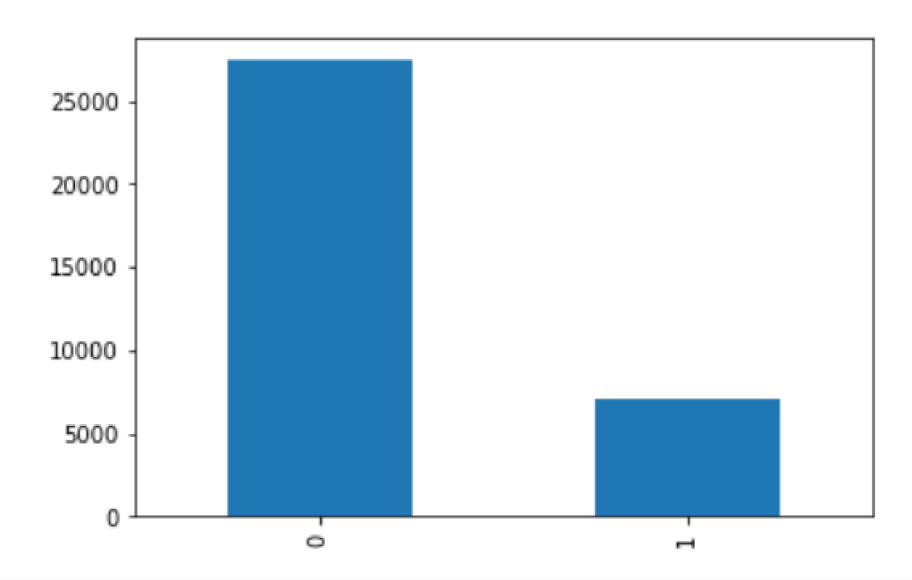
Outline

- Introduction
- Methodology
- Experimental results
- Conclusion and future work

Introduction

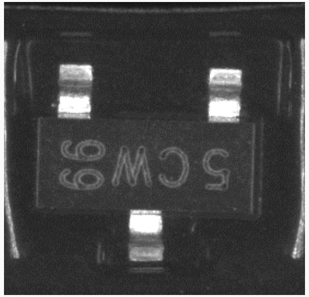
- Nexperia Dataset:
  - Train sets: 34,459 labeled images (27,420 images are “good” and only 7,039 images are labeled as “defect”)
  - Test sets: 3,830 images

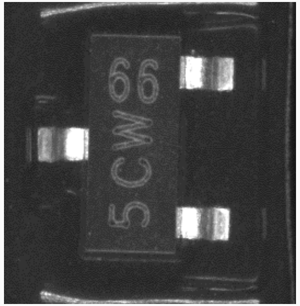


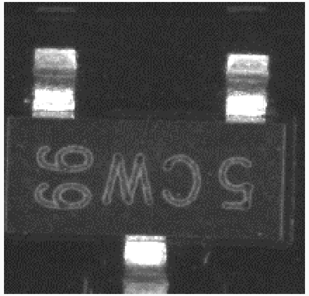
Methodology

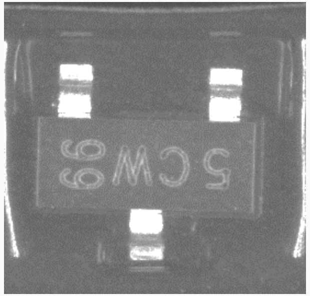
Oversampling and Data Augmentation

- Apply transformation:
  - Random flips
  - Rotates
  - Zooms
  - Contrast
  - Brightness changes





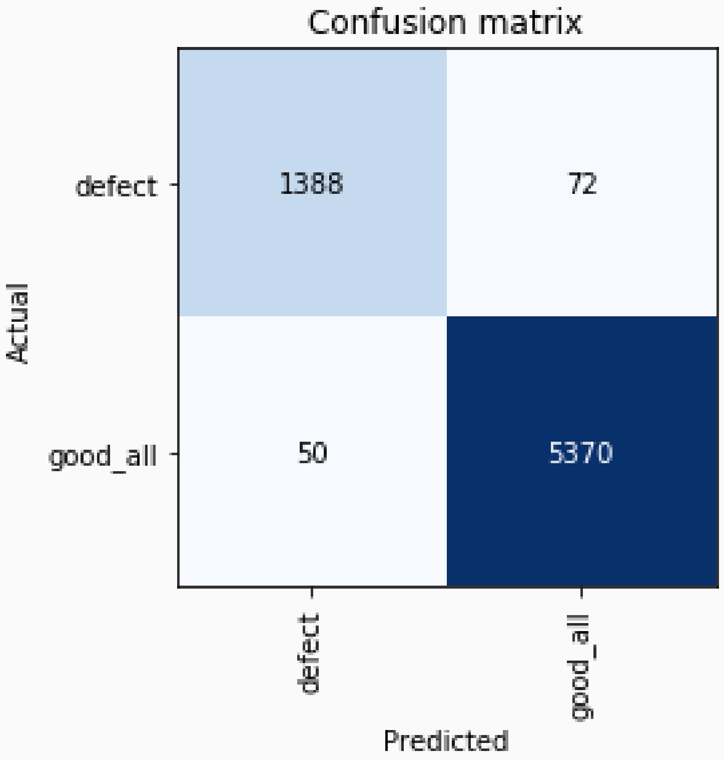


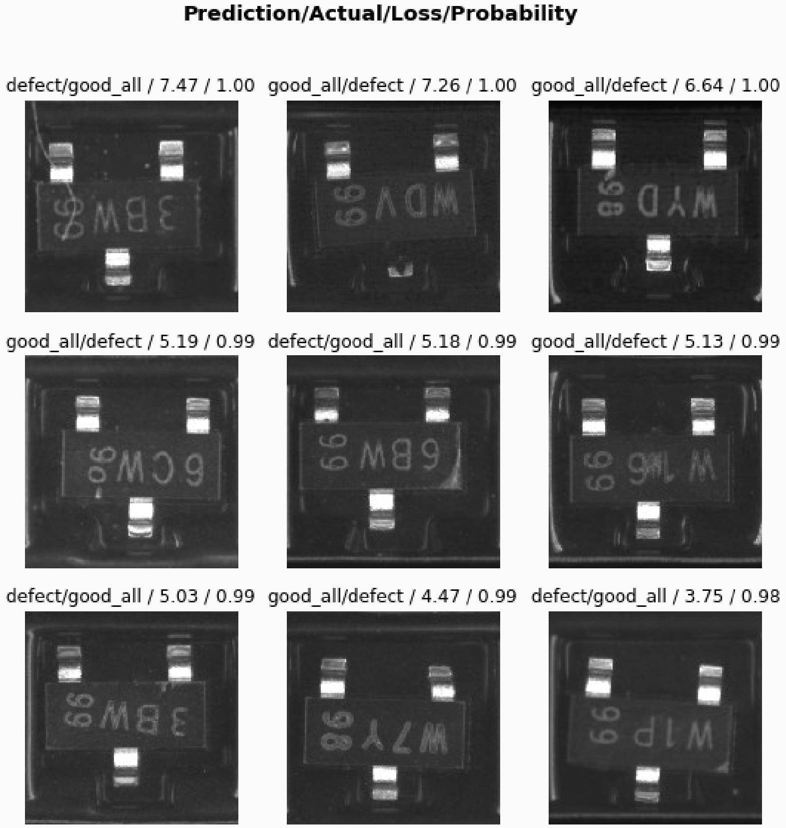


Transfer Learning

- Used pre-trained model Resnet34
- Trained the newly added deeper layers
- Unfroze the entire model and fine tuned
- Different layer weights were updated using different learning rates

Experimental results





Training process

- Training loss, valid_loss, error_rate

epoch	train_loss	valid_loss	error_rate	time
0	0.069746	0.071867	0.028779	02:38
1	0.060838	0.072623	0.028052	02:39
2	0.056797	0.070990	0.027616	02:39
3	0.062390	0.066626	0.025581	02:39
4	0.058042	0.065132	0.025436	02:40
5	0.052717	0.063052	0.023983	02:40
6	0.053801	0.061399	0.023983	02:40
7	0.044757	0.060245	0.022674	02:41
8	0.045994	0.059496	0.023110	02:40
9	0.038565	0.059194	0.021657	02:41
10	0.045283	0.058038	0.021366	02:42
11	0.036330	0.056835	0.021948	02:41
12	0.034587	0.055763	0.020640	02:41
13	0.037137	0.055768	0.021366	02:42
14	0.030773	0.055227	0.020930	02:42
15	0.035343	0.054702	0.020640	02:43
16	0.031796	0.052888	0.018314	02:42
17	0.030739	0.052637	0.019041	02:43
18	0.028280	0.054318	0.020349	02:43
19	0.023721	0.052248	0.019767	02:43
20	0.027725	0.052014	0.019041	02:43
21	0.025350	0.050648	0.018314	02:43
22	0.021983	0.050902	0.018023	02:43
23	0.021916	0.049887	0.017878	02:44
24	0.020140	0.048809	0.017733	02:44

Conclusion and future work

- It hard to differentiate between good and bad semiconductors just from images alone.
- It would be fascinating to compare the performance of the current model with other approach (GAN, Variational AutoEncoder)
- Apply preprocessing to improve images quality, design/ adapt new network architecture, extract more features to distinguish good and bad semiconductors

Thank you for your attention