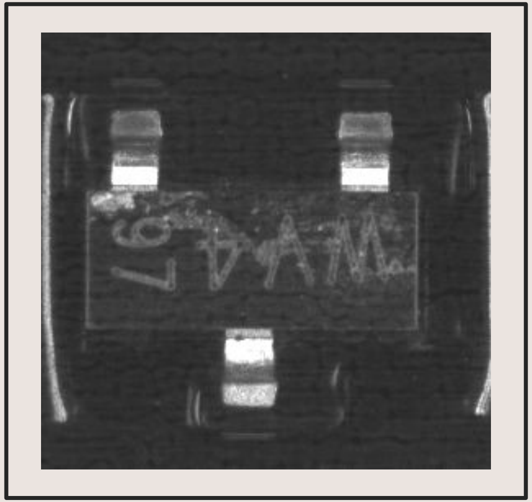
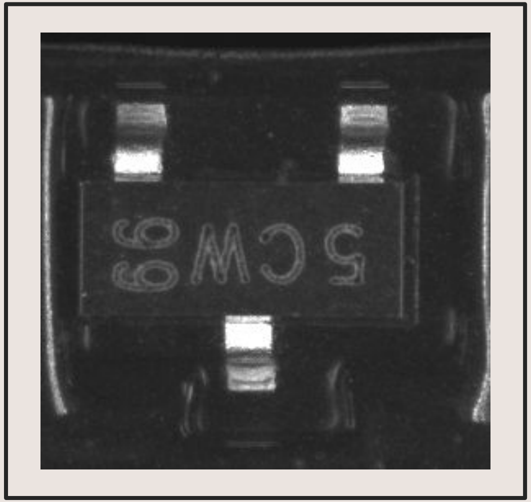
Nexperia Image Classification Using CNN

1. Overview



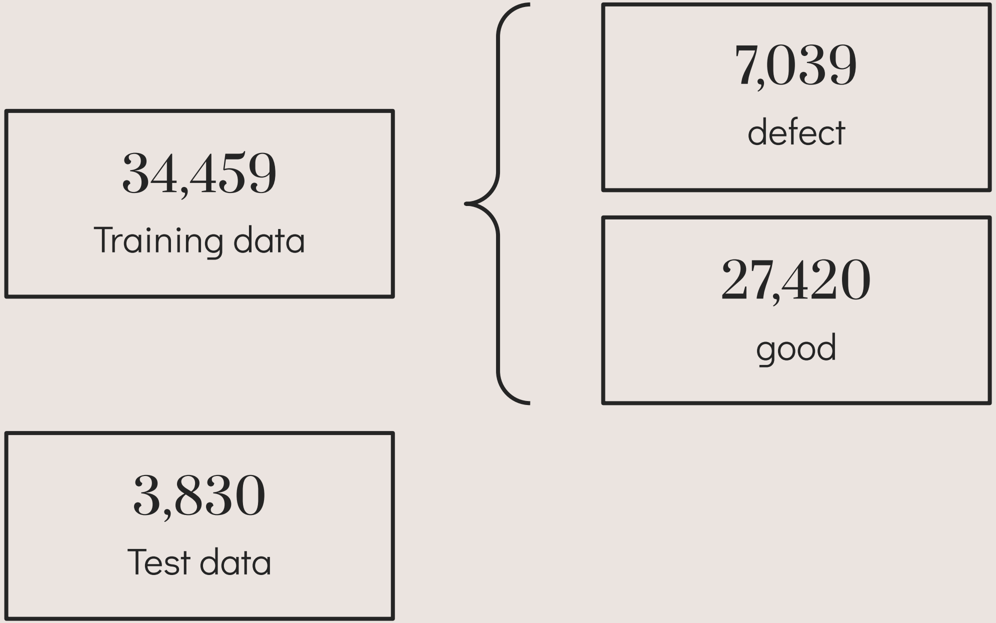
defect

Help Nexperia pick defect devices from a batch of semiconductors



good

2. Data Preprocessing



34,459

Training data

7,039

defect

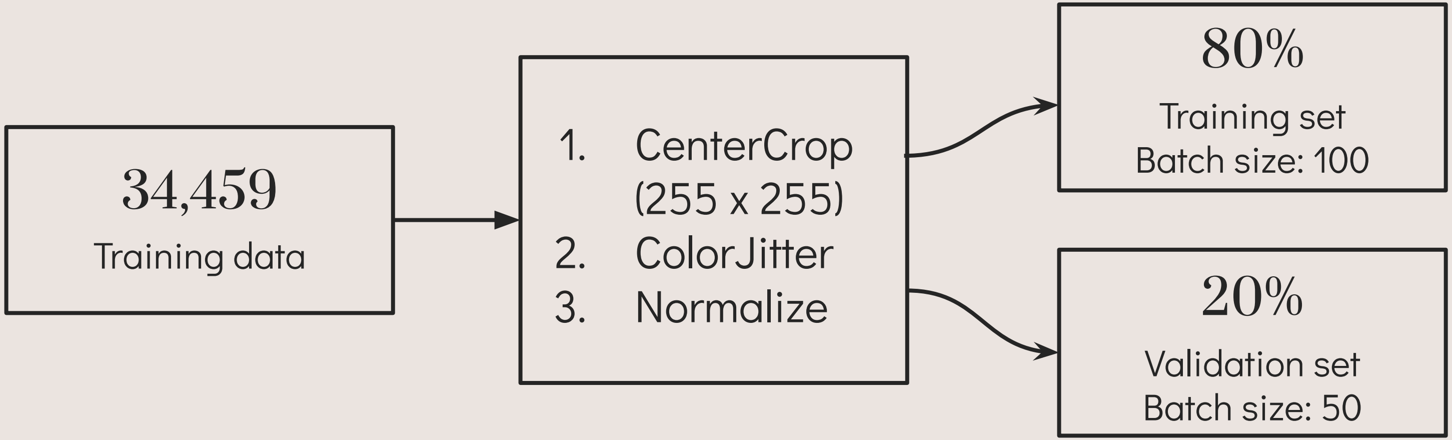
27,420

good

3,830

Test data

2. Data Preprocessing



34,459

Training data

1. CenterCrop (255 x 255)
2. ColorJitter
3. Normalize

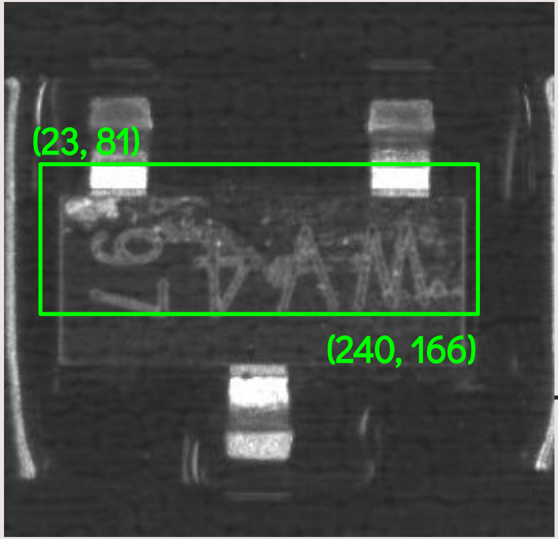
80%

Training set
Batch size: 100

20%

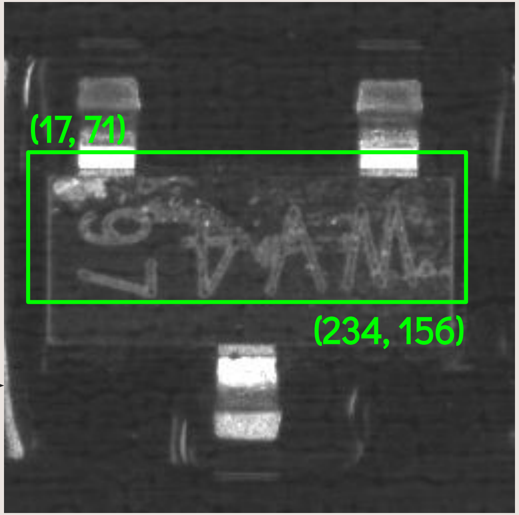
Validation set
Batch size: 50

2. Data Preprocessing

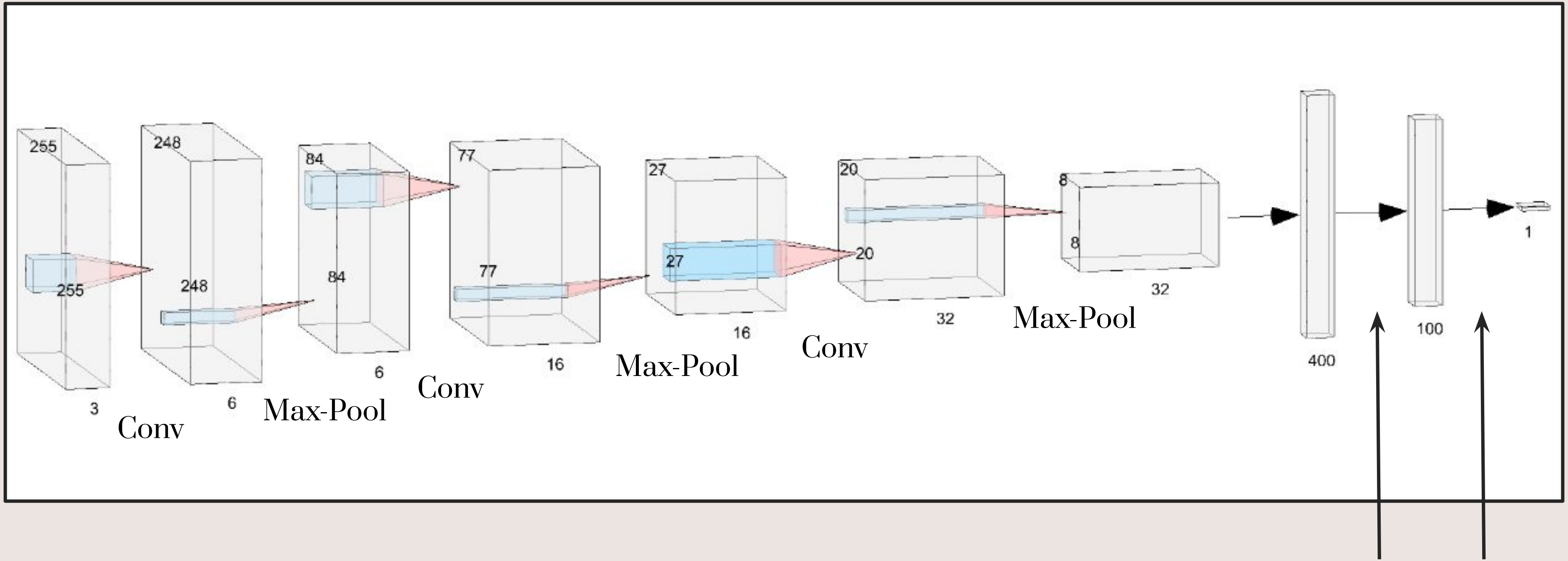


defect_area.csv

1. Match the coordinates after cropping
2. Fill in missing values



3. Model



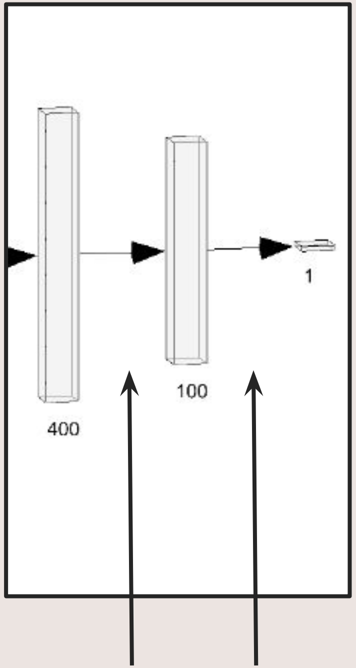
Drop out rate: 0.15

4. Hyperparameter tuning

- Average training loss of the last 10 training batches

- Dropout rate (Initial: 0.3)

0.1	0.216
0.15	**0.213**
0.2	0.232
0.25	0.243
0.3	0.289
0.35	0.332
0.4	0.341
0.45	0.386

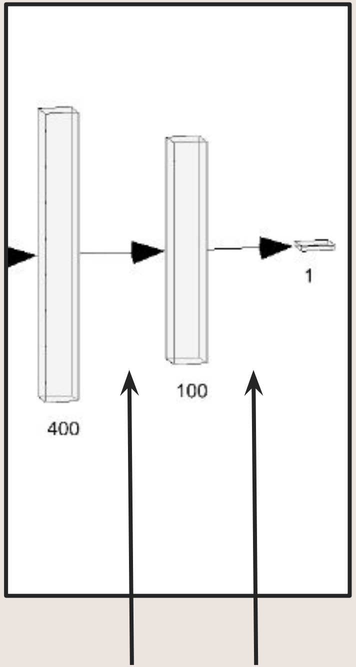


Drop out rate: 0.15

4. Hyperparameter tuning

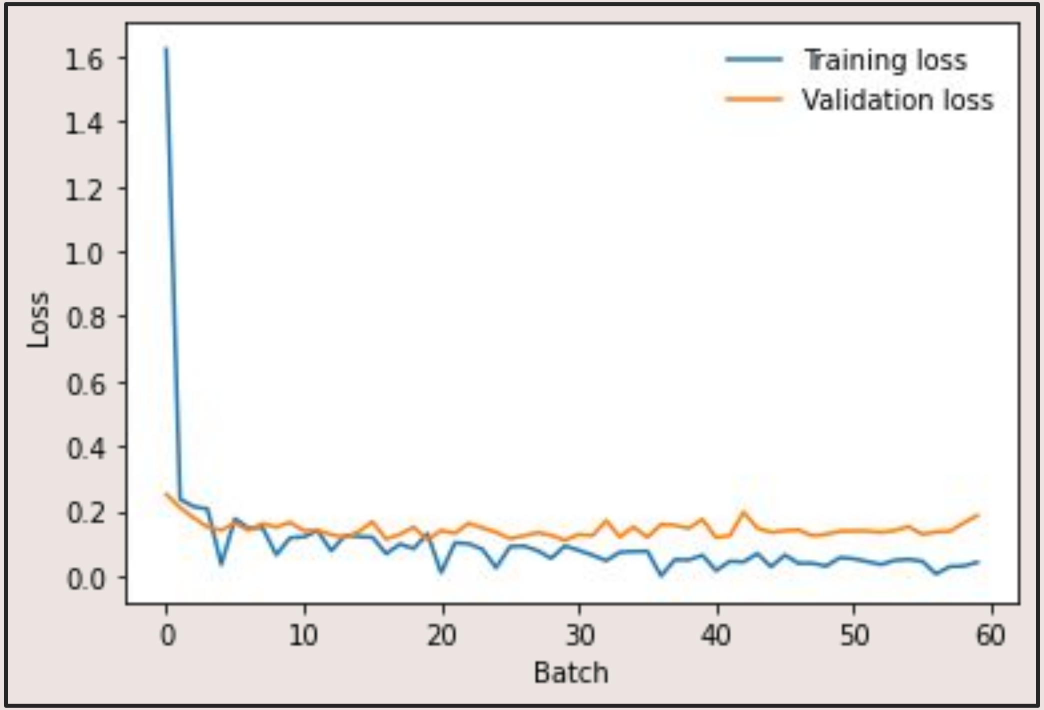
- Number of nodes in dense layer (Initial: 1000-200)

○ 1500-1000	0.122
○ 1500-500	0.099
○ 1500-100	0.071
○ 1500-50	0.202
○ 1500-10	0.327
○ 1000-500	0.109
○ 1000-100	0.051
○ 1000-50	0.181
○ 1000-10	0.229
○ 600-500	0.116
○ 600-100	0.048
○ 600-50	0.092
○ 600-10	0.213
○ **400-100**	**0.043**
○ 400-50	0.095
○ 400-10	0.301
○ 200-100	0.102
○ 200-50	0.128
○ 200-10	0.305

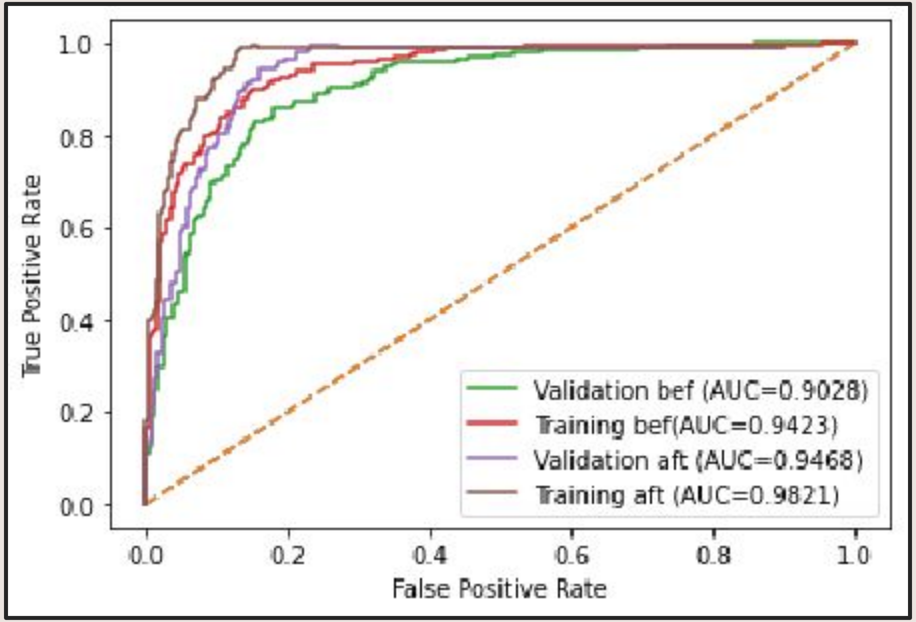


Drop out rate: 0.15

5. Result


Training loss
Validation loss
Loss
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Batch

5. Result


1.0
0.8
0.6
0.4
0.2
0.0
True Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
False Positive Rate
Validation bef (AUC=0.9028)
Training bef(AUC=0.9423)
Validation aft (AUC=0.9468)
Training aft (AUC=0.9821)

5. Result

Before tuning

Accuracy: 0.9070	label: defect	label: good
predict: defect	1126 (0.1634)	359 (0.0521)
predict: good	282 (0.0409)	5125 (0.7436)
Precision: 0.7582	Recall: 0.7997	**F1 Score: 0.7783**

Dropout rate: 0.15

Accuracy: 0.9571	label: defect	label: good
predict: defect	1233 (0.1790)	121 (0.0176)
predict: good	175 (0.0254)	5363 (0.7782)
Precision: 0.9106	Recall: 0.8757	**F1 Score: 0.8928**

Fully Connected layers: 400-100

Accuracy: 0.9830	label: defect	label: good
predict: defect	1373 (0.1993)	82 (0.0119)
predict: good	35 (0.0051)	5402 (0.7839)
Precision: 0.9436	Recall: 0.9751	**F1 Score: 0.9591**

6. Conclusion

Kaggle AUC Score: 0.97822

The result is much better after the hyperparameter tuning.

Not as good as transfer learning result (from other students).