Mobile Phone Surface Defect Detection Based on Improved Faster R-CNN



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BEGAN



INTRODUCTION

Background

Mobile phone surface defect (MPSD) is an inevitable factor in the production process of mobile phones. Efficient defect detection can provide enterprises with production information in time to improve production technology.

Motivation

At present, the number of defective samples in mobile phone production is very small, and it is difficult to obtain high-quality defective sample images. When detecting mobile phone defects, the size of the defect is very small. Therefore, we proposed a deep learning based method to cope with these problems.

Key Idea

- we use BEGAN to augment the dataset, making the data more diverse while ensuring quality.
- FPN is used to obtain small target feature.
- ROI Pooling is applied to reduce pixel loss due to quantization.

PROSOSED METHOD

BEGAN is a very simple network. A hyperparameter Υ is provided, this hyper-parameter can balance the diversity of the image and the quality of the generation, which is the reason why we use BEGAN.



Samples generated by BEGAN

FPN

A statistics of the dataset we made show that 58% of the defects are very small. Sowe introduce the FPN network to cope with this hard problem.



ROI Align

ROI Align method cancels all quantization operations. Four sampling points are set in each bin, and the pixel value of the feature map is obtained by the method of bilinear interpolation, thereby avoiding the loss of accuracy caused by the quantization process.

PIPELINE OF PROPOSED METHOD



RESULTS ON MPSD DATASET

MPSD Dataset: A total of 1250 defective pictures are taken. Data augmentation include flipping, rotation, color jitter and BEGAN. After data augmentation, 4753 samples are obtained. Notably, our method achieves better accuracy than previous detectors on the MPSD dataset.

Dataset	(a) Point defect (c) Screen scratch	(b) Edge defect (d) Stripe dent		Results	elgedrist:	1.6 Stope dest: 1.0
Method	mAP	Point defect	Edge defect	Screen scratch	Stripe dent	Inference time
HOG+SVM	63.45%	73.88%	62.33 %	48.52%	69.06%	-
LBP+SVM	72.39%	77.52%	75.21%	61.80%	75.03%	-
Faster R-CNN(VGG16)	90.84%	90.81%	90.96%	91.44%	90.15%	0.111s
Faster R-CNN(ResNet10	01) 93.92%	95.75%	93.61%	93.97%	92.35%	0.197s
SSD-300	90.47%	90.82%	89.58%	90.17%	91.31%	0.016s
Yolov3(Darknet-53)	92.47%	94.36%	88.63%	92.23%	94.45%	0.029s
Our method	99.43%	99.39%	99.99%	99.45%	98.89%	0.208s

CONCLUSION

- To achieve high-quality feature extraction for small size mobile phone defects.
- To solve the problem of small samples.
 BEGAN
- To prevent the regression from being affected by the quantization operation.
 Rol Align

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