Surface Defect Detection Using YOLO Network

스마트팩토리 : 제조공정에서의 불량 검출

발표자 박 재 용

Surface Defect Detection
Using YOLO Network

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요약

Abstract

문제인식

사용 도구

과정

결과

Abstract. Detecting defects on surfaces such as steel, can be a challenging task because defects have complex and unique features. These defects happen in many production lines and differ between each one of these production lines. In order to detect these defects, the You Only Look Once (YOLO) detector which uses a Convolutional Neural Network (CNN), is used and received only minor modifications. YOLO is trained and tested on a dataset containing six kinds of defects to achieve accurate detection and classification. The network can also obtain the coordinates of the detected bounding boxes, giving the size and location of the detected defects. Since manual defect detection is expensive, labor-intensive and inefficient, this paper contributes to the sophistication and improvement of manufacturing processes. This system can be installed on chipsets and deployed to a factory line to greatly improve quality control and be part of smart internet of things (IoT) based factories in the future. YOLO achieves a respectable 70.66% mean average precision (mAP) despite the small dataset and minor modifications to the network.

환경

environment

YOLO v3

You Only Look Once

Google CoLab

CUDA, cuDNN, Python3

NEU Dataset

Northeastern University (NEU) surface database

contains six types of defects.
- rolled-in scale (Rs)
- patches (Pa)
- crazing (Cr)
- pitted surface (Ps)
- inclusion (In)
- scratches (Sc)

300 images for each defect.
(1800 total)

size : 200×200 pixels

내용

Content

문제의 배경

metal surfaces with defects have 40% less strength with much faster strength degradation.

의의

helping in visual inspection and replacing manual labor in many industries

요구사항

1. designed defect detector must be accurate and fast.

2. The detector must also be able to distinguish between defects and non-defective interference such as dust.

내용

Content

검출 방법

Changes to the hyperparameters are made to be able to train and test using the custom dataset provided.

훈련 및 테스팅 방법

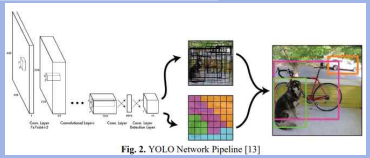


Fig. 2. YOLO Network Pipeline [13]

- transfer learning
- Leaky ReLU for Activation function
- darknet53
- mini-batch (64->24)
- Data pre-processing (image resizing, labeling)
- The images are split into 10% for testing and 90% for training.

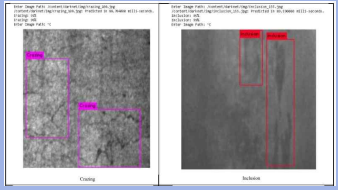
* small dataset with no data augmentation.

결과 분석

After many trials and changes to the hyperparameters , YOLO is able to achieve a mAP of 70.66% with 79% precision and 68% recall.

The network also obtains the coordinates of resulting bounding boxes in order to calculate the size and position of the defects.

even though YOLO trained on metal steel surfaces, it can be used and trained on other surfaces such as wood, glass and paper.



내용

Content

장점

- 빠르다.

- 적은 데이터를 요구한다.

단점

- ‘Replacing manual labor in many industries.’ 라는 의의를 만족하기엔 정확도가 부족하다.

- 장점인 ‘비교적 적은 데이터를 요구한다.’ 라는 항목을 증명하기위해 데이터에 제한을 뒀다.

개선사항

hyperparameters such as learning rate, anchors, loss function and even altering the layers of the network by changing the values of filters and maybe adding or removing certain layers.
Accuracy may also be improved in the case of a bigger dataset, pre processing of the data and data augmentation techniques.

하이퍼파라피터를 조정한다.
데이터의 사이즈를 조정한다.
배치의 크기와 인풋 데이터의 량을 조절한다.

Backbone을 변경한다.
*CSPNet: A New Backbone that can Enhance Learning Capability of CNN

[Submitted on 27 Nov 2019]

감사합니다.

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