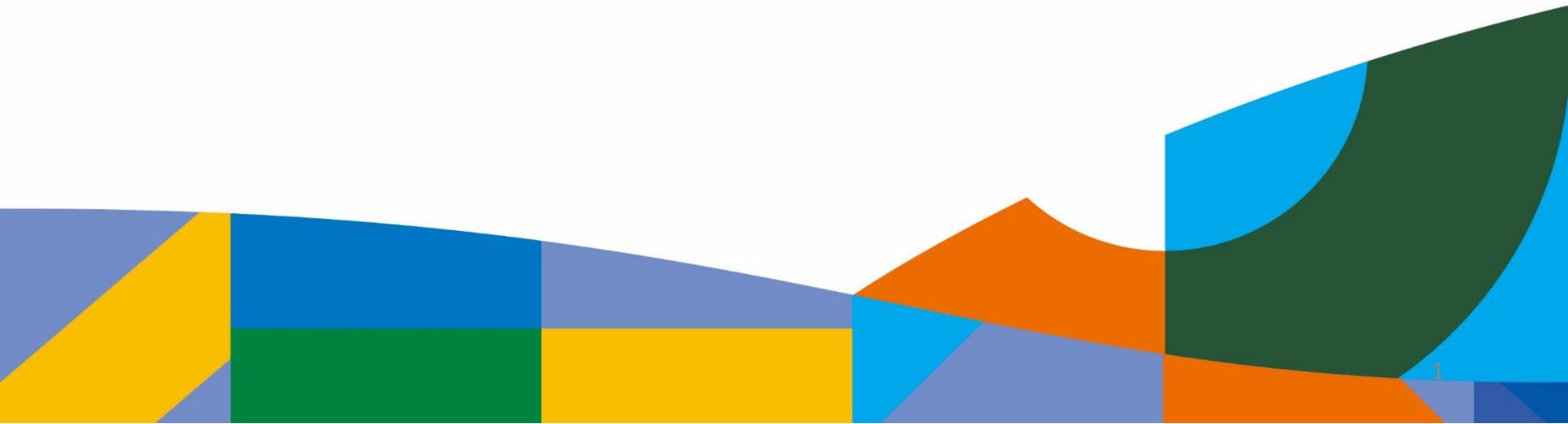# Defect Detection of Stainless Steel Plates Using Deep Learning Technology

Presenter: Shih-Hsiung Lee
Department of Intelligent Commerce,
National Kaohsiung University of Science and Technology

Outline

- Introduction
- Deep Learning method
- Definition defects and experiment
- Conclusion

Introduction

- Image recognition has always been one of the emphases in the development of multimedia technology.

- Image recognition is often applied in people's daily life, such as face or license plate recognition.

- In recent years, image recognition on hardware has been gradually improved and deep learning technology has been introduced, which have resulted in great breakthroughs in the field of computer vision and artificial neural networks.

Introduction

- In the era of industry 4.0, factories around the world are developing towards automation and artificial intelligence, in which industrial detection plays an important role.

- In the process of metal preprocessing and cutting, there will be scratches, chisels, stains, and other defects produced on the metal surface, which must be identified and removed through detection.

- In traditional detection, frozen images of high-speed moving metal machining parts are inspected manually by visual inspection combined with a stroboscope.

Introduction

- As the human eye cannot conduct long-term monitoring like a camera, manual detection cannot achieve the goal of comprehensive detection.

- Therefore, our work develops a defect detection system based on deep learning technology.
  - improve the quality of the products
 - improve production and work efficiency

Deep Learning method

- This paper used existing mature deep learning models for object detection, **YOLOv3(You Only Look Once)** and **SSD(Single Shot MultiBox Detector)**, which are the base network architectures for the defect detection of stainless steel plates, in order to effectively improve the accuracy of stainless steel plate detection.

- Among the object detection algorithms with real time performance mentioned in recent years, YOLOv3 and SSD are most influential.

Stainless steel image
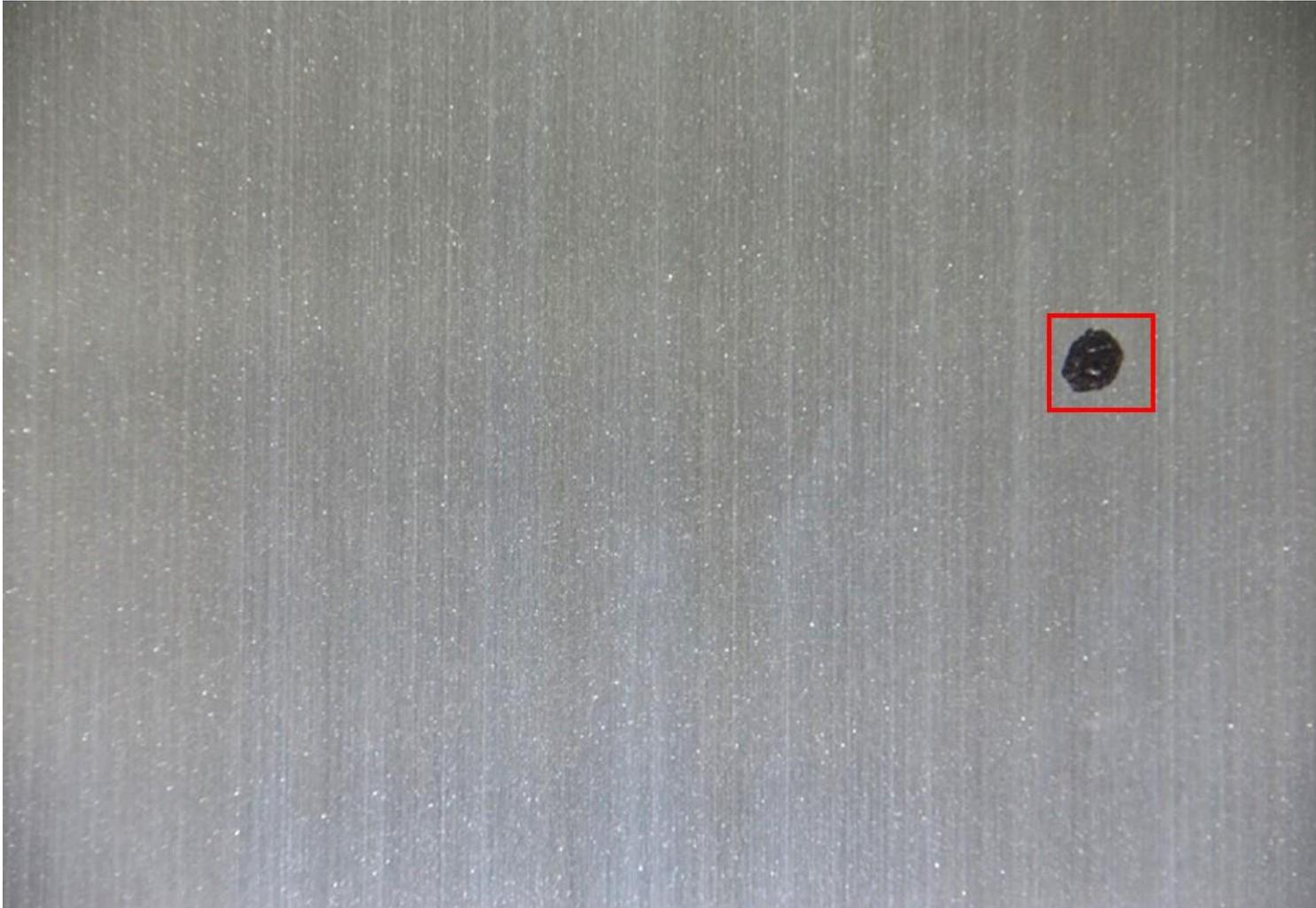
- Normal surface image of steel product.
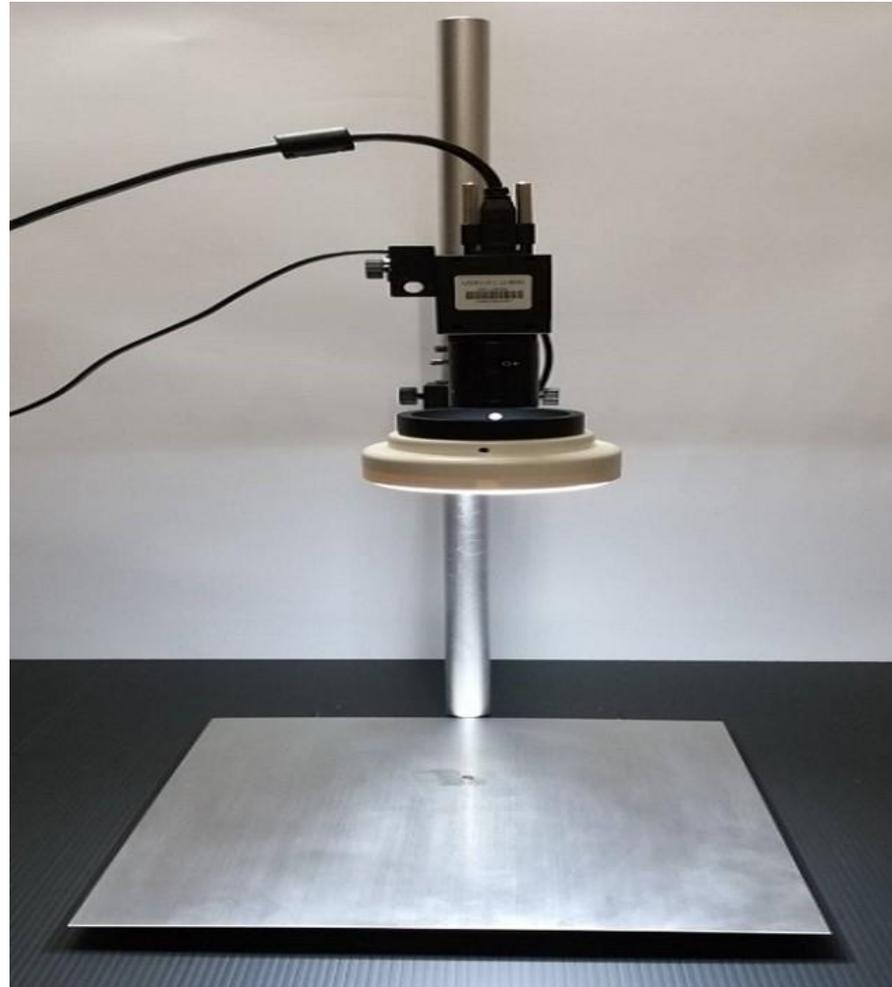
Linear defects
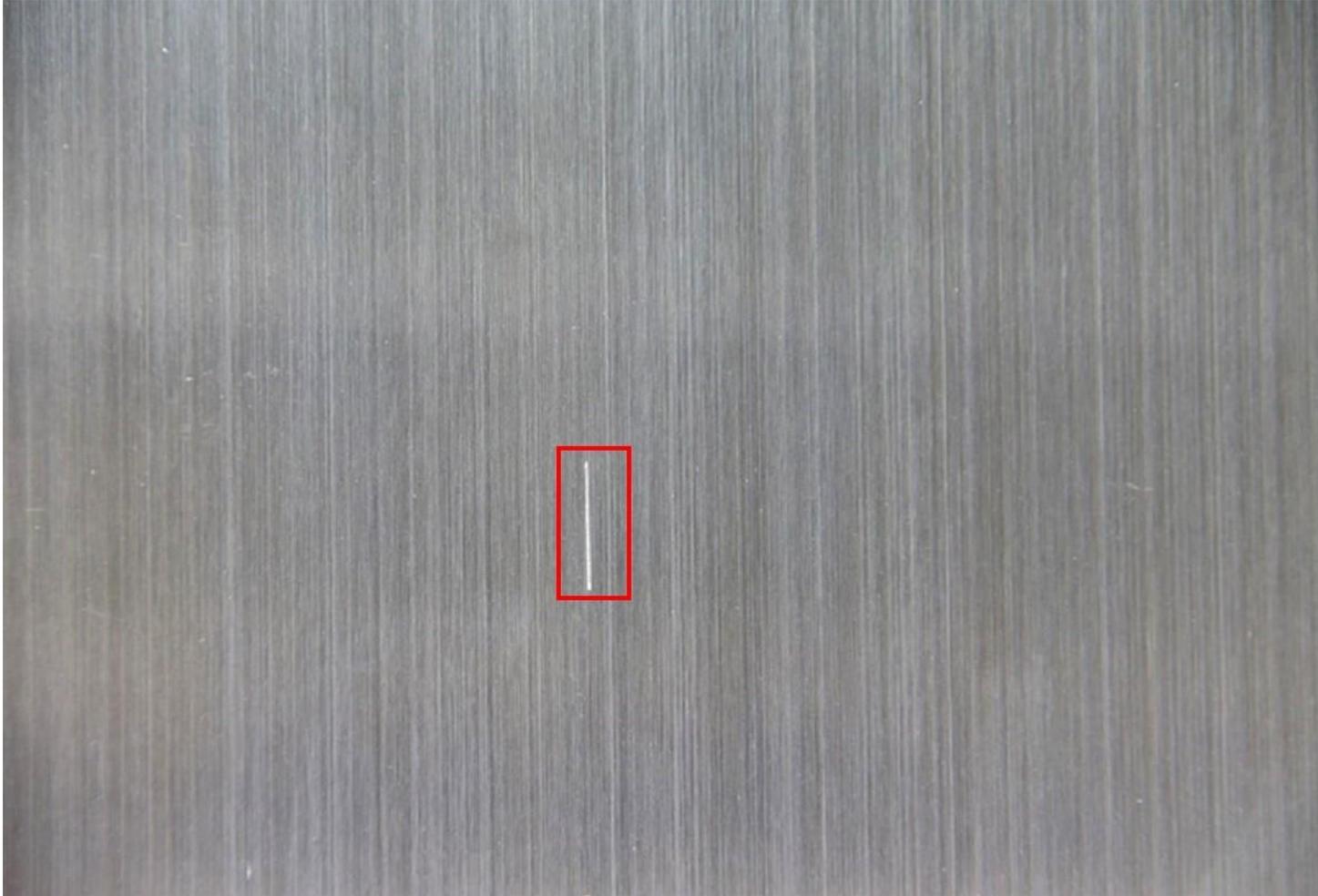
Regional defects - Chisel
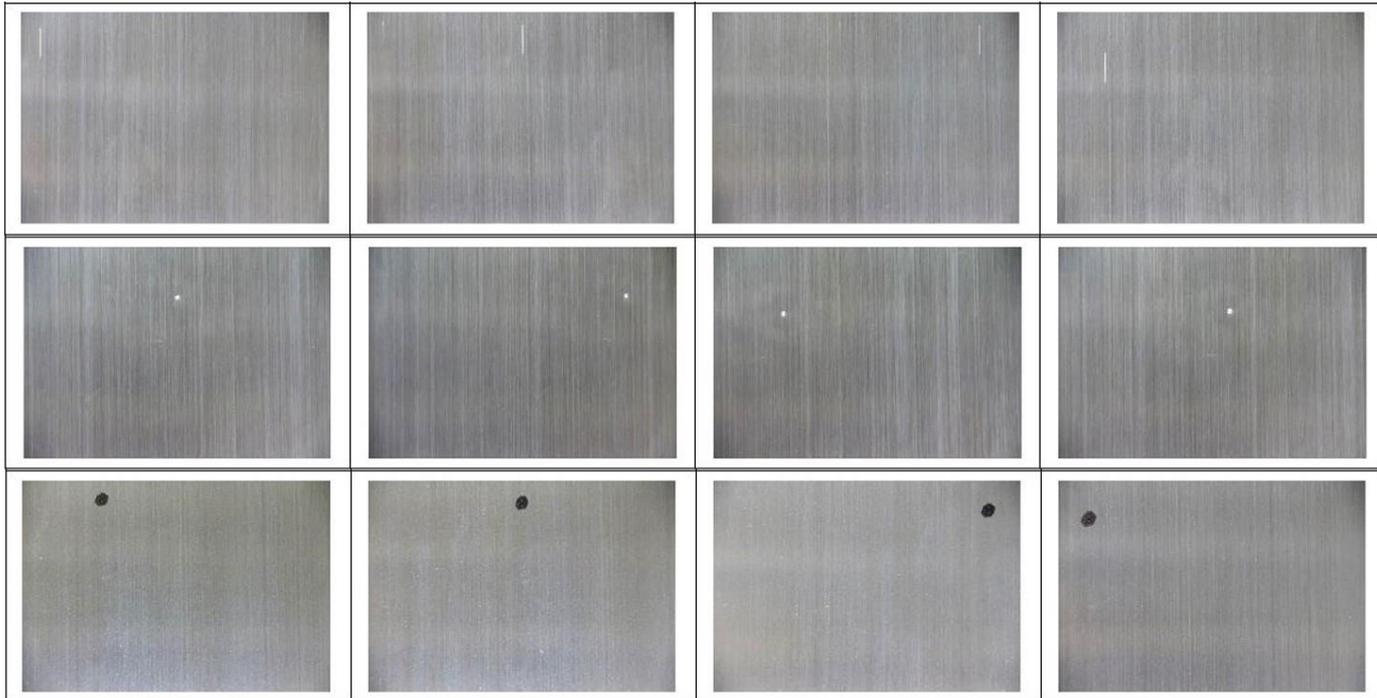
Regional defects - Stain

Image capture and environment establishment
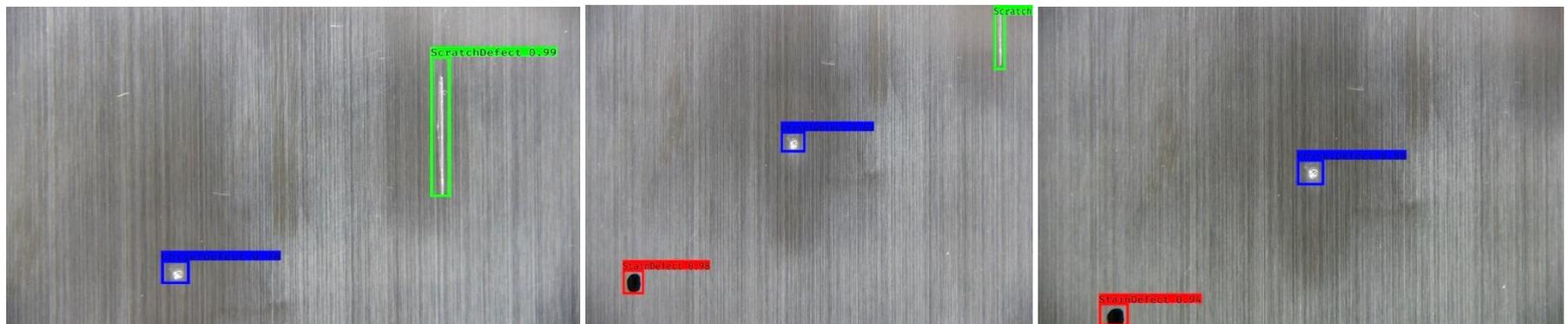
Dataset

- 3000 images
  - Scratches 1000 images
  - Chisel 1000 images
  - Stains 1000 images
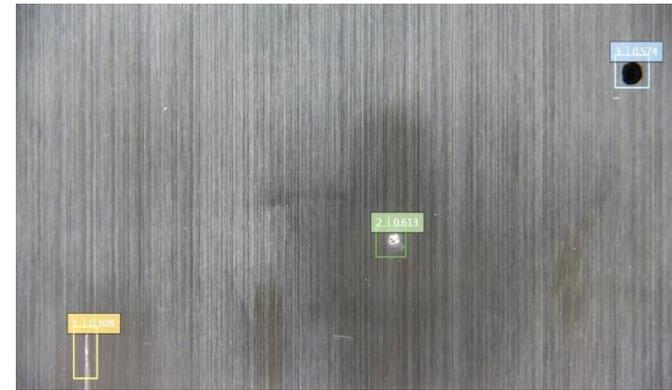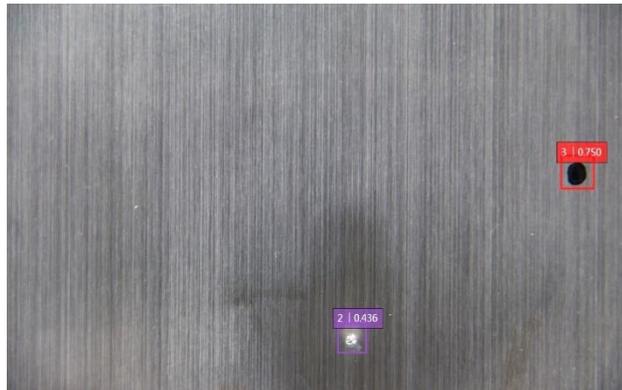- 90% for training and 10% for verification

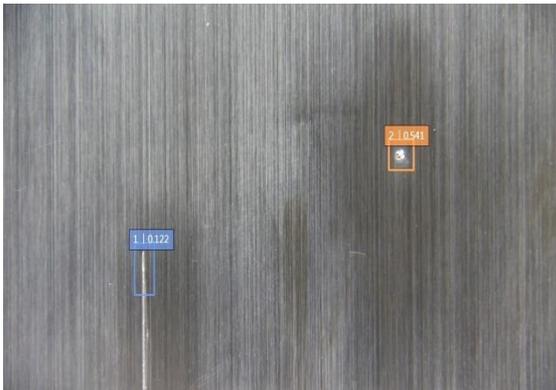# The result of YOLOv3 experiment

items	scratch	chisel	stain	average
under kill rate	20.95%	44.4%	21.3%	28.9%
over kill rate	0%	0.63%	0%	0.21%
accuracy rate	97.8%	96.7%	98.7%	97.7%

The result of SSD experiment

items	scratch	chisel	stain	average
under kill rate	70.31%	79.9%	62.1%	68.1%
over kill rate	11.64%	9.1%	7.72%	9.5%
accuracy rate	84.6%	88.9%	90.7%	88%

Conclusion

- This paper proposed a set of stainless steel plate detection techniques to replace the current method of manual visual detection of stainless steel plate surface defects.

- The detection system, as developed in this paper, can reduce the factory end visual inspection work, which reduce both labor and costs.

- There are still more difficult and invisible defects, such as chisel defects. Therefore, our future study will add filters to reduce high-light interference and improve recognition accuracy.

Thank you very much