

Transfer Learning Anomaly Detection & Segmentation for image-based Quality Control in Industry

Univ.-Prof. Dr.-Ing. Dorit Merhof
Head of Institute

Oliver Rippel
Research Scientist

Institute of Imaging & Computer Vision
Room 139
Kopernikusstrasse 16
52074 Aachen
Germany

Phone: +49 241 80-27866
Fax: +49 241 80-22200

Oliver.Rippel@lfb.rwth-aachen.de

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Introduction

Image-based quality control is concerned with detecting anomalies in products and poses a crucial yet challenging part of the production process. It still relies heavily on manual inspection due to the complexity and variety of manufactured products and defects combined with the rarity of defect occurrence.

Apart from detecting anomalies, anomaly segmentation (i.e. delineation of defects) is another important task. Here, data driven approaches employing machine learning have greatly improved performance. Specifically, transfer learning ImageNet pre-trained classifiers currently yields SotA performance with respect to both anomaly detection as well as anomaly segmentation (refer [1](#), [2](#) & [3](#)). SotA therefore draws on the general representativity of features yielded by supervised large-scale visual dataset training. Recently, it has been reported that features yielded by self-supervised training on large-scale visual datasets yield [even better features](#) (i.e. features that are more suitable for transfer learning via fine-tuning on downstream tasks). Self-supervised large-scale training is often combined with vision-transformers, which have a lesser inductive bias compared to CNNs.

Thesis Aim

This thesis investigates whether benefits of self-supervised pre-training on large-scale datasets reported in literature also transfer to the transfer-learning anomaly detection task. To this end, supervised ImageNet models will be compared with their self-supervisedly trained counterparts. Also, SoTA AD methods will be adapted to the vision-transformer architecture. The thesis will employ public anomaly detection datasets (e.g. MVTec AD).

Requirements

- Interest in digital image processing
- Strong knowledge about machine learning theory
- Programming experience

Additional, desirable skills are:

- Experience in python and relevant frameworks (scikit-learn, pytorch, pytorch lightning)
- Knowledge in AD & open set recognition

Our Offer

During the course of the work, you will acquire competences in the field of machine learning, specifically anomaly segmentation. Additionally, the thesis offers the possibility of actively planning/detailing its contents, which is also desired. We aim to publish results in a relevant, peer reviewed venue, and experience in that regard may also be gained.

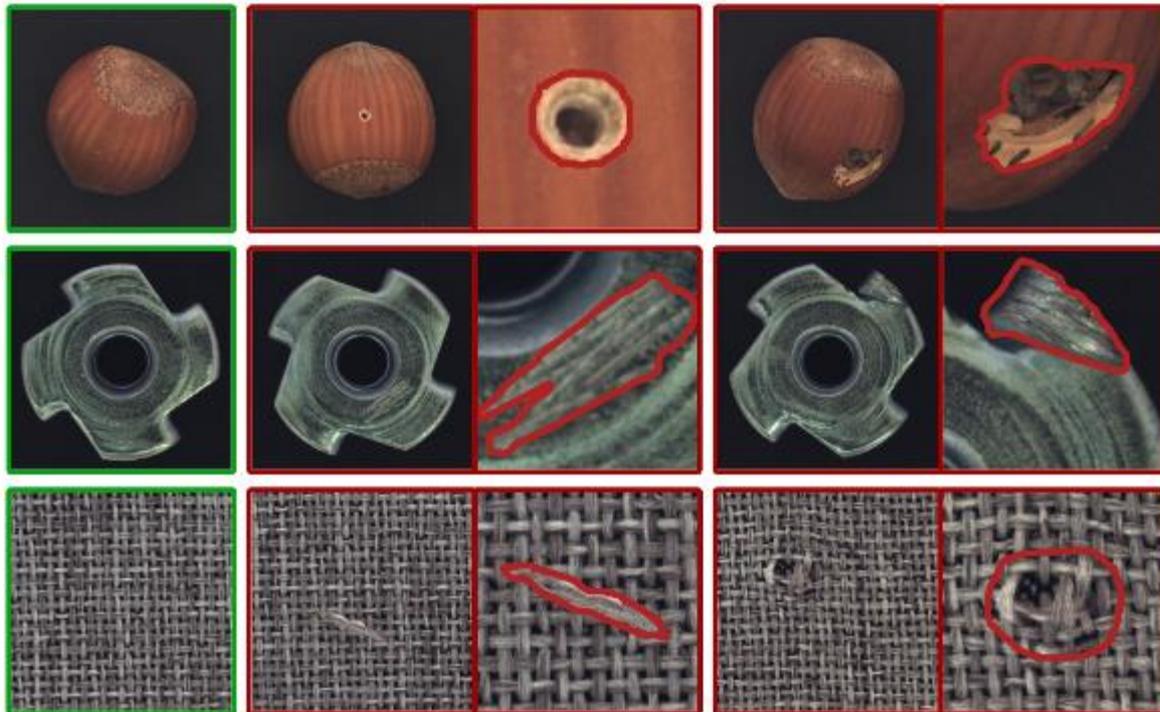


Figure 1: Examples of the MVTec AD dataset. Green = Normal, Red = Anomalous