

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

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, e.g. via [Knowledge Distillation](#) or the [direct estimation of the normal data's PDF](#) in pre-trained feature representation, currently yields SotA performance. However, spatial resolution of yielded anomaly segmentations are low and could be improved further. Here, segmentation networks natively provide high resolution feature maps and should be well suited.

Thesis Aim

This thesis aims at developing anomaly segmentation algorithms based on transfer learning segmentation (and possibly also object detection) networks. In a first step, appropriate SotA networks and their backbones will be identified (e.g. [HRNet](#)) and pre-trained backbones used as input to SoTA AS algorithms (refer above). Afterwards, extensions will be developed based on insights gained from initial experiments. 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)
- Knowledge in anomaly segmentation & 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.

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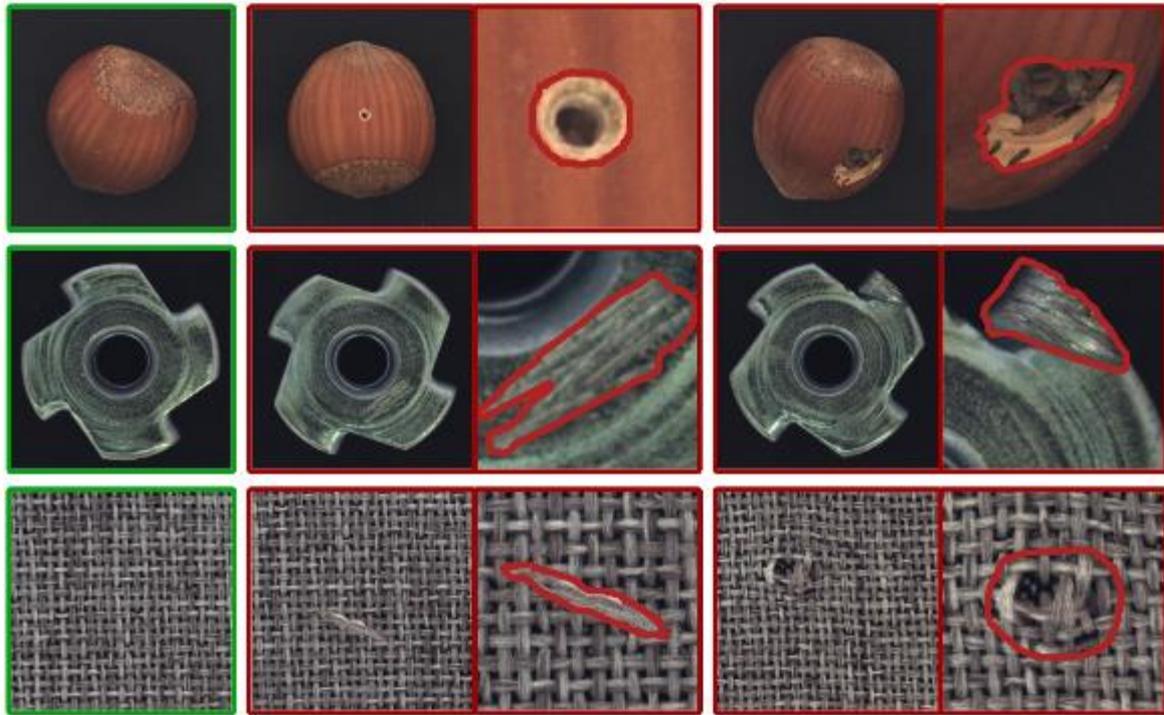


Figure 2: Examples of the MVTec AD dataset. Green = Normal, Red = Anomalous