

Problem (MCM)

Industrial Surface Defect Detection

Surface defects in metal or plastic products not only affect the appearance of the product, but may also cause serious damage to the performance or durability of the product. Automated surface-anomaly detection has become an interesting and promising area of research, with a very high and direct impact on the application domain of visual inspection[1]. Kolektor Group provided a dataset of images of defective production items[2], and we would like to use this dataset as an example to investigate a mathematical model for automatic detection of product surface defects through photographs.

Domen Tabernik, Matic Šuc, and Danijel Skočaj have built a model for detecting surface defects using deep learning[3], which is claimed to be able to provide good discrimination even with a small amount of training. However, our problem at this point is slightly different; first, we want our model to be deployable on inexpensive handheld devices. Such devices have only very limited storage space and computational power, so the model is very demanding in terms of the amount of computation as well as the storage space required. Second, since this dataset does not encompass all defect patterns, we would like the model to have relatively good generalization capabilities when other defect types are encountered as well. You and your team are asked to build easy-to-use mathematical models to accomplish the following tasks.

Tasks:

1. Determine whether surface defects appear in a photograph, and measure the amount of computation and storage space required for your model to do so;
2. Automatically label the locations or areas where surface defects appear, and measure the amount of computation, storage space, and labeling accuracy required by your model.
3. Please clarify the generalization capability of your model, i.e. why is your model still feasible if you encounter defect types that are not exactly the

same as those in the dataset.

References

- [1] Domen Tabernik, Matic Šuc, and Danijel Skočaj. Automated detection and segmentation of cracks in concrete surfaces using joined segmentation and classification deep neural network, Sep 2023.
- [2] <https://www.vicos.si/resources/kolektorsdd/>.
- [3] Domen Tabernik, Samo Šela, Jure Skvarč, and Danijel Skočaj. Segmentation-based deep-learning approach for surface-defect detection, Mar 2020.