Master's Thesis Engineering Technology

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Development of AI classification system for sorting food applications

Bram Verstraeten

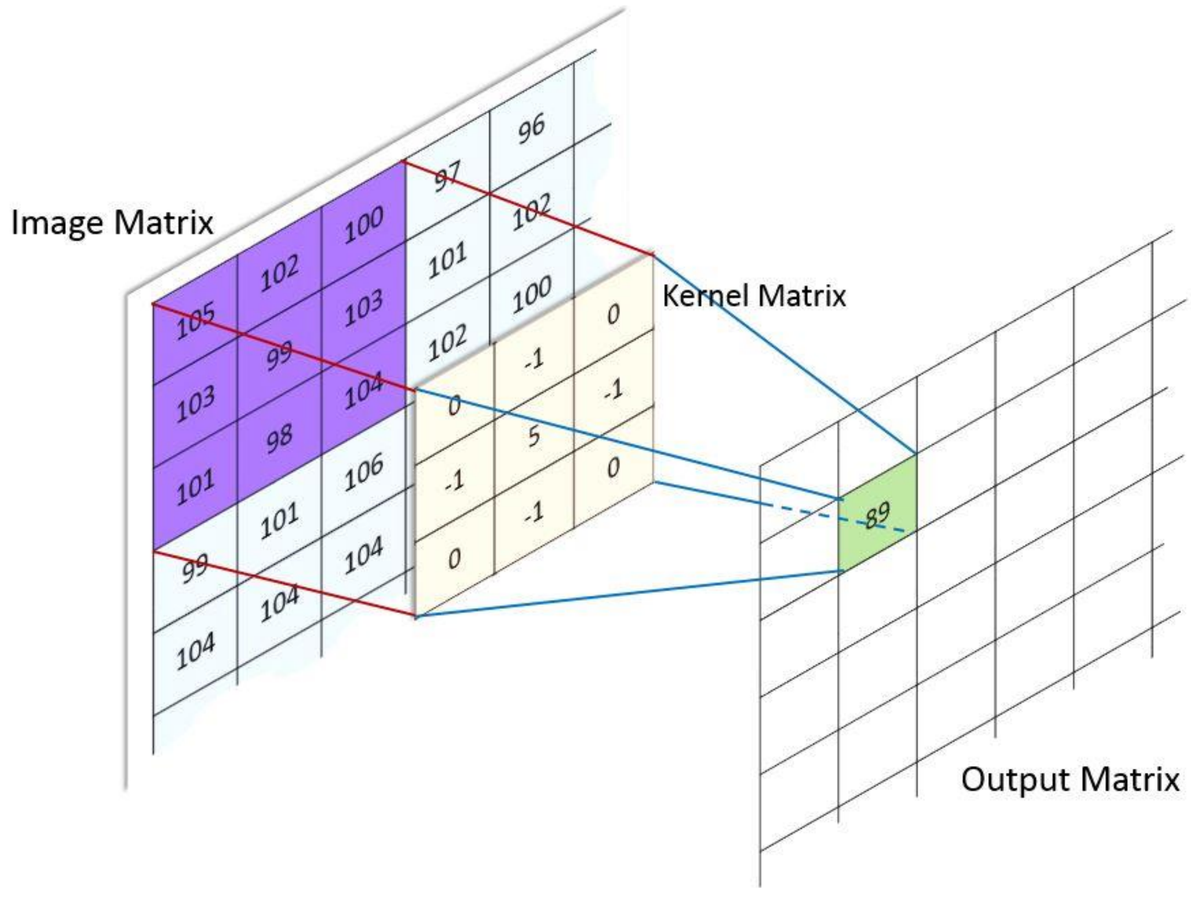
Master of Electronics and ICT Engineering Technology

1) Problem

Sorting green beans in bulk food sorting applications has still room for improvements. The highest quality requirements of the customers are still not met. This low quality is due to the complex shape and texture of these beans and defects that are present. The bean can have various small defects as well as that the stem or stalk is still present. Therefore an approach with machine learning is explored.

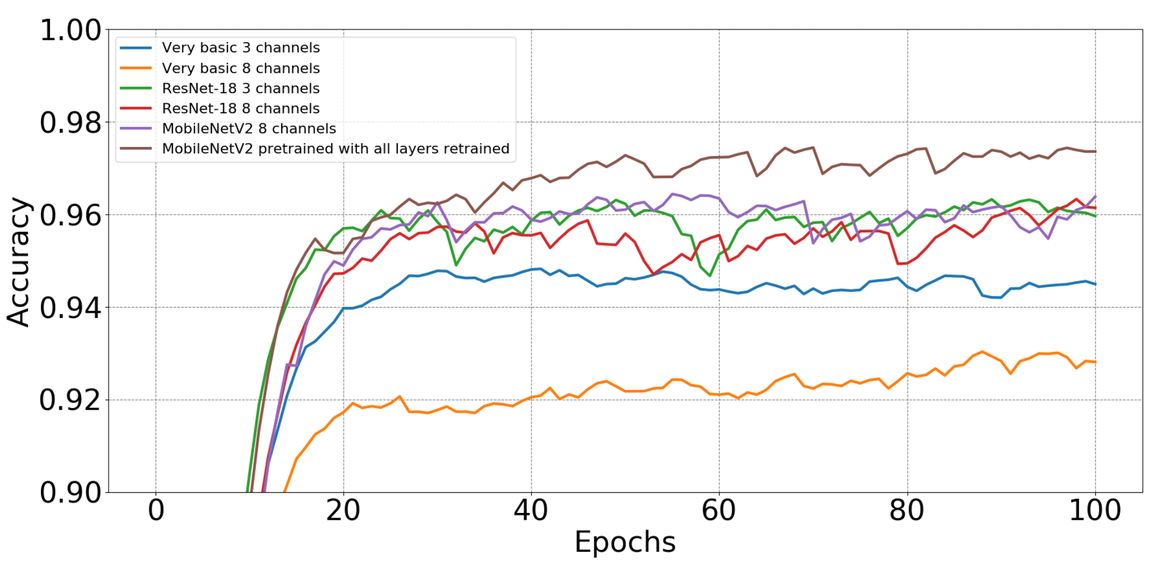
2) Method

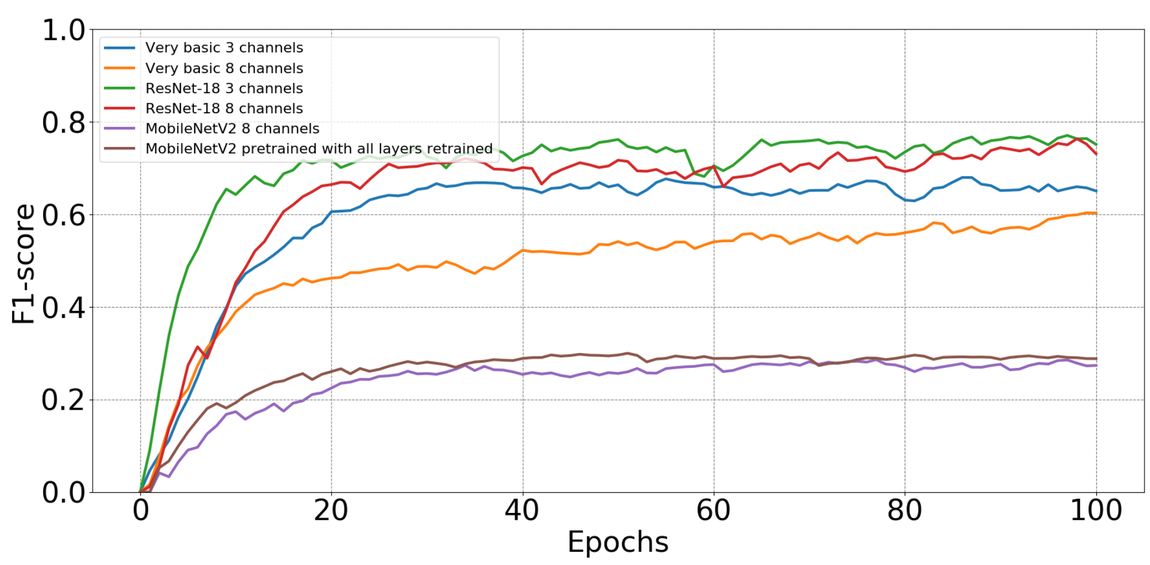
In this research multiple model convolutional architectures were used on two sorts of images. These two sorts of images have 3 (RGB) channels or 8 channels that contain extra information gathered with laser. The tested model are a basic custom, ResNet-18, ResNet-50 and MobileNetV2 architecture. The models were run in a local Python environment that uses TensorFlow and Keras which makes it possible to train on a GPU.



Visual representation of a convolution [1]

3) Results





The ResNet-50 is not visualized in this figure because it took too long to train with very low results after 10 epochs. These results do not yield a network that classifies the objects correct enough to use in production. The questionable results are mainly due to the lack of training data. The data set that was provided was simply to small. Another explanation is that the samples in the data set are sorted by hand. This introduces the risk that errors are inserted into the data set.

4) Conclusion

In this research multiple network architectures are tested while none of them succeed in classifying the data with a high enough F1-score. This calls for further work. Therefore a few task are given. The first is constructing a method to efficiently acquire a representative data set. The second task is developing a better and preferable custom architecture to successfully classify the objects because all networks (except the basic network) are found on the internet and are designed for another classification task. The last step is the speed up the algorithm so that it can be used in bulk sorting applications.

Supervisors / Cosupervisors: Prof. dr. ir. Luc Claesen
dr. ir. Gert Poesen

[1] M. L. Guru, \Image Convolution." [Online]. Available: http://machinelearninguru.com/computer{_}vision/basics/convolution/image{_}convolutionf g1.html

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