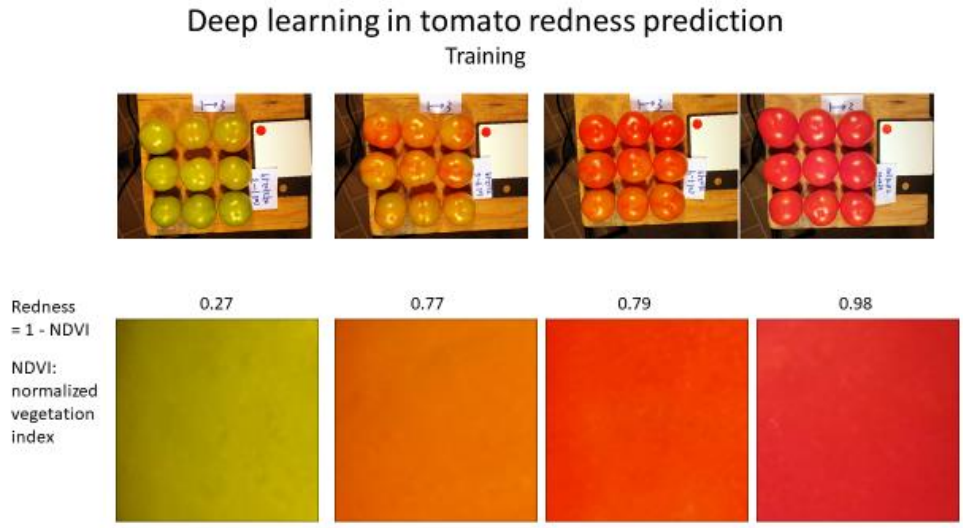
Deep learning in vegetable/ fruit quality estimation

Jiangsan Zhao, Jihong Liu Clarke

Norwegian Institute for Bioeconomy

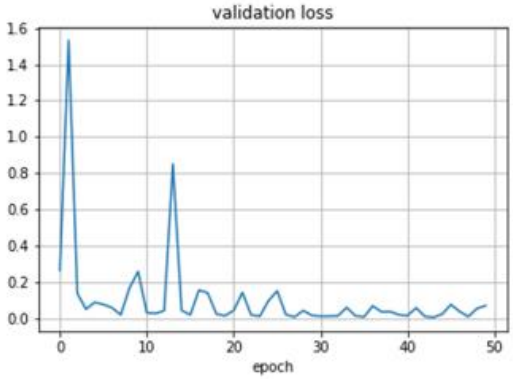
Postharvest loss of vegetables and fruits is severe challenging obstacle for the whole food industry. Its further reduction is of great importance in order to promote marketing and investment for food industry. A grading system that can estimate vegetable and fruit quality, thus helping prolong their shelf life and minimizing malnutrition should be proposed. With the overwhelming advancement of deep learning, non-invasive and automatic quality check is possible through image analysis. The color of vegetables and fruits can effectively reflect their health status and metabolic contents. For example, the color of tomato changes from green to yellow, to pink and finally red with the degradation of chlorophyll and accumulation of carotenoids during ripeness. Lycopene, the major component of tomato red color, also high in antioxidant activity. Leafy vegetables, like lettuce was reported that their chlorophyll content decreased during several storage periods (Perucka et al., 2013). The amount of chlorophyll content is largely responsible for lettuce's green color which is one of the most parameter affecting customers' purchase decision. Quantitatively determination of vegetable/tomato's color index, either red or green through deep learning can be of great value in several aspects at least: classifying them as health and rotten, ripeness level and estimation of the potentials shelf life. As the color quantification is more objective, it can provide growers and workers during handling process with more precise guidelines like the time points of harvest, separation of vegetables/fruits based on maturity levels and more specific storage conditions for to prolong shelf life.

Preliminary results of deep learning in tomato red color estimation:



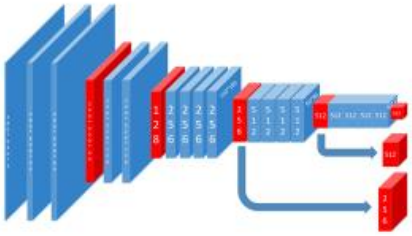
Deep learning in tomato redness prediction

Validation loss



Deep learning in tomato redness prediction

demo



VGG19 network architecture

Will be implemented in mobile phone for color prediction

The preliminary results have shown very high prediction accuracy (low validation loss) in terms of tomato redness. It can be further improved for tomato automatic detection, size estimation, different colors' prediction and finally implemented in mobile apps for widely usage.

Reference

Perucka, I., Olszówka, K. and Chilczuk, B., 2013. Changes in the chlorophyll content in stored lettuce Lactuca sativa L. after pre-harvest foliar application of CaCl2. *Acta Agrobotanica*, *66*(4).