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Continual learning to study the ripening of agricultural commodities using infrared thermography

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Abstract

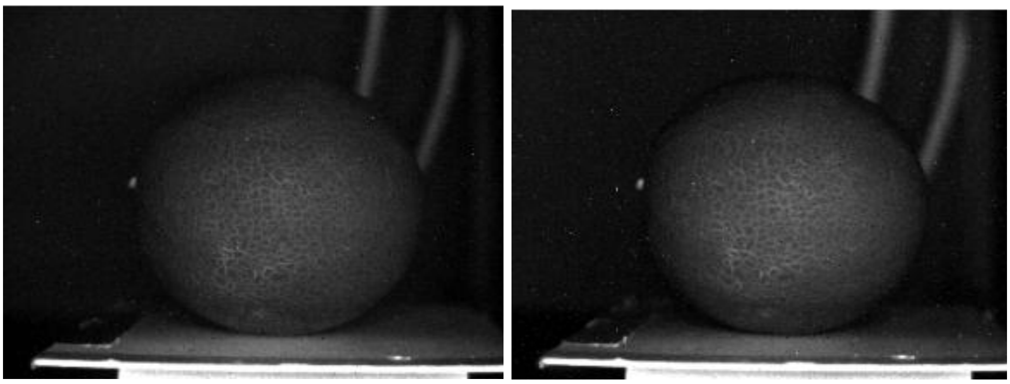
Deep learning holds on the assumption that the data trained on come from the same data distribution. While continual learning is a revolving branch in deep learning which allows to break this assumption, it tries to infer novel tasks by not forgetting previously acquired knowledge when data is incrementally available. Using regularization-based approaches and replay methods, we are able to show that good results can be achieved when training on thermal datasets to alleviate forgetting previously tasks.

1. Introduction

The high demand for ripe agricultural goods encourages research to find features that directly relate to the flavour and aroma of fresh articles. While agricultural goods come with different morphological traits, the detection of external defects and bruises has become a well-established computer vision task nowadays mainly approached via artificial intelligence (AI). However, while supervised learning preassumes that all data is available at once, novel approaches try to adapt to sequentially arriving data when changes of the data distribution might be presented often referred to as *concept drift*.

Artificial General Intelligence strives for a system that is able to transfer knowledge by adapting trained knowledge to new situations. Continual learning is methods is one approach that tries to approach this by learning sequentially evolving tasks by learning without forgetting. With fundamentals in robotics, continual learning is inspired by the biochemical interactions within brain activity. While catastrophic forgetting has been alleviated by replaying previously acquired knowledge the inspiration has been drawn from data processing within the hippocampus.

Within this work, we train a deep learning model which has been predetermined by neural architectural search and should be used for sequentially arriving data. To study the potential of continual learning, we study the impact of capability of learning new tasks based on L2-regularization (as a vanilla case), elastic weight consolidation and continual learning using experience replay. Furthermore, we point out their potentials and downsides when being used in real-world applications.



(a) (b)

Fig. 1. *First FFT frame in the infrared (a), (c) mid- and (b), (d) long wavelength at the same ripening stage*