

Deep learning methods in microscopy for evaluating the quality of lithium ion batteries

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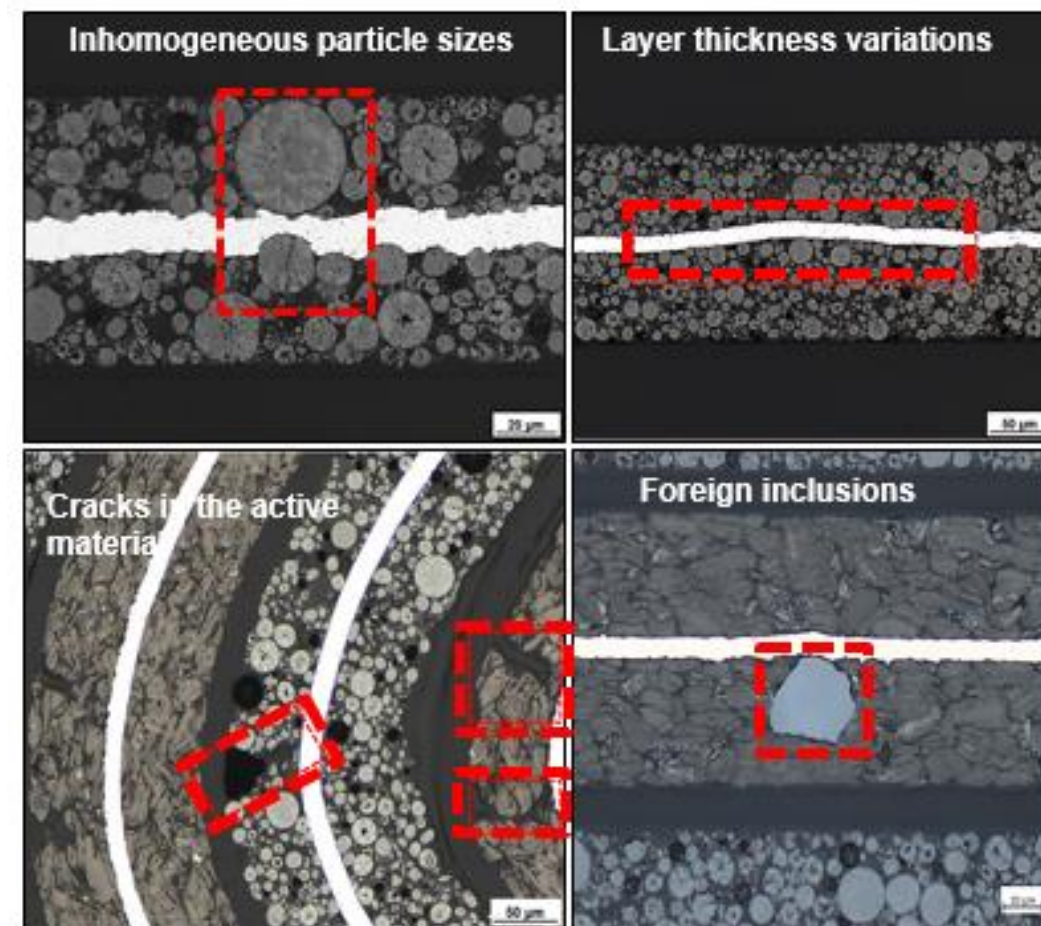
Motivation

The performance of Li-ion battery is intrinsically linked to the electrode microstructure.

Automated electrode evaluation software

- To automatically detect defects such as :

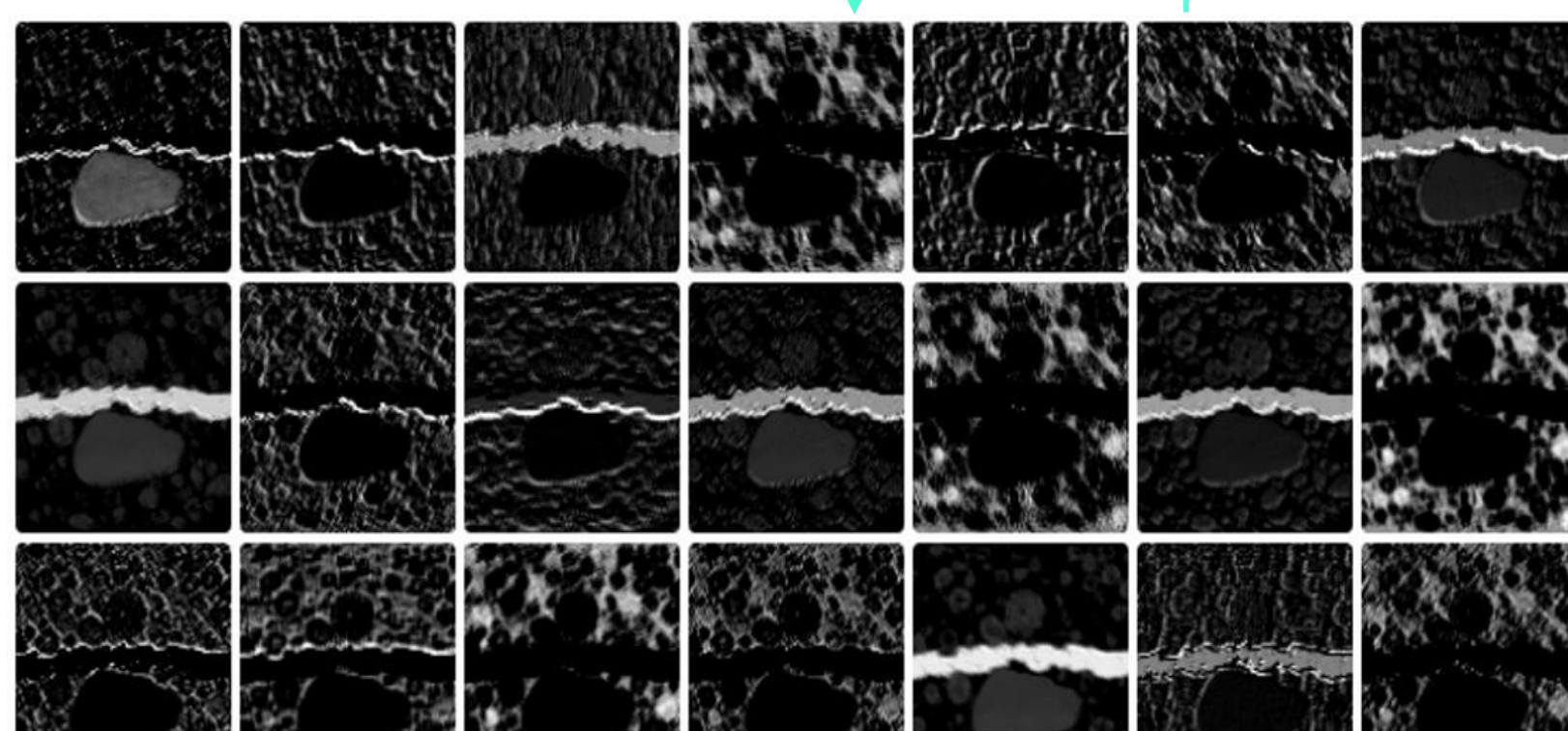
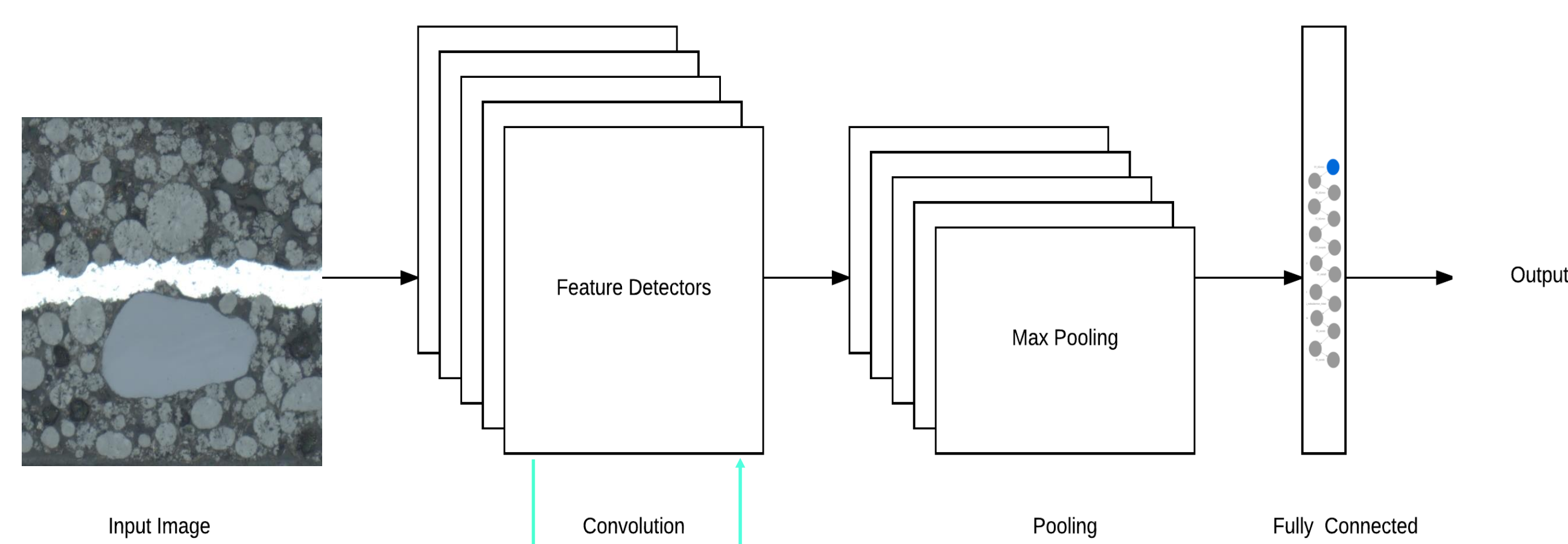
- Cracks in the active material
- Foreign inclusions
- Layer thickness variations



Will enable the optimization of production parameters and thus improvement of battery performance.

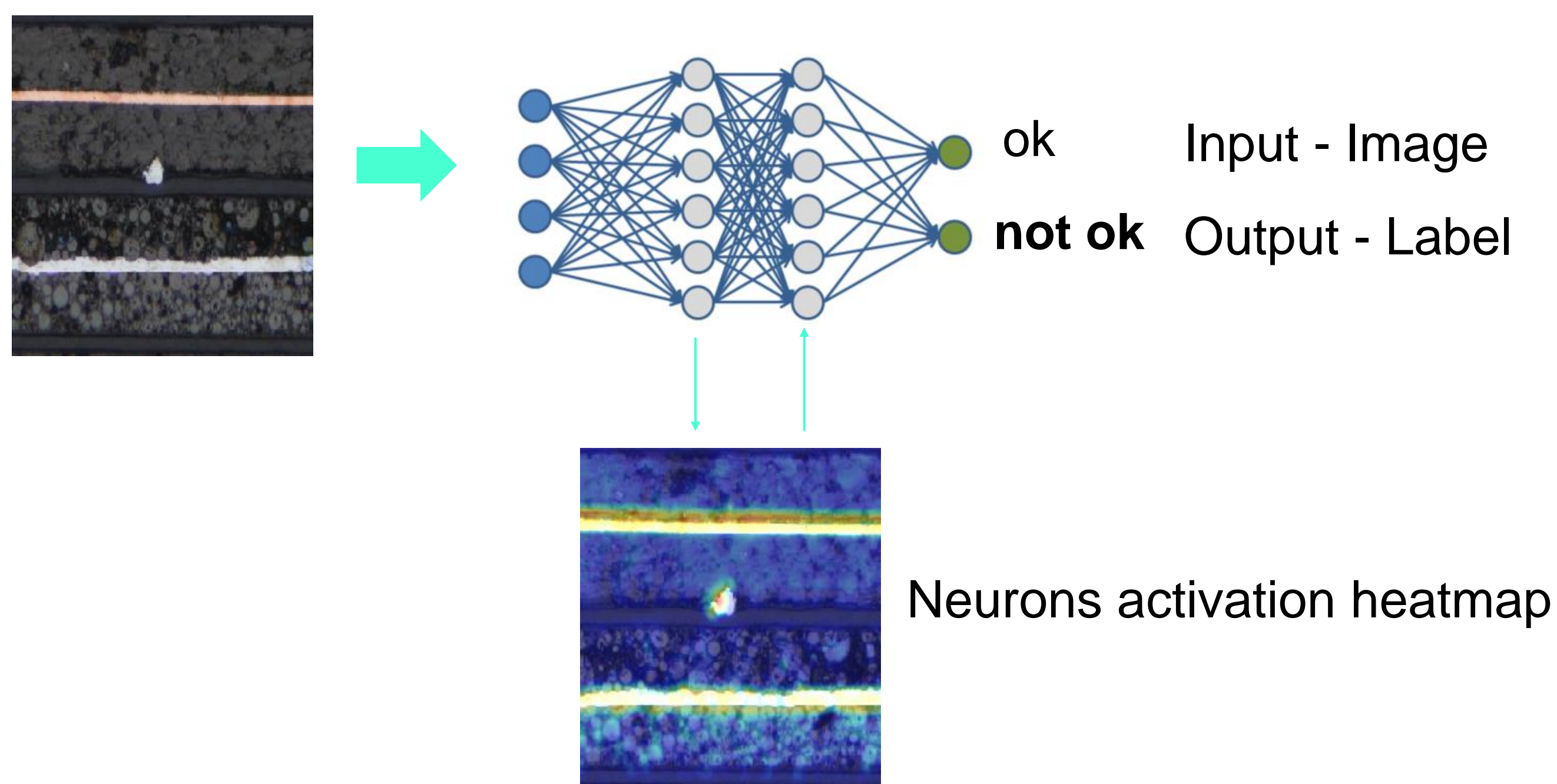
Image classification

Convolutional neural network

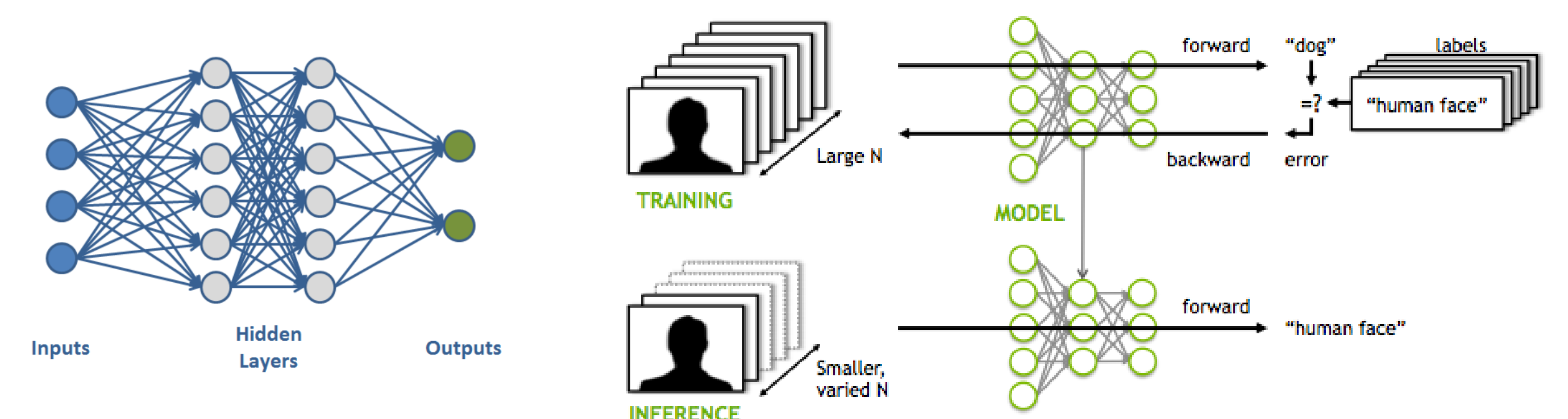


Convolutional layers automatically learn to extract meaningful features from the images

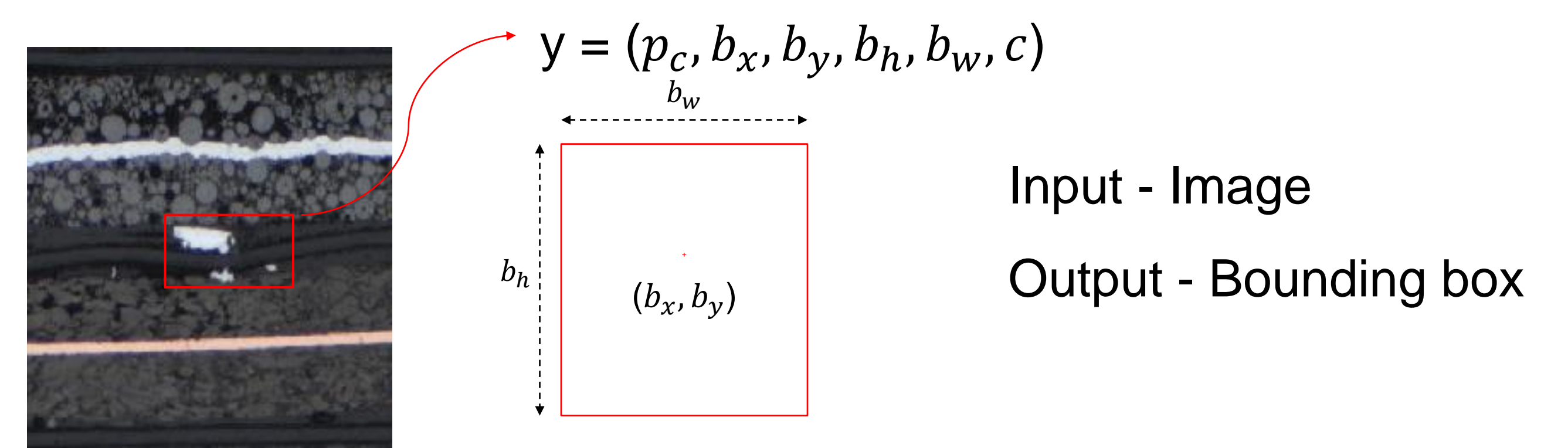
Neurons activation heatmap



Deep learning

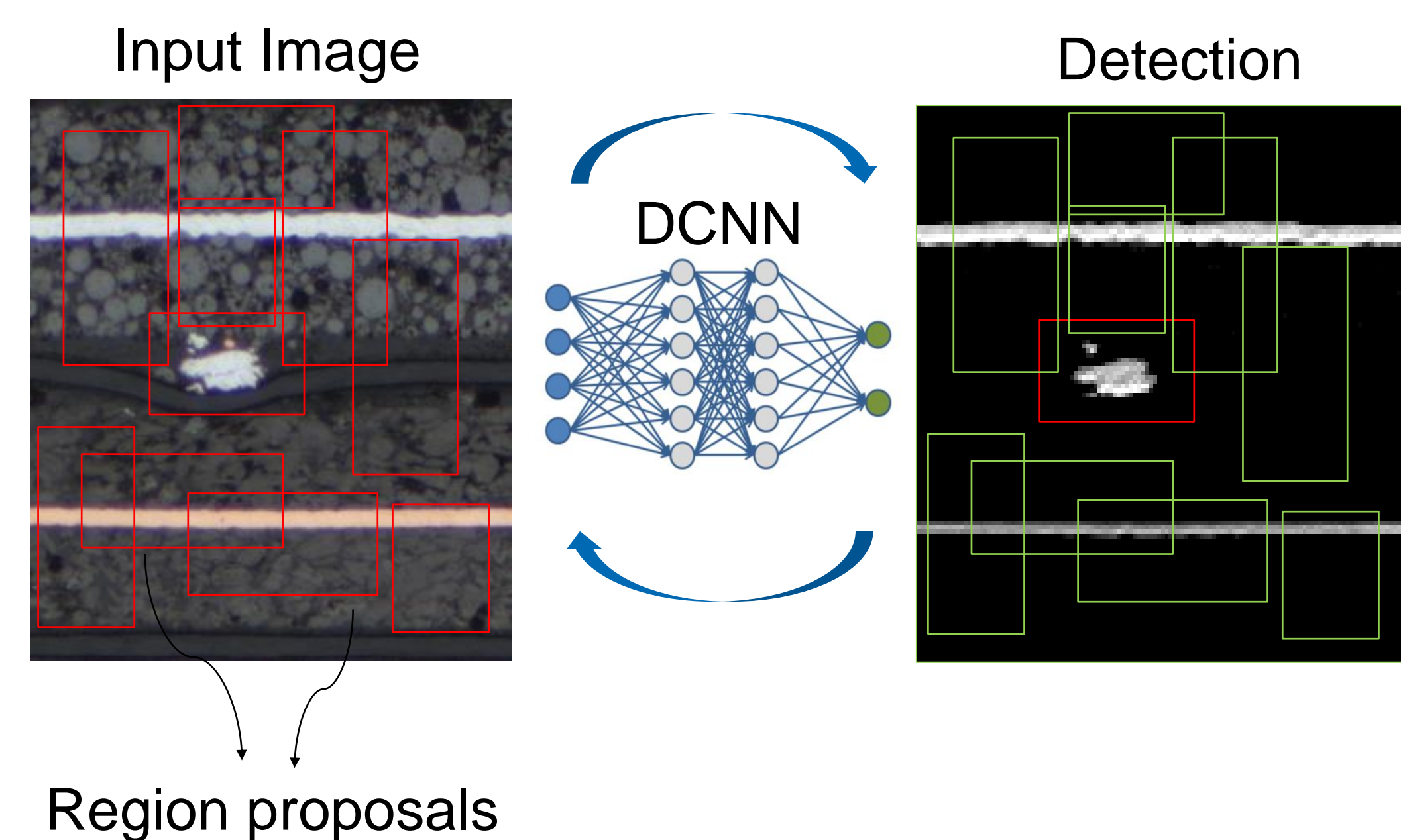


Object localization

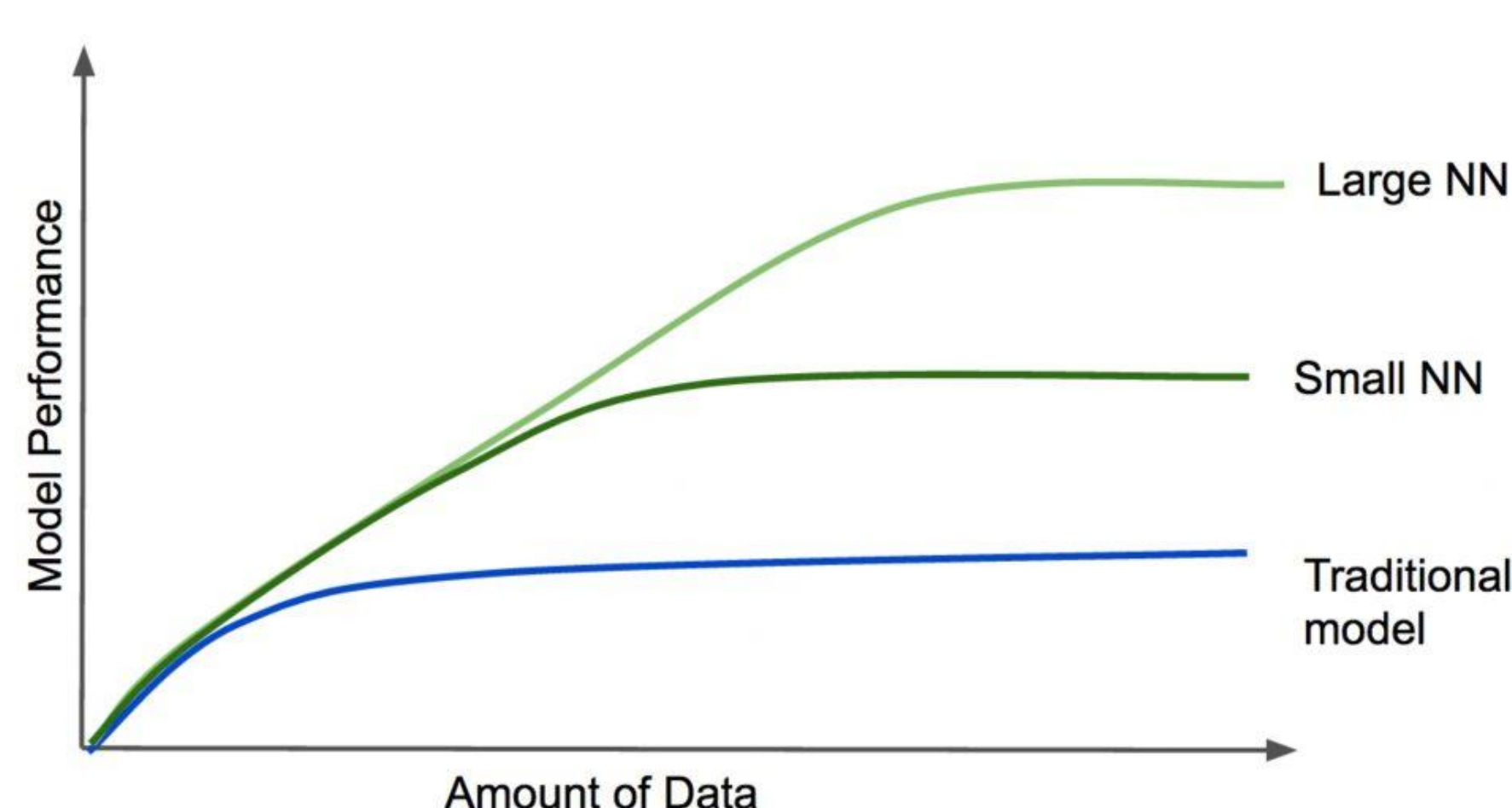


$p_c = 1$: confidence of an object being present in the bounding box
 $c = 0$: class of the object being detected (0 for defect, 1 for no defect)

Region proposal network



Conclusion



Automating the qualitative evaluation of lithium ion battery microstructure using deep learning

- Provides a scalable tool for enabling the optimizing of battery production parameters.
- Allows for cost effective and efficient quality assessment of batteries from various producers.
- Since relevant features are automatically learned from data making the model more robust to various imaging conditions.