# An approach for smart and cost-efficient automated E-Waste recycling for small to medium-sized devices using multi-sensors

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Recycling electrical and electronic devices in an automated method can reduce the negative impact on human health and the environment compared with manual dismantling. This approach suggests using multi-sensors by using RGB sensor to classify the devices using a deep learning method and InfraRed (IR) sensor to recognize the internal component of the device. Particularly, the sorting accuracy achieves 98.5% using the state-of-the-art EfficientNet for the tested devices, and infrared images give a significant guide to the main components of the devices. Eventually, this information can be transferred to the next stage of material processing to provide fewer risks and a smarter way to avoid toxic materials.
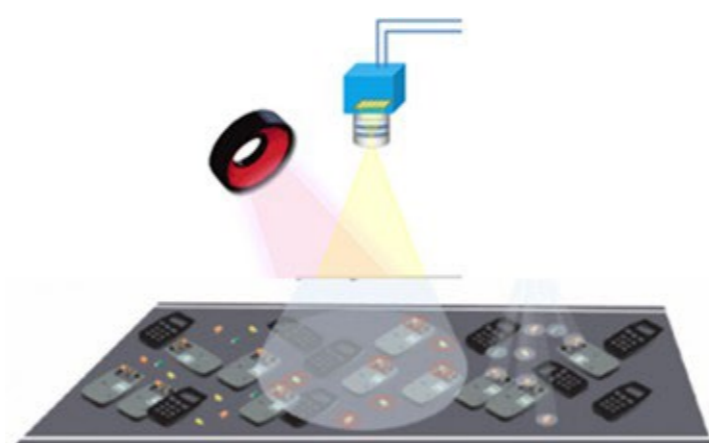
Using an InfraRed Sensor

IR images could reveal the internal components of a smartphone (such as the battery, the lenses, and the fingerprint sensor) and an electric screwdriver (the motor, the battery, and the head)
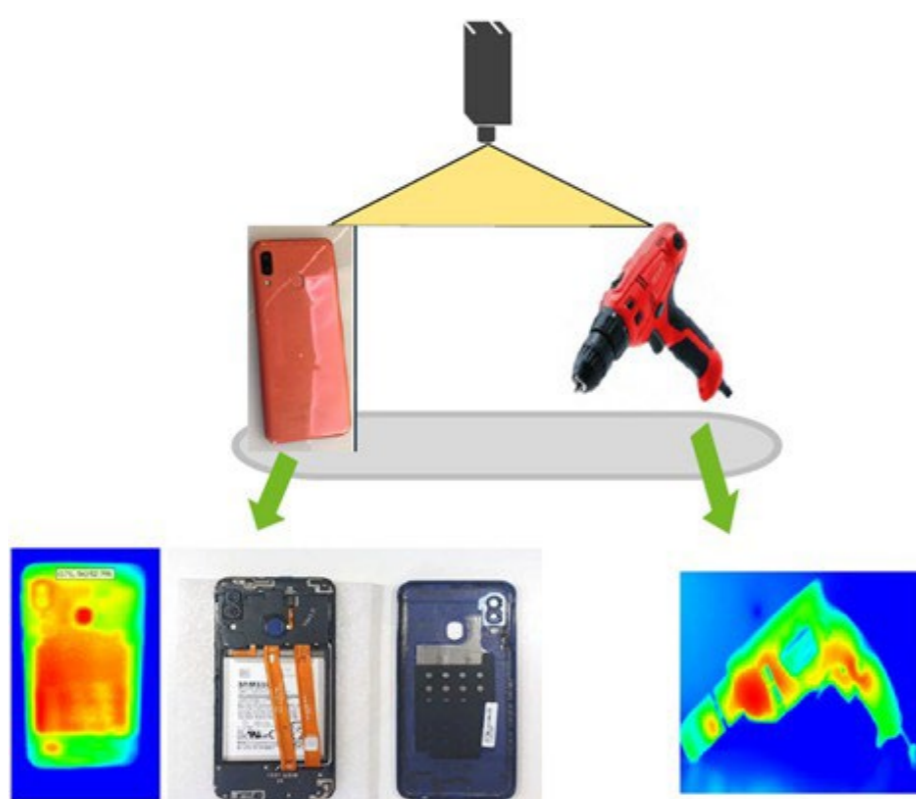

Figure 1. Using IR sensor to detect the internal components of the device

Future work

- Testing more electrical devices and include more sensors like X-ray.
- Further experiments: Defining the characteristics of materials based on their heating and cooling curves.

Using an RGB Sensor

RGB sensor to classify devices into device type, brand, and model number. Therefore, transfer learning is applied using a pretrained weights of EfficientNetB0.
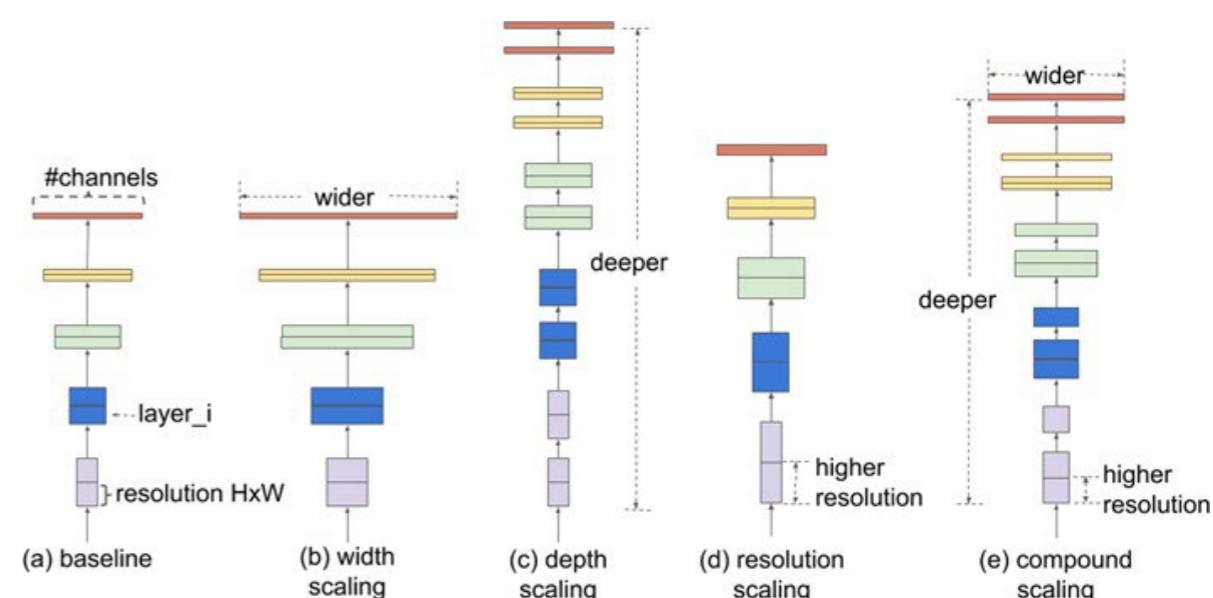

Figure 2. Model scaling concept of EfficientNet

iPhone 3, 97.5%

GSR 12V 15, 98.1%

Samsung A20, 98.5%

iPhone 4, 98.3%

Figure 3. Example of classification accuracy of a subset of the tested devices