

Material Recognition Using Deep Learning

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Material recognition is the process of classifying material into different categories. Classification of material is very important problem applied in many fields and in this project we focus on the industrial field. In many factories that use production line to manufacture their products, one step is to separate materials and package different materials. It helps to move each material into specific containers. This step usually requires a worker to sort the material. This is time consuming because the worker needs to wait until the product is ready to sort it. This repetitive step can be automated which saves money and time and can improve efficiency. Deep learning (DL) is a branch of machine learning, employing deep neural network architectures to solve different problems in computer vision, and image classification. In our project we propose an automated material recognition system to classify and separate the most common types of materials using deep learning. This is very useful for Jordanian factories because the factories are looking to maintain quality and reduce the cost of production.

We constructed our system by training on the common Flickr Material Database (FMD) dataset as a baseline for comparing the performance of our system. We used a convolutional network architecture called VGG 16 trained on the Image Net database then adjusted the weight by training on the FMD dataset. The system achieved a 94.9% accuracy that is higher than the reported performance in the literature. Internet of Things (IoT) is a very important technology nowadays. Hence we wanted to implement our project and make it smart by embedding our DL system and program microcontrollers –Raspberry Pi 3 and Arduino- to make our system portable with low cost.

To adapt the system to Jordanian factories, we built our own database, The University of Jordan Inspection System (UJIS) database of the same material categories. The same architecture was trained on UJIS and it achieved an accuracy of 96.9%. The proposed inspection system consists of inspection room that contains a camera that is connected to the Raspberry Pi 3 to do the required deep learning operations for material classification. We demonstrated an excellent recognition rate that is consistent with the accuracy above.