Waste Classification System Using Image Processing and Convolutional Neural Networks

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CNN use for plastic garbage classification method

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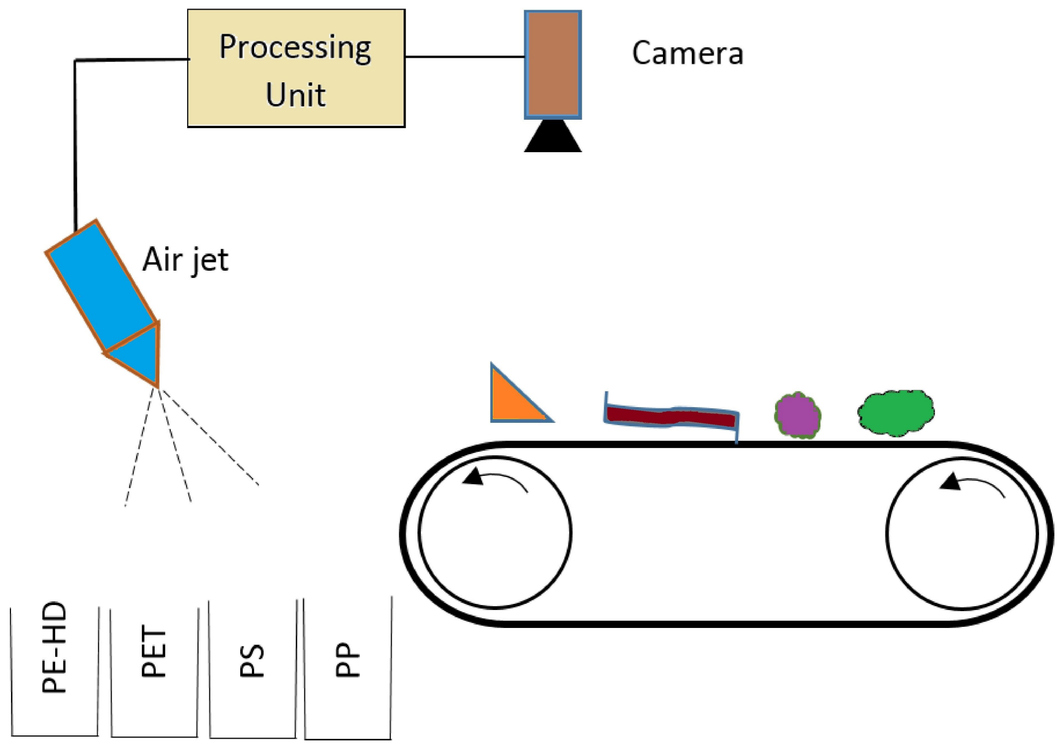
Sorting of materials is part of the municipal waste management necessary in the recycling process. The manual sorting process is tedious and expensive, which is why you need to create automated sorting techniques to improve recycling efficiency. An important element of the whole process is the preliminary division of waste into various groups of materials, followed by detailed segregation. The disposal of plastic waste is the most important problem in environmental protection. The article proposes a method for the automatic plastic waste segregation system. The convolution neural network was used to classify images with plastic waste most popular in household waste, and in particular polyethylene terephthalate, which can be reused. We offer a simpler and hence faster network compared to AlexNet.



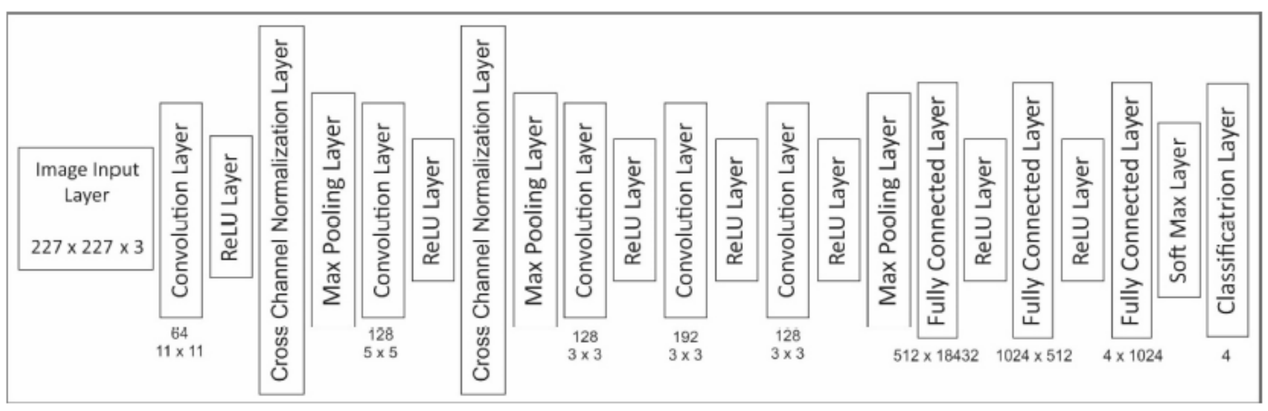


Figure 2: The structure of the AlexNet - 23 layers

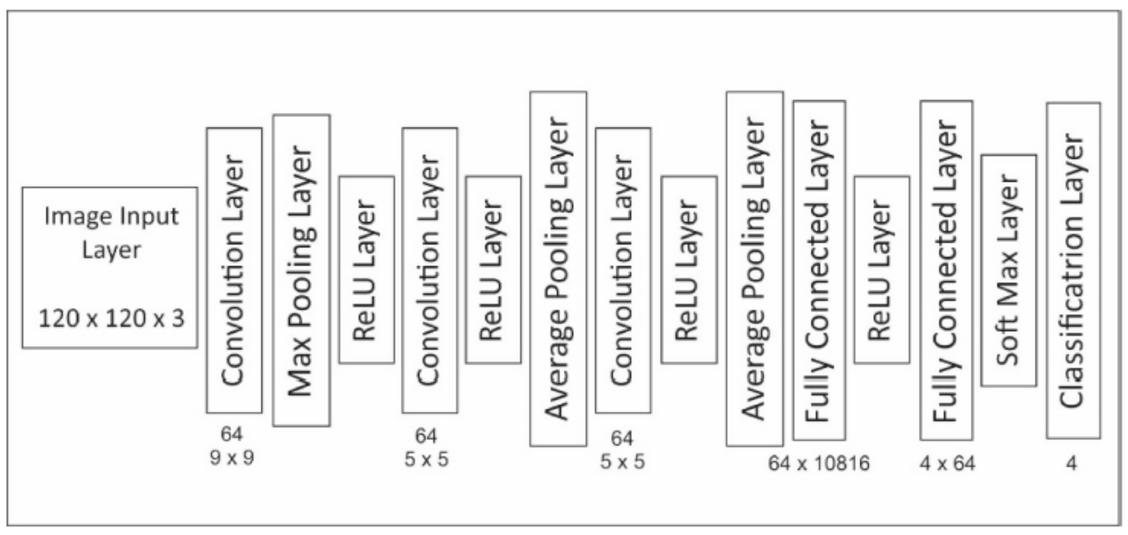


Figure 3: The structure of our networks - 15 layers

NETWORK	No. of Layers	Size of images	Accuracy [%]	Learning time [s]
AlexNet	23	120x120	96,41	364
Our Network	**15**	**120x120**	**99,92**	**217**
AlexNet	23	227x227	99,23	725
Our Network	15	227x227	91,72	540

CONCLUSION AND FUTUREWORKS

The obtained research results showthat our 15 -layer network allows to achieve high performance for images with a resolution more than twice lower than the 23-layer network with images of 227 x 227 pixels. Classification of segregated waste into four main classes takes place in most cases without error. An additional advantage ofour network is definitely a shorter learning time compared to the AlexNet network, especially for 120 x 120 pixel images. Our in the future assumes the ability to train the network while working in real conditions. That is why we are trying to obtain video records of waste on the conveyor belt from waste segregation companies. After introducing modifications in the training database, we also want to determine the accuracy of classification of actual images of waste taken from the conveyor belt during the segregation process.