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Faculty: Medical Engineering and Technomathematics
Course of Study: Scientific Programming

Autonomous Fault Detection Using Artificial Intelligence Applied to CLAS12 Drift Chamber Data

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While fully connected feed forward networks work well on data of moderate dimensionality, training them becomes increasingly more difficult once the number of inputs grows. In the case of image classification for example, even an image with just a resulution of 256x256 pixels produces $256 \cdot 256 = 65536$ inputs. Considering that colored images usually have at least three color channels (take the popular **R**ed **G**reen **B**lue color model as an example), this multiplies the amount of input dimensions by a factor of 3, yielding $65536 \cdot 3 = 196608$ dimensions total. If we wanted to use a fully connected hidden layer with only half as many hidden neurons, we would have to optimize $196608 \cdot 98304 = 19,327,352,832$ weights only for the first layer. Let us assume that storing a single weight in floating point format costs 4 bytes. This would lead to spacial requirements of $19,327,352,832 \cdot 4 = 77,309,411,328$ bytes or 77.31 gigabytes! One should quickly notice that using this kind of neural networks to classify images is beyond infeasible. But how is it possible that state-of-the-art classifiers achieve human like performance in image classification, also relying on artificial neural networks [Rus+14]? In the following sections, we will explain how to modify our current feed forward architecture in order to cope with these challenges and how these astonishing results are possible.

4 Implementing and Testing a CNN-Model in DL4J

5 Discussion

6 Conclusion

Bibliography

[Rus+14] O. Russakovsky et al. “ImageNet Large Scale Visual Recognition Challenge”. In: *ArXiv e-prints* (Sept. 2014). arXiv: `1409.0575 [cs.CV]`.

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