

Blood group typing with Artificial Intelligence

Degree programme : MAS Data Science

Developing a proof of concept to solve forward blood group typing with a neuronal network and integrating the model into the existing system with minimal impact.

Introduction

Determining blood groups across several blood group systems with high accuracy and high throughput has always been a challenge. The TWIN System of CTC Diagnostics AG solves this problem by printing a matrix of antibodies into a single well. Ensuring high-throughput forward blood group typing of the ABO-, Rh- and Kell blood group systems with high accuracy. The TWIN System uses images of the wells and measures the size and intensity of the reacted dots in the well to determine if a phenotype is present or not. At the moment the system uses basic image processing and calculates threshold values to analyze and check for positive blood group phenotypes. It shall be examined if a neuronal network can achieve the same or better accuracy to predict the blood group phenotypes from the same picture of the reacted well. Furthermore, a concept to integrate a neuronal network into the existing TWIN System with minimal impact and maximum flexibility shall be developed.

Blood group prediction with a Neuronal Network

Before the images enter the neuronal network for prediction, the input data needs to be prepared. In this step, called feature engineering, the images are resized, cropped and the pixel values normalized.

Additional image processing like increasing contrast and transforming to grey-scale were necessary for the network to learn the patterns. A convolutional neuronal network was used as a multilabel classifier. This makes it possible to detect all the available blood group phenotypes at once with one single neuronal network. With this approach, the accuracy of >96% for every single phenotype was achieved, showing that a neuronal network can be an alternative or maybe even better solution for forward blood typing in the TWIN System.



Marco Meier

Software Architecture

A microservice architecture makes it possible to integrate the neuronal network into the existing system with minimal impact. This way the neuronal network can be developed independently and is completely decoupled from the rest of the existing software. A streaming component connects the TWIN System to the microservices, making it the only modification needed within the TWIN software. The microservices consist of an AI image analysis service, which calls the neuronal network and stores the results along with the image and the sample Id, and a Web Application to view the predictions of the neuronal network.

Results

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=H01402130041200__Well6
AB+CCeekk

=H01402130041100__Well3
B-cceekk

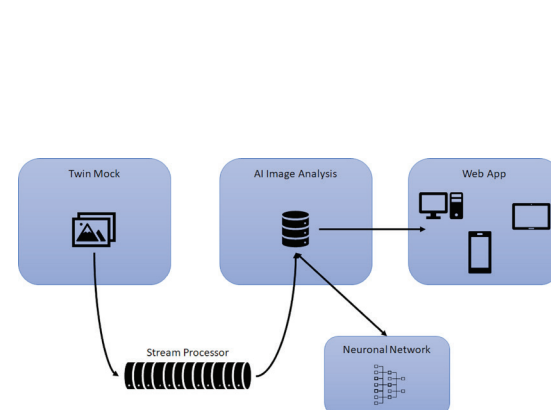
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B+CCeekk



Web Application



Microservice Architecture