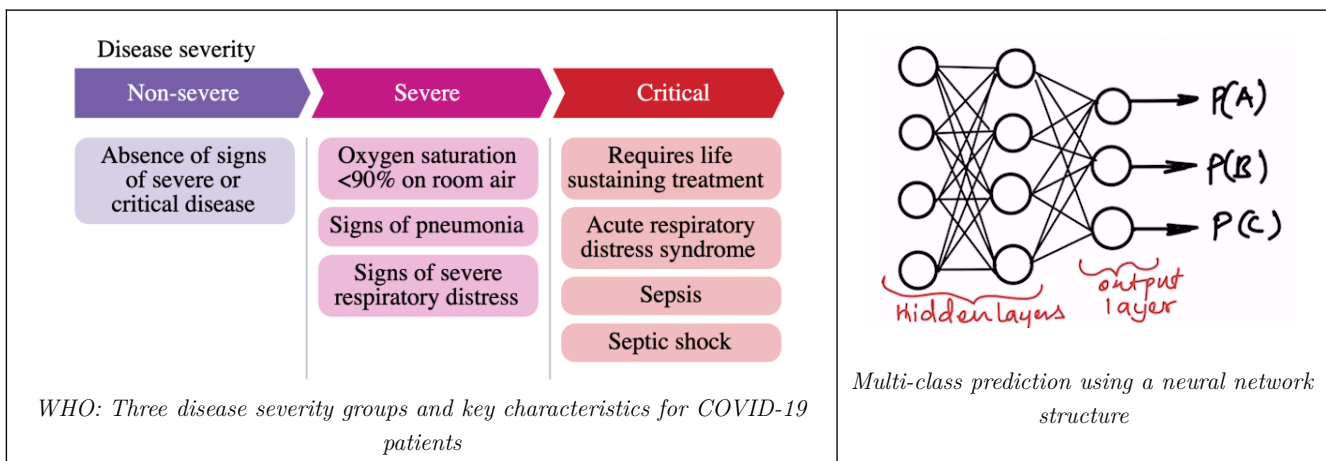


## Hyper-parameter tuning of neural network models for prediction of WHO COVID-19 severity states based on immunological marker signatures

In a former project it was shown that the severity of an acute respiratory distress syndrome (ARDS) following a SARS-CoV-2 infection can be predicted with quite good accuracy from flow cytometry immunological marker signatures using purpose-trained neural networks. Nevertheless, training success and validity of networks predictions depend strongly on data quality as well as prior data preparation. Different machine learning methods can be used to reduce data dimensionality, remove data noise and balance predictor variability prior to network training. Based on the results of such pre-processing efficient hyper-parameter tuning of neural networks can dramatically decrease test and validation errors during the training process and thus the amount of false classifications.

This thesis will be part of the MUDAFACS project at the Institute for Environmental Research. The aim of the thesis is to use different machine learning methods (e.g. PCA, SVM, Random forests) to pre-process flow cytometry data and use the results to manually tune hyper-parameters of a given neural network to predict the WHO severity states of COVID-19 patients given their immunological marker signatures. Former results from a recent research project as well as several Master and Bachelor theses on immunological profiling of COVID-19 patients are available.

The candidate will have the opportunity to develop skills in multivariate data analysis, machine-learning methods and algorithm development in a predictive medicine context. The candidate will work in closely supervised cooperation with the members of the working group for Computational Eco(toxico)logy at the Institute for Environmental Research. Additional support will be available from the Institute for Molecular Medicine at the Uniklinik Aachen as well as the German Cancer Research Center (DKFZ). At least some prior knowledge in programming (preferable R and/or MATLAB) and statistics is required. Experience in immunology and/or flow cytometry will be of advantage.



**In case of interest please contact or go to:**

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