Hyperparameters: Nr. of epochs, learning rate, batch size, num workers, input size, output size

To implement: Test results, linear regression (for Präsi, Doku)

1. Machine-Learning-Enabled Foil Design Assistant

17 Parameters, 13 control points to describe the foil shape

XFOIL: 200Points, cubic spline interpolation with the remaining CL and CD values, 9 alphas, Re=8x10E6

UIUC database of foil designs (1500 foil profiles encoded via point sets of varying lengths) Dataset Vectors

Regression ANN models, Multivariate Linear Regression (MLR), feedforward Artificial

Neural Networks trained with Levenberg–Marquardt (LM) back-propagation, and LM with Bayesian Regularization, Layers: Input 17-32 Parameters, Hidden (20-30 Neurons), Output (9-19 values), hyperbolic tangent sigmoid activation functions

Forward and Reverse Design (Optimization) -> Foil Design Assistant Software

Reverse: XFOIL for coefficients

1. Multi-Objective Optimization of Low Reynolds Number Airfoil Using Convolutional Neural Network and Non-Dominated Sorting Genetic Algorithm +++

Direct problem: airfoil shape -> coefficients, CNN, “classical validation case for low Reynolds number airfoil data is E387 at a Reynolds number of 2.0E5”, alpha=4.5°, XFOIL + CFD comparison for coefficients, 15 low Re-Numbers, Images (greyscale 160x160 were used) for airfoil shape, normalization: max, min values), Relu act funct

CNN structure: 5 conv-pooling pairs, 2 fully connected layers, 1. 256 neurons, 2. 128 neurons, output layer: 48 neurons-16 for each coefficient

Optimisers: SGD (different parameters: converges after 400 epochs), adaptive learning rate: AdaGrad (lr0.1), RMSdrop (lr0.0001), **Adam (lr0.0001)->chose**

1. Machine learning in aerodynamic shape optimization
2. A reinforcement learning approach to airfoil shape optimization
3. An inverse design method for supercritical airfoil
4. High Reynolds number airfoil turbulence modeling method based on machine learning technique

Turbulence Modeling

MLP (Multi Layer Perceptron), Pytorch, Adam, batch size 128, lr0.003, training epoch 300, error order 10E-5