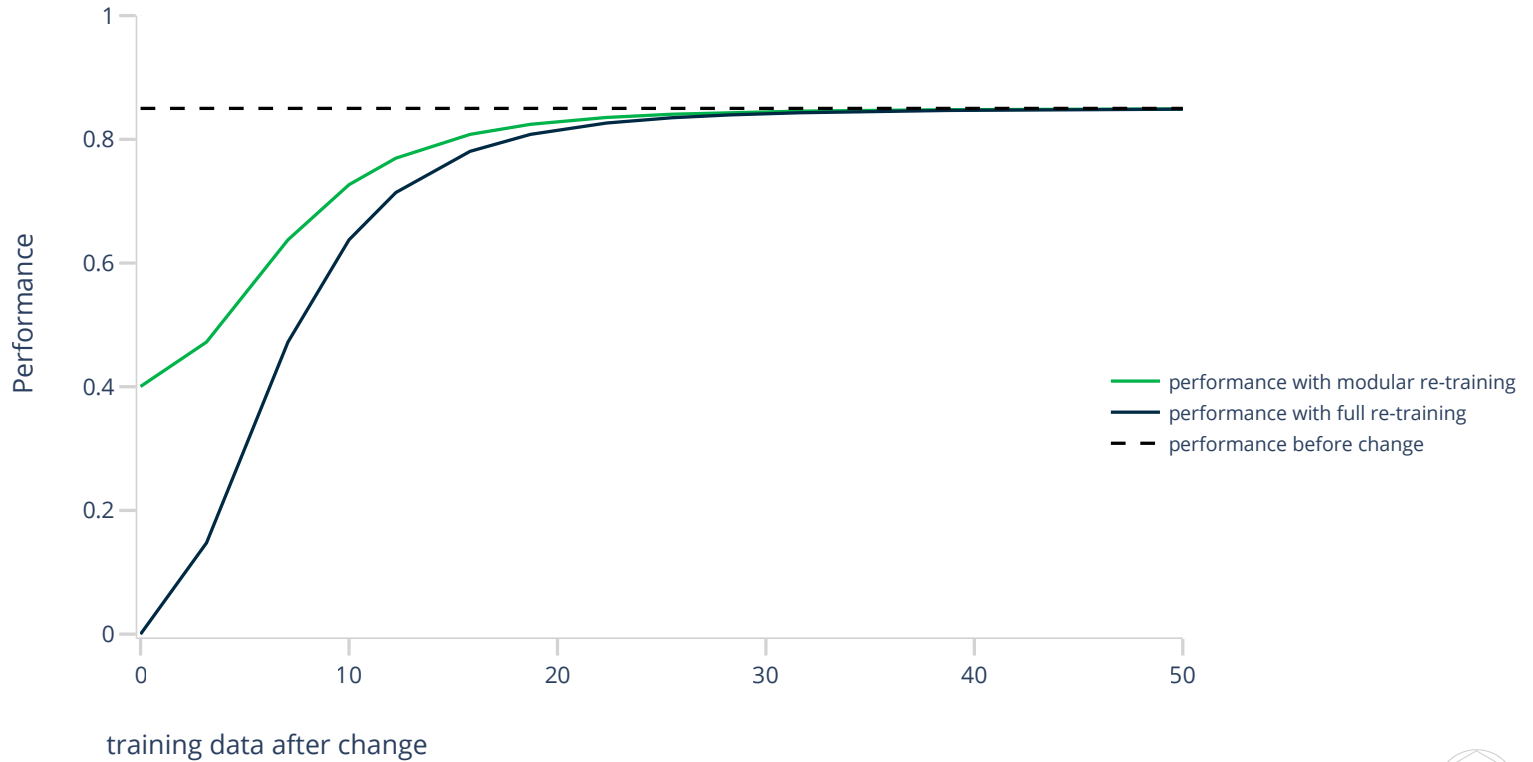
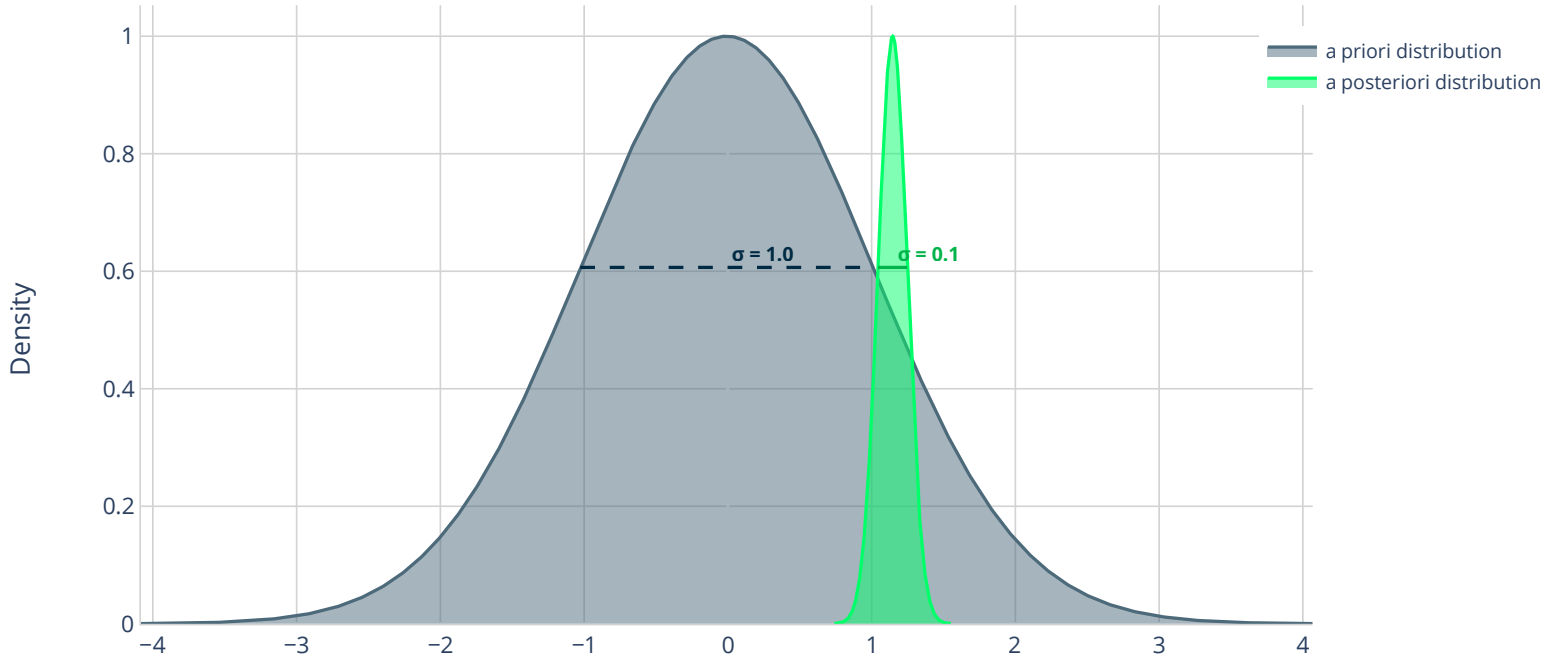


## Modular re-training after a change in the process.

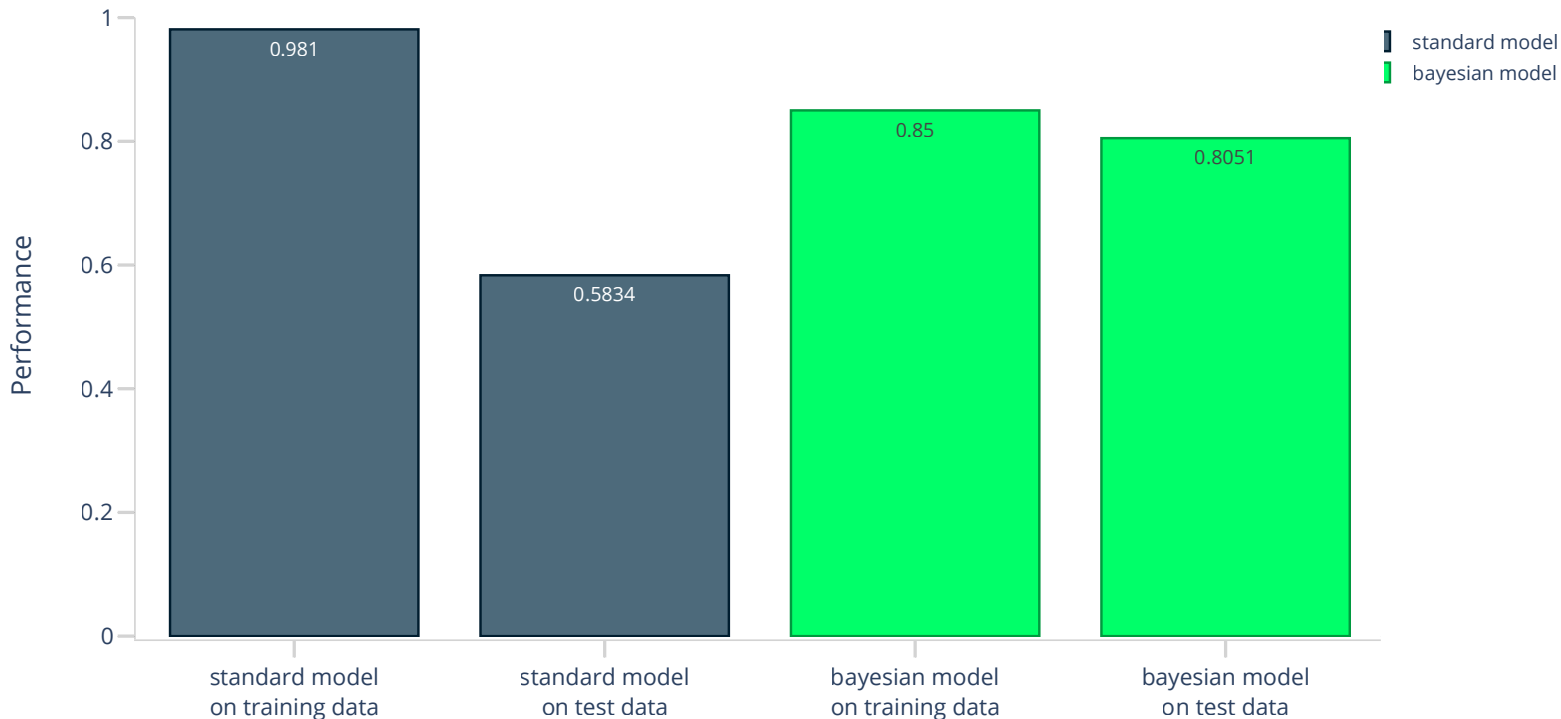


## Information update about model parameters



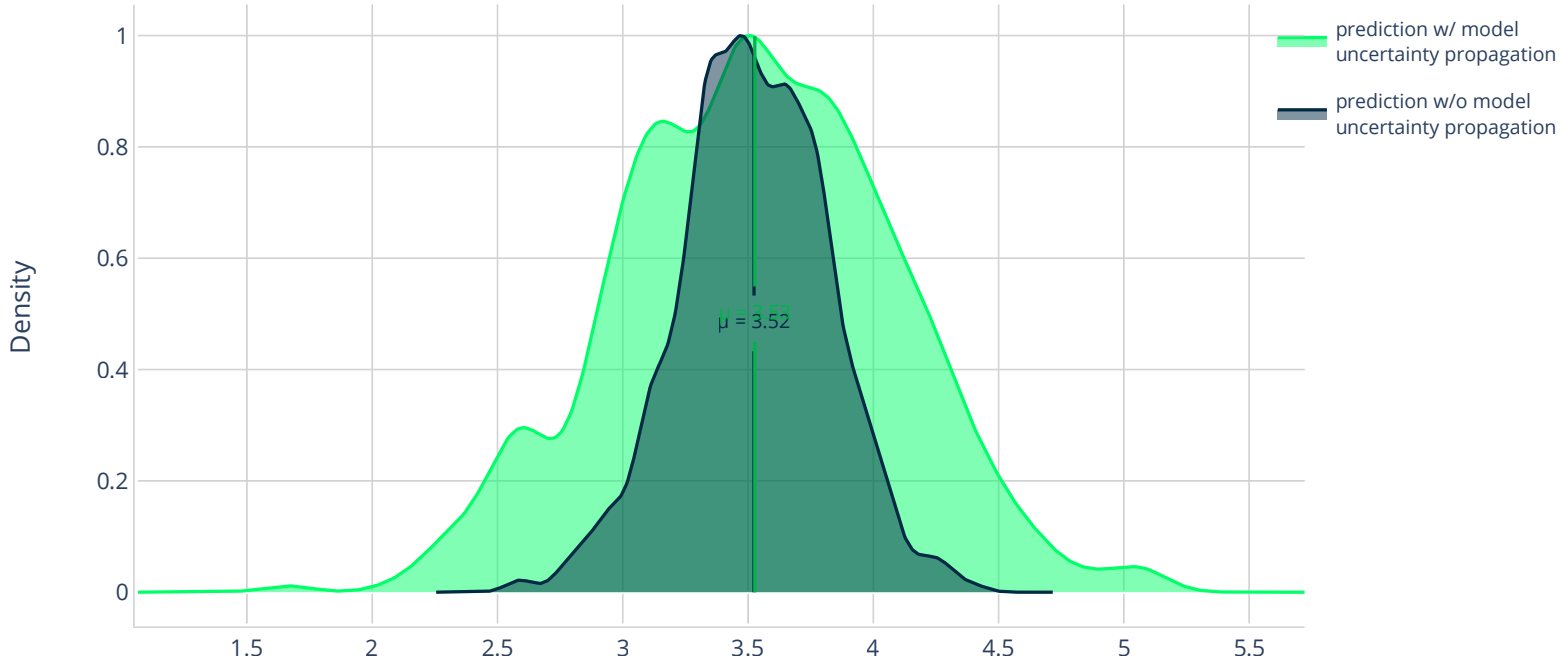
Training parameters means updating their a priori distribution to a a posteriori distribution. This update shows the information gain (the narrowing of the curve). The width of the posterior curve shows how much uncertainty about the parameter is left. Shown in blue is the a priori distribution that shows the state of information before training. Shown in blue is the a posteriori distribution that shows the state of information after training.

## Built-in regularization



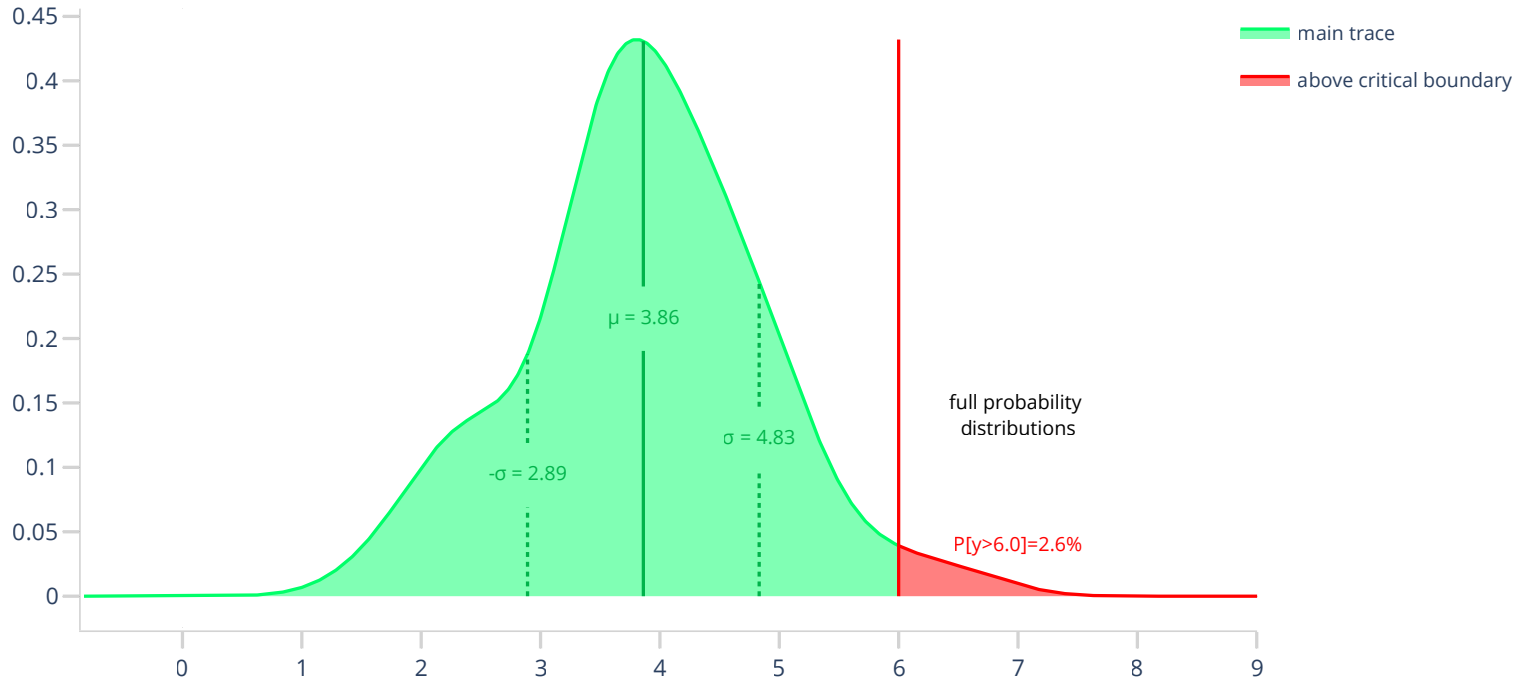
Bayesian models are automatically regularized which makes them less prone to over-fitting.

# Don't underestimate your uncertainties!



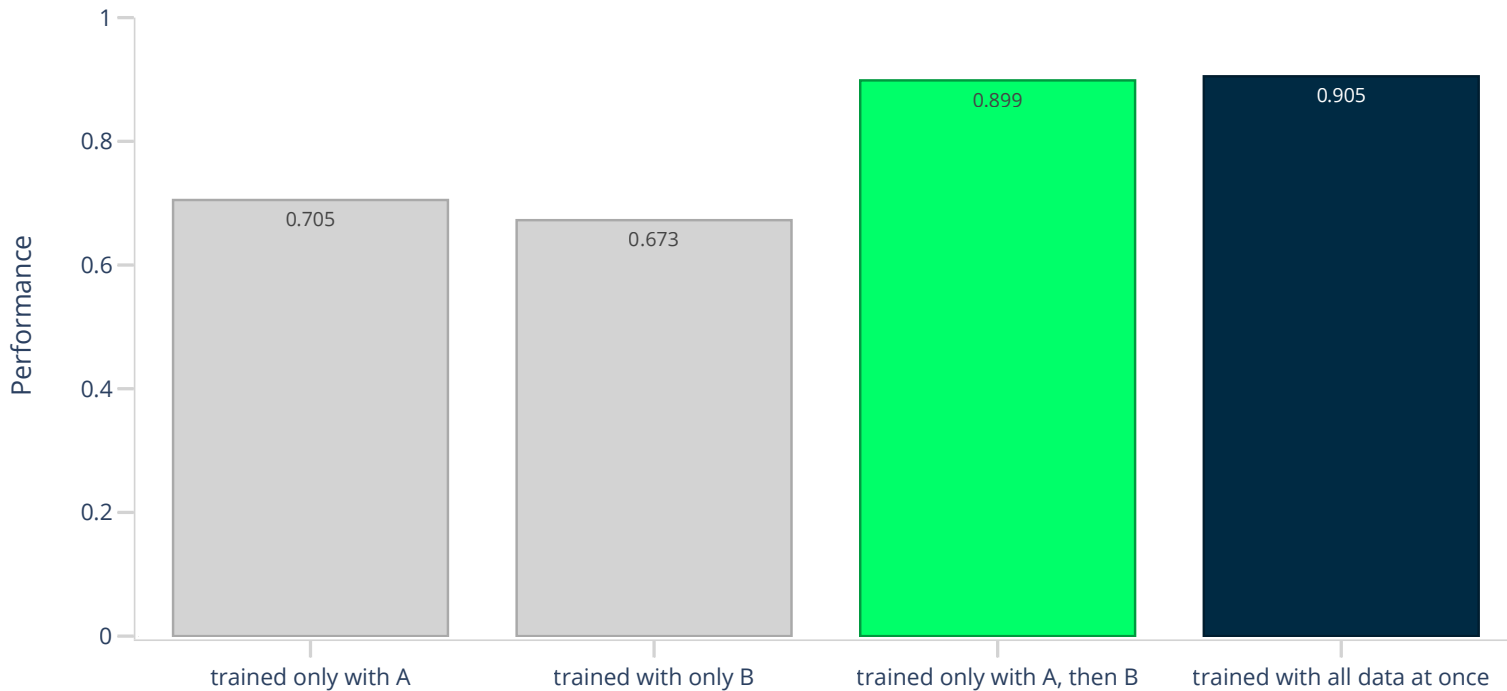
To only consider the uncertainty encoded in the model means underestimating the total uncertainty. The blue distribution is the output prediction without considering the model uncertainty. The green distribution shows the prediction with the model uncertainty. As is visible, the blue distribution underestimates the error.

# Quantitative Risk Assessment



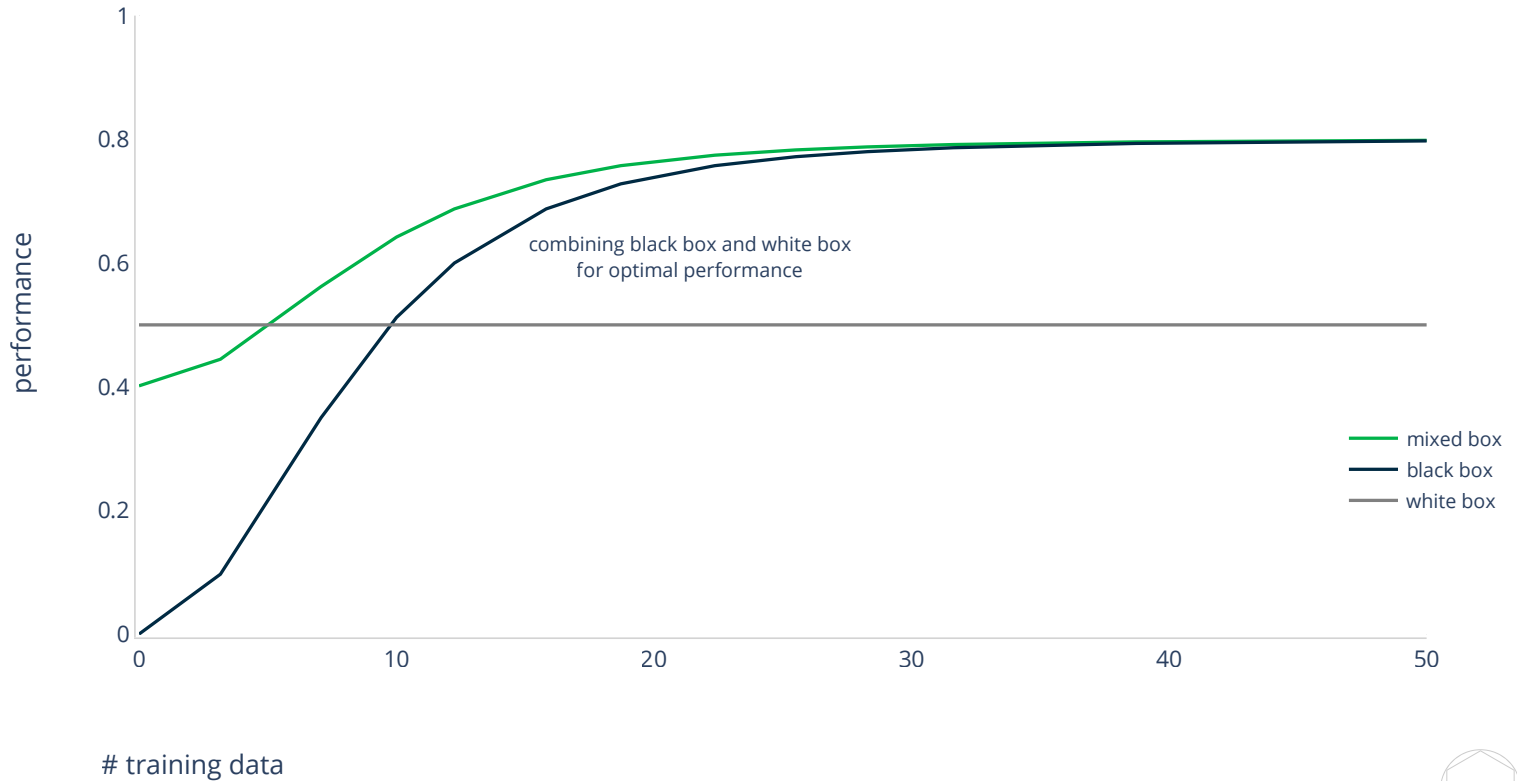
The output of a probabilistic regression is a distribution of possible output values. Shown in green is the distribution of possible outputs according to the regression. The vertical lines indicate the mean value and the 67% confidence intervals. The part of the distribution that is above the critical boundary (vertical red line) is filled in red.

## Training can be split with almost no performance loss.



With HALerium a trained model can be used as a starting point for a new training phase. The training results are memorized in a statistically consistent way, so that training with additional data yields almost the same results as if all data had been used at once.

## Mixing black-box and white-box elements.



— mixed box  
— black box  
— white box