



EXTRA:
NEURAL NETWORKS
VS
RULE-BASED SOLUTIONS

Neural networks vs rule-based solutions: an example assignment



Neural networks can be used to solve tasks that were previously solved by rule-based applications only. We can look at the differences in techniques with the following exercise: calculate how long distance s a dropped ball will fall in time t , if the initial velocity is u .

➤ Rule-based solution:

- First, we must have an understanding of the rules to be applied. Isaac Newton's formula, $s = ut + 1/2at^2$, lets us compute distance, with a representing the acceleration, gravity in the case of free fall. This rule-based approach is straightforward for computer programs and clarifies how the variables relate.

➤ Neural network solution:

- A large number of carefully instructed and supervised drops are performed, and the results of the experiments are reported: u , t and s .
- A neural network is designed and trained with the collected observational data, from which both the input data and the results are known.
- Now, the neural network can predict the distance travelled with some accuracy, even with new and unknown input data.
- But: a neural network would be a "black box" for us, and we would not have an understanding of how it works.

Neural networks vs rule-based solutions: pros and cons

The neural network is an effective tool for modelling phenomena and, therefore, also for the implementation of artificial intelligence, but its suitability for other types of use is quite limited. Below is a comparison of the techniques.



➤ In favour of a rules-based solution

- The rules of a rule-based solution are designed and understandable by humans, but a neural network is a "black box", for which there is no human-interpretable description or formula. For the same reason, prediction with a neural network can only be done with a neural network trained for the task at hand.
- A neural network produces statistical predictions, but a rule-based solution can also produce accurate results.

➤ In favour of a neural network solution

- Because neural network technology is statistical modelling, the neural network would be able to take into account dependencies that are unknown to humans but statistically observable.
- Designing and maintaining rules for rule-based solutions is a human effort. Therefore, rule-based solutions cannot compete with the algorithmically updated, up to trillions, calculation parameters of large neural networks.

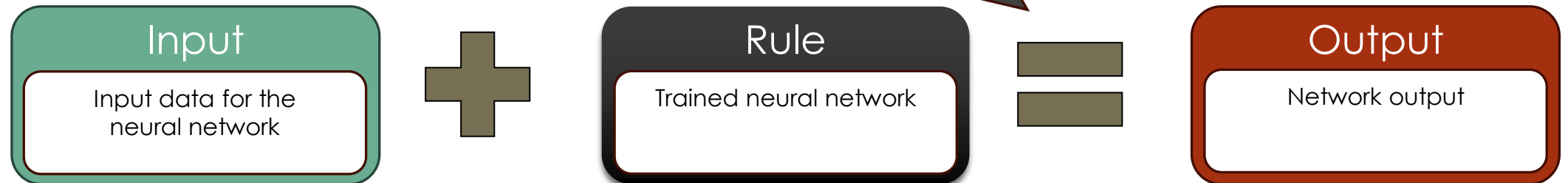
Neural networks vs rule-based solutions: a top-level comparison



NEURAL NETWORK TRAINING



USE OF THE NEURAL NETWORK



USE OF A RULE-BASED PROGRAM

