

**Source :** Statistica Help

This example illustrates how to perform regression analysis using *STATISTICA Automated Neural Networks (SANN)*. In particular, it describes how to choose and retain models using novel, state-of-the-art algorithms capable of ranking alternative models based on performance and suitability for the given task according to user-defined search criteria and configurations.

This example is based on a data set describing the dynamics of the **4-bar linkage**. The goal of the project is to create a neural network model architecture that can best describe the relationship between the target and input variables that drive and control the behavior of the mechanical system.

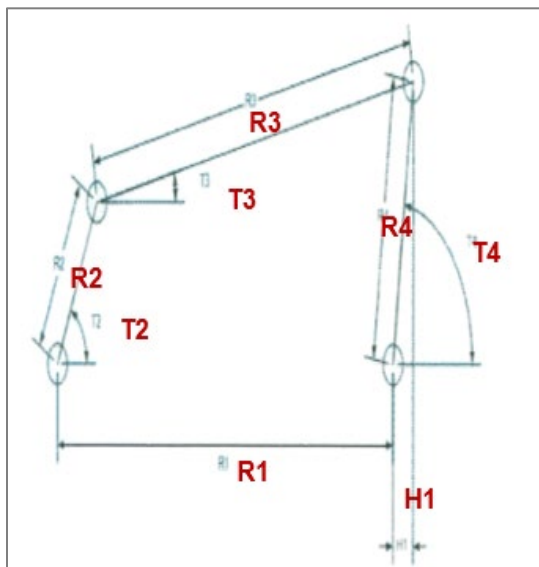
The example concentrates on data modeling using the *STATISTICA Automated Network Search (ANS)*, although the choice of the *Custom Neural Network (CNN)* strategy is also possible.

As you work through the example, you may find it necessary to read through the [Neural Networks Overviews](#), which contain an introduction to the basic concepts of neural networks and include a list of references to good introductory textbooks.

**Note:** The results shown here may be slightly different from your analysis because the neural network algorithms use random number generators for fixing the initial value of the weights (starting points) of the neural networks, which often result in obtaining slightly different (local minima) solutions each time you run the analysis. Also note that changing the seed for the random number generator used to create the train, test, and validation samples can change your results.

**Purpose.** The purpose of this example is to illustrate the adeptness of the *Automated Network Search* application with regard to **modeling data that are nonlinear in nature**.

**Problem definition.** The problem is to find a neural network architecture that accurately relates the targets of the **4-bar** example to the input variables. This process involves training a finite set of neural network architectures and retaining the one that is best suited for the task given a number of user-defined search criteria and conditions.



$$\gamma = \cos^{-1} \left( \frac{R_3^2 + R_4^2 - R_1^2 - R_2^2 + 2R_1R_2 \cos(T_2)}{2R_3R_4} \right)$$
$$T_3 = 2 \tan^{-1} \frac{-R_2 \sin(T_2) \pm R_4 \sin(\gamma)}{R_3 + R_1 - R_2 \cos(T_2) - R_4 \cos(\gamma)}$$
$$T_4 = 2 \tan^{-1} \frac{R_2 \sin(T_2) \pm R_3 \sin(\gamma)}{R_4 - R_1 + R_2 \cos(T_2) - R_3 \cos(\gamma)}$$
$$H_1 = R_4 \cos(T_4)$$
$$V_1 = R_4 \sin(T_4)$$

**Input (X) :** R1, R2, R3, R4, T2

**Output (Y) :** T3, T4, H1, V1