# Neural Network Applications in Nuclear Physics: Determination of Semi-Empirical Mass Formula Coefficients

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As a mathematical method neural network mimics human brain functionality. It is very useful when standard techniques fail. The method is very successful even if the data has a nonlinear form. In the method, the main task is to determine the natural relation between input and output data. These data is lied in input and output neuron layers. The neurons in different layers are connected between weighted connections. All the data has been partitioned into two sets: training and test. First part has been used for obtaining the weights in the training stage. Once weights are determined, they can be used similar type of unknown data in test stage for prediction of the outputs of given inputs. In nuclear physics, the method finds wide application area in nuclear structur4e studies such as determination binding energy, mass, nuclear radius, beta decay energy, beta decay half life, fusion barrier energy, alpha decay half life and alpha decay energy.

The atomic nuclei which is the main motivation of the nuclear physics study is composed of the proton and neutrons. In the liquid drop model of the atomic nuclei, the binding energies of the nuclei are obtained by using a semi-empirical mass formula formulated by Weizsacker in 1935. Although the constant in the formula are determined by the experimental data, the basis of the formula is based on the theoretical calculations. The coefficients determined by fitting process on experimentally obtained atomic binding energies are updated and improved since 1935 by using several methods. It is not possible to determine the most appropriate coefficients for the entire region of the nuclidic chart. Besides, giving better results in certain areas and conditions are available. In this work, the coefficients in the semi-empirical binding energy formula are aimed to determine with high accuracy by using artificial neural network. Different approaches have been applied in order to determine the coefficients. In one of the approaches, the A,N and Z numbers of the atomic nuclei have been used as input data and the coefficients have been determined. According to the results, the energies obtained by using new coefficients are very close to the experimental values. The other approaches have been given results within similar deviations from experimental values.