ARTIFICIAL NEURAL NETWORKS FOR THE DETECTION OF UNCONTROLLABLE NUCLEAR FISSION

Nadine Suzanne Francis
Natzina Juanita Francis
Tomsk Polytechnic University, Networking and Communication
nadinesuzannefrancis@gmail.com, natzina_92@yahoo.com

Abstract

Artificial Neural Networks over the years has gained importance in various fields of science. In this paper, the implementation of a neural network is fastened using the value of momentum. The implementation of these neural networks have been successful in the field of nuclear physics although it has a slow learning rate. On further research these Neural Networks could be made more efficient by reducing the speed of the neutrons. Thereby the results of the study will help to provide a model with fast learning rate, interlinking science with software by providing a proactive field and providing efficiency that is capable of reducing the nuclear field intensity.

Introduction

Nuclear Reactors such as the Pressurized Water Reactor is energized by fuel with the largest amount of fissile material in it. Most Nuclear Reactor Cores uses water for both it's coolant as well its moderator. During the fission process energy is released in huge quantities. Since energy is released in large quantities, during fission of materials like U-235, Pu-239 materials like Boron and Cadmium that are used to contain the field must be capable of withstanding extreme temperatures and also any radioactive field. These reactors' physical form are therefore modified to withstand this. The structure of the fuel within a Core Reactor should remain stable and thus helping it to prevent any fission product from escaping into the reactor Coolant. In most Pressurized reactors, the fuel pellets form a fuel rod with the help of a zirconium alloy tube and this forms the core. However most Nuclear Power Reactors consists of a main symmetry and a secondary symmetry axis. In the main symmetry axis the core is divided into four parts thus making it easier to work with smaller number of fuel assemblies and thus reducing the time involved in computing neutronic calculations.

The fissile isotope in the nuclear fuel during a reaction is incapable of producing energy at a constant or stable power due to the consumption of the nuclear fuel. A cycle can be therefore defined as the time taken for the nuclear reactor to operate with the specified amount of fuel assemblies. The pressurized water reactor at the end of every cycle has to be shut down in order to refuel. During this process a third of the fuel assemblies are replaced with new ones and it wont be feasible if they are replaced in the exact same position as before. The replacement process may consist of a number of core reloading issues which is optimizing the the rearrangement of the assemblies and yet maximizing the burn up of fuel and its cycle length. This process of rearrangement of assembly fuels in the core reactor is called loading pattern. Usually mathematical models are used to accelerate the evaluation process of the loading pattern by the core designers.

Some researchers have predicted that artificial neural networks are capable of predicting with accuracy the rate at which the neutrons travel. Thus on further research, artificial neural networks can be used to not only study the rate at which neutron hits the nucleus of an atom but can also control the speed of the process by increasing the study rate of the network.

Studying only the rate at which neutrons travel cannot help in controlling fission. Hence the neural network must be able to study the rate of the traveling neutron and also the number of neutrons released after the fission of every nucleus under attack simultaneously, thus providing an environment where any explosion caused by nuclear fission can be studied and hence controlled using proper physical means.

Theoretical Analysis

Artificial Neural Networks resembles that of a biological neural system and is used to process information, by a number of elements called the neurons. Neural networks have gained importance over the years because of its ability to derive meaning from imprecise data. The reason for collaborating a neural network with that of nuclear physics is that these networks although learn at a slow rate they can recognize patterns unidentifiable by the human eye or even by any computerized mechanism.

In the research of uncontrollable fields, a neural network with three layers is used with each neuron having adaptive synaptic weights respective to the linear method. The first input layer consists of neutrons which traveling at different accelerations. The main idea of the neural network is to study the acceleration level of the neutron and also the number of neutrons emitted after fission of each nucleus.

Though knowledge dealt down over the years, we know that if the number of neutrons emitted after fission is more than one, the result is uncontrollable and if it is less than one, the reaction experiences fadeaway. The neural network hence will study the speed and and the number of neutrons and the study pattern will help to provide an alternative field to that will help to subside the uncontrollable fission reaction. Through already known model compression technique, we could shrink the size of the neural network. We know convolutional methods help the networks learn faster and fully connected networks make the neural networks smaller. A breakthrough in a recent conference by Suraj Srinivas suggested that neural networks could be made faster and smaller at the same time. Using this method, we are going to help our neural network study the fission process. In addition to this we add the value of momentum to make learning even faster thus helping us to identify a way in which we could hep in providing a solution to uncontrolled nuclear fission. The first step in studying the neural network and also controlling fission involves removing a lot of unwanted neutrons or changing the values of some neutrons to 0. In Fig, you can see the number of neutrons hitting the atoms reducing. The second step is to reduce the number of atoms hit by the neutrons. This helps in minimizing the fission reaction through n stages. Now we can split the neural network to contain information of neutrons separately and atoms separately . This method will help to study the neuron network faster. This way neural networks could be used to diminish uncontrolled fission reaction

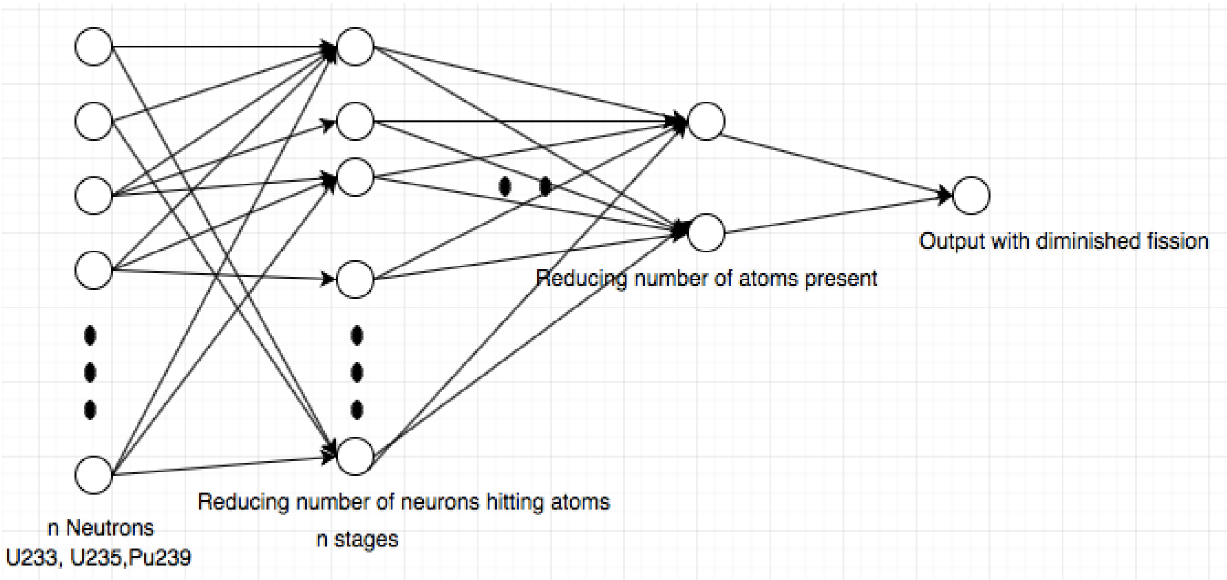

Fig. The process of decreasing the number of neutrons through neural networks

Conclusion

Artificial Neural Networks although have a slow learning rate are more than capable of learning data at incredible rates with the right process implementation. The networks with the value of momentum can thus be used to detect the neutrons released during any nuclear reaction. Although a number of theories have proved that these networks cannot learn at rates as fast as a nuclear reaction, with the right number of intermediary levels which consist of weights corresponding to the materials used in control rods in that of a nuclear reaction, such conditions can be controlled. The input of the artificial neural network can be made to react to the reaction thus creating the number of levels needed to produce the required output.

By the process of understanding how these uncontrollable fields work and how they can be incorporated with different neural networks thus helping to reduce the intensity of such reactions.

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