

Report about Neural Networks as paradigm to simulate human intelligence

First of all, what led Geoffrey Hinton to believe in neural networks as the right path to understanding and simulating human intelligence? Artificial Neural Networks process information using the entire network structure. The initial inspiration came from the desire to understand how the brain works. Previously, scientists tried to simulate the brain network by building artificial neural networks in the form of computer simulations. In this, the neurons of the brain are simulated by nodes assigned different values and the synapses are represented by connections between nodes that can be made stronger or weaker. The training and “learning” process of the Artificial Neural Network is repeated to create connections between nodes similar to how the brain works. Here the training of artificial neural networks aims to create strong connections between nodes to enhance the exchange of information between them. Since it is modeled and trained to operate based on the brain network, it can be said that artificial neural networks are the right path to understand and simulate human intelligence.

Second, how did physics fundamentals help Geoffrey Hinton obtain the necessary insights to develop his research and discoveries related to Neural Nets? As a physicist, he had a strong background in physics. So when he turned to biology and chemistry, he was well placed to learn about magnetic materials that have special properties due to their atomic spin, a property that makes each atom a tiny magnet. The spins of neighboring atoms influence each other; this can allow domains to form with spins pointing in the same direction. He was able to create a model of the network with nodes and connections using physics that describes how the material evolves as spins influence each other. He thus described the overall state of the network with a property that is equivalent to the energy in a spin system found in physics; the energy is calculated using a formula that takes all the values of the nodes and all the connection strengths between them. In simple terms, searching for a stored state in a network is like rolling a ball through a complex terrain, with friction slowing the ball down. The ball will move to the nearest valley and stop. Similarly, when a network is given a pattern that is close to one of its stored patterns, it will move until it finds the closest pattern in its memory. Geoffrey Hinton used his physics background to develop his research and explore Artificial Neural Networks.