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Computational Deep Neural Network for Solving Differential Equation

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Neuron, the basic unit of nerve cells, transmits stimuli by sending neurotransmitters to other neurons when receiving signals above the threshold. The algebraic structure that mimics this process is called perceptron, the basic unit of the artificial neural network (ANN). The ANN is used to solve problems in many fields of data processing such as classification, and is a useful tool, self-updating weights at each learning step, unlike traditional machine learning methods. In the past, the ANN has been used to solve linear classification problems only. However, currently, using algebraic processes that deal with inputs and outputs, the neural networks are now applied to solving the nonlinear classification and learning in many fields such as images, voice, and text. The property of the ANN is also being studied by many researchers in physics as a tool that can be used in numerical calculations. Physicists are interested in the change of nature in time, and therefore we need to solve the differential equations. Some of them are not solved analytically and they require numerical calculations. In this study, we discuss how to solve the differential equations numerically using the ANN. We also present a deep neural network model that can be applied to differential equations by adopting an improved activation function instead of those commonly used.

Theory / experiment

Theory

Group or collaboration name

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