Artificial Neural Networks for Solving Integral Equations

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Abstract

This study investigated the use of artificial neural networks as a framework to solve third-kind integral equations of the Volterra and Fredholm types. Third kind integral equations are as a results of a number of important problems in elasticity, neutron transport, particle scattering. Since these equations usually cannot be solved explicitly, it is going to be obtained in approximate solutions. There are some numerical methods for approximating solution of Fredholm-type integral equations of the third- kind but Volterra integral equations of this type received less attention.

We present efficient learning algorithms for solving integral equations of this type. The integral equation turns into an unconstrained optimization problem. The trial solution of the integral equation contains adjustable parameters based on networks configuration. The learning algorithms are embedded into the networks to train the parameters.

We discuss distinctive features as well as feasibility of this approach and we propose some extensions. This demonstrates potential for general applicability to any kind of integral equations. The comparison of our results with well-established numerical approach, collocation method, will be presented.

Key words: Neural networks; learning algorithms; third-kind integral equations.

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