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A Computational Solution of Neuronal Communication Differential Equation

Gajanand Rajak

M.Phil, Roll No: 141410

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University Department of Mathematics

B.R.A Bihar University, Muzzaffarpur

Abstract

We present another strategy for tackling the fragmentary differential equations of beginning worth issues by utilizing brain networks which are developed from cosine premise capabilities with movable boundaries. Via preparing the brain networks over and over the mathematical answers for the fragmentary differential equations were gotten. Also, the procedure is as yet material for the coupled differential equations of partial request. The PC designs and mathematical arrangements show that the proposed technique is extremely powerful.

Keywords: *Neuronal, Communication, Differential Equation*

Introduction

As of late, fragmentary differential equations have acquired extensive significance because of their continuous appearance applications in liquid stream, rheology, dynamical cycles in self-comparable and permeable designs, diffusive vehicle likened to dispersion, electrical organizations, likelihood and measurements, control hypothesis of dynamical frameworks, viscoelasticity, electrochemistry of erosion, synthetic physical science, optics and sign handling, etc. These applications in interdisciplinary sciences persuade us to attempt to figure out the logical or mathematical answers for the partial differential equations. Be that as it may, for most ones it is hard to find out or try and have accurate arrangements. Hence, essentially, the mathematical methods are applied to the partial differential equations.

Presently, numerous powerful strategies for settling partial differential equations have been introduced, for example, nonlinear practical examination strategy including droning iterative method, topological degree hypothesis, and fixed-point hypotheses. Additionally, mathematical arrangements are gotten by the accompanying strategies: arbitrary walk, framework approach, the Adomian deterioration strategy and variational cycle technique, HAM, homotopy annoyance technique, etc. Not very far in the past, in, Raja et al. by applying Molecule Multitude Advancement calculation alongside feedforward ANN got the mathematical answers for partial differential equations. In any case, the union of the calculation has not been demonstrated, and this technique is simply applied to the single partial differential equations. In this paper, we develop two unique brain networks in light of cosine works and acquire the states of calculation assembly.

Mathematical calculation in many disciplines, like material science, applied math, electrical designing, natural chemistry, and so on, has gotten a lot of consideration as of late as a viable method to comprehend complex peculiarities that are beyond difficult to systematically treat. Supercomputers have been worked to accelerate the estimation. Moreover, new figuring calculations in view of the idea of simultaneous handling have been created and carried out by interfacing few processors.

As of late, exceptionally equal brain networks have been researched broadly to take care of confounded issues like example acknowledgment and combinatorial advancement. Straight synchronous equations likewise have been treated by applying brain organizations. Execution of brain networks by using volume holographic optical interconnections have ended up being promising.

One of the broadest techniques for tackling differential equations is to utilize limited distinction equations and to address the logarithmic equations. The computational burden for addressing the distinction equations increments extremely quick as the quantity of discrete focuses turns out to be huge. In this way, an exceptionally equal calculation to tackle the limited distinction equations is fundamental when a muddled issue is experienced.

The primary brain organization (NU) is applied to straight and nonlinear partial differential equations of the structure

$$D_{0+}^{\alpha} y(x) = f\left(x, y(x)\right), \quad 0 < x \leq 1, \; 0 < \alpha \leq 1 \qquad (1)$$

with initial condition as follows:

$$y(0) = C, \quad (2)$$

where D_{0+}^{α} is the Caputo fractional derivatives of order α.

The second neural network (NU) is applied to the fractional coupled differential equations of the form

$$\begin{aligned} D_{0+}^{\alpha} y(x) &= f(x, y(x), z(x)), \\ & \qquad 0 < x \leq 1, \; 0 < \alpha \leq 1, \quad (3) \\ D_{0+}^{\alpha} z(x) &= g(x, y(x), z(x)), \end{aligned}$$

with initial conditions as follows:

$$\begin{aligned} y(0) &= C_1, \\ z(0) &= C_2, \end{aligned} \quad (4)$$

Where D_{0+}^{α} are the Caputo fragmentary subsidiaries of request. The answers for the over two issues are composed as cosine premise works, whose boundaries can be changed in accordance with limit a suitable blunder capability. Thus, we really want to register the angle of the blunder concerning the organization boundaries. By changing the boundaries over and over, we acquire the mathematical arrangements when the blunder values are not exactly the necessary precision or the preparation times arrive at most extreme.

Collective Computation of Neural Networks

Brain networks comprise of individual processors and interconnections between the processors. For instance, the schematic portrayal of a basic brain network is attracted Fig. 1. Every processor is called as a neuron which has a relationship in natural brain frameworks. Every neuron can have two unique states, i.e., here and there which are addressed by paired numbers 1 and 0 (or 1 and - 1). The activity of the multitude of neurons is something very similar. Normally, every neuron aggregates every one of the signs coming from the wide range of various neurons through the weighted interconnections, edges the added sign to 0 or 1 (or - 1 or l), and has an impact on its state as per the thresholder yield. This activity happens at each neuron in the organization all the while or arbitrarily. Thusly, in the event that the absolute number of neurons in the organization is huge, the condition of the entire organization comprising of the individual neuronal state changes progressively, and the organization displays helpful impacts. This sort of agreeable impact is exceptionally normal in factual material science.

The brain network portrayed above can be used for calculation. The twofold conditions of the neurons can be recognized as a paired portrayal of certain factors. The interconnection qualities between the neurons might address the data of the particular issue.

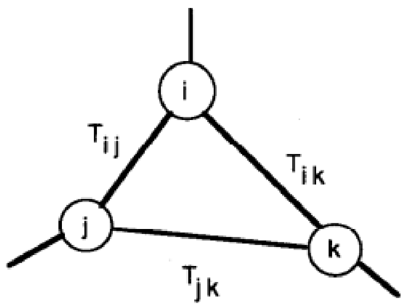

FIG. 1. Schematic diagram of a simple neural network. T_{ij}, T_{ik}, and T_{jk} are connection strengths between the pairs of neurons (i, j), (i, k), and (j, k).

Then, an underlying preliminary state for the organization addressing the underlying preliminary arrangement might meet to the last condition of the organization as per the brain elements, and it might give the arrangement of the issue. This strategy for calculation depends on the aggregate collaboration between the neurons, and it displays a serious level of parallelism. One more quality of the brain network is that the handling of every neuron is very straightforward, nonetheless, the huge number of neurons and interconnections yields tremendous computational power.

Definitions

Definition 2.1. The fractional (arbitrary) order integral of the function f of order $\alpha > 0$ is defined by

$$I_a^\alpha f(t) = \int_a^t \frac{(t-\tau)^{\alpha-1}}{\Gamma(\alpha)} f(\tau) d\tau.$$

When $a = 0$, we write $I_a^\alpha f(t) = f(t) * \phi_\alpha(t)$, where (*) denoted the convolution product

$\phi_\alpha(t) = \frac{t^{\alpha-1}}{\Gamma(\alpha)}, t > 0$ and $\phi_\alpha(t) = 0, t \leq 0$ and $\phi_\alpha \to \delta(t)$ as $\alpha \to 0$ where $\delta(t)$ is the delta function.

Definition 2.2. The fractional (arbitrary) order derivative of the function f of order $0 \leq \alpha < 1$ is defined by

Remark 2.1. From Definition 2.1 and Definition 2.2, we have

$$D^{\alpha} t^{\mu} = \frac{\Gamma(\mu+1)}{\Gamma(\mu-\alpha+1)} t^{\mu-\alpha}, \mu > -1; 0 < \alpha < 1$$

and

$$I^{\alpha} t^{\mu} = \frac{\Gamma(\mu+1)}{\Gamma(\mu+\alpha+1)} t^{\mu+\alpha}, \mu > -1; \alpha > 0.$$

Definition 2.3 The function $F(s)$ on the complex variable s defined by

$$F(s) = \angle\{f(t); s\} = \int_0^{\infty} e^{-st} f(t) dt$$

is called the Laplace transform of the function $f(t)$

Definition 2.4 The Mellin transform of the function $f(t)$ is

$$M\{f(t)\}(s) = \int_0^{\infty} t^{s-1} f(t) dt.$$

Definition 2.5 By $Fox's\, H-$ functions we mean a generalized hypergeometric function, defined by means of the Mellin-Barnes type contour integral

$$H_{p,q}^{m,n}\left[z \left| \begin{matrix} (a_j, A_j)_1^p \\ (b_k, B_k)_1^q \end{matrix} \right. \right] = \frac{1}{2i\pi} \int_{c'} \frac{\prod_{k=1}^{m} \Gamma(b_k - sB_k) \prod_{j=1}^{n} \Gamma(1 - a_j + sA_j)}{\prod_{k=m+1}^{q} \Gamma(1 - b_k + sB_k) \prod_{j=n+1}^{p} \Gamma(a_j - sA_j)} z^s ds$$

Conclusion

In this paper, by utilizing the brain organization, we acquired the mathematical answers for single partial differential equations and the frameworks of coupled differential equations of fragmentary request. The PC illustrations exhibits that mathematical outcomes are in well concurrence with the specific arrangements. The brain network is a strong strategy and is compelling for the over two issues, which ought to be likewise ready to tackle fragmentary incomplete differential equations.

Reference

1. S. Momani and Z. Odibat, "Homotopy perturbation method for nonlinear partial differential equations of fractional order," *Physics Letters. A*, vol. 365, no. 5-6, pp. 345–350, 2007.
2. M. A. Z. Raja, J. A. Khan, and I. M. Qureshi, "Evolutionary computation technique for solving Riccati differential equation of arbitrary order," *World Academy of Science, Engineering and Technology*, vol. 58, pp. 531–536, 2009.
3. L. Song and H. Zhang, "Solving the fractional BBM-Burgers equation using the homotopy analysis method," *Chaos, Solitons & Fractals*, vol. 40, no. 4, pp. 1616–1622, 2009.
4. S. Das and P. K. Gupta, "Homotopy analysis method for solving fractional hyperbolic partial differential equations," *International Journal of Computer Mathematics*, vol. 88, no. 3, pp. 578–588, 2011.
5. Z. Odibat, S. Momani, and H. Xu, "A reliable algorithm of homotopy analysis method for solving nonlinear fractional differential equations," *Applied Mathematical Modelling*, vol. 34, no. 3, pp. 593–600, 2010.
6. H. D. Qu and X. Liu, "Existence of nonnegative solutions for a fractional m-point boundary value problem at resonance," *Boundary Value Problems*, vol. 2013, article 127, 2013.
7. Z. Liu, L. Lu, and I. Szántó, "Existence of solutions for fractional impulsive differential equations with *p*-Laplacian operator," *Acta Mathematica Hungarica*, vol. 141, no. 3, pp. 203–219, 2013.
8. Z. H. Liu, J. H. Sun, and I. Szántó, "Monotone iterative technique for Riemann-Liouville fractional integro-differential equations with advanced arguments," *Results in Mathematics*, vol. 63, no. 3-4, pp. 1277–1287, 2013.
9. Z. Odibat and S. Momani, "Numerical methods for nonlinear partial differential equations of fractional order," *Applied Mathematical Modelling*, vol. 32, no. 1, pp. 28–39, 2008.
10. S. B. Yuste, L. Acedo, and K. Lindenberg, "Reaction front in an reaction-subdiffusion process," *Physical Review E*, vol. 69, no. 3, Article ID 036126, 2004.

11. R. Metzler and J. Klafter, "The random walk's guide to anomalous diffusion: a fractional dynamics approach," *Physics Reports*, vol. 339, no. 1, pp. 1–77, 2000.
12. Ibrahim, R.W. & S. Momani. On the existence and uniqueness of solutions of a class of fractional differential equations. J. Math. Anal. Appl. 334 :1-10 (2007).
13. Momani, S.M. & R.W. Ibrahim. On a fractional integral equation of periodic functions involving Weyl-Riesz operator in Banach algebras. J. Math. Anal. Appl. 339 :1210-1219 (2008).
14. Ibrahim, R.W. Global controllable for fractional differential equations Miskolc Math. Notes 12 :51-60(2011).
15. Ibrahim, R.W. & M. Darus. Subordination and superordination for univalent solutions for fractional differential equations. J. Math. Anal. Appl. 345 :871- 879 (2008).
16. Ibrahim, R.W. Existence and uniqueness of holomorphic solutions for fractional Cauchy problem. J. Math. Anal. Appl. 380 :232-240 (2011).
17. Thamarai, S., H.A. Jalab & A. Taqa. Overview of textual anti-spam filtering techniques. International Journal of the Physical Sciences 12 :1869-1882 (2010).
18. Kilbas, A.A., Srivastava H.M. & J.J. Trujillo. Theory and Applications of Fractional Differential Equations. North-Holland, Mathematics Studies. Elsevier (2006).
19. G. F. GARRIER AND C. E. PEARSON, Parfial Differential Equations: Theory and Technique (Academic Press, New York, 1976).
20. M. A. Z. Raja, J. A. Khan, and I. M. Qureshi, "A new stochastic approach for solution of Riccati differential equation of fractional order," *Annals of Mathematics and Artificial Intelligence*, vol. 60, no. 3-4, pp. 229–250, 2010.