National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Kernel LS-SVM: primal-dual optimization for modelling and analyzing dynamic systems
Speaker	: Bhubaneswari Mishra
Supervisor	: Prof. S. Chakraverty
Venue	: Seminar Room, Department of Mathematics
Date and Time	: 25 Oct 2024 (11:30 am)
Abstract	: This research presents an innovative machine learning method designed to address linear and nonlinear ordinary differential equations (ODEs) by integrating least squares-support vector machines (LS-SVM) with a collocation approach. The technique exploits kernel functions and the LS-SVM formulation to minimize the least squares error between the predicted solutions and the actual solutions of the ODEs. The method works by employing kernel functions, which allow for the handling of both linear and nonlinear problems effectively by transforming the data into a higher-dimensional space. For linear ODEs, this approach is particularly efficient as it translates the problem into its dual form, thereby generating a system of linear algebraic equations that can be solved with relative ease. To validate the effectiveness of this method, numerical examples are used, showcasing its practical application. The results reveal that the LS-SVM-based approach excels in several key areas compared to traditional methods. It offers enhanced speed, achieving faster computation times; high accuracy, providing precise approximations of the ODE solutions; and exponential convergence, meaning the solution becomes more accurate rapidly as the number of collocation points increases. Overall, the integration of LS-SVM with the collocation method presents a promising and effective alternative for solving a wide variety of linear and nonlinear ODEs. The method's demonstrated advantages in terms of computational efficiency, accuracy, and convergence make it a valuable tool in the field of differential equations.