Faculty Development Program

Title : Foundations of Scientific Machine Learning (SciML)

Date : 2025-01-27 - 2025-01-31
Time : 10:00 - 17:30
Venue : SJT 620

Event Outcome

- Understand SciML principles and techniques (PINNs, UDEs)
- Gain practical implementation experience using open-source tools
- Explore diverse SciML applications across scientific domains
- Empower participants to integrate SciML into their research and teaching
- Engage with experts to discuss current and future SciML landscape

	**Resource Person 1 - Details** **Name :** Ragukumar P **Designation :** Assistant Professor Sr. Grade 2, School of Advanced Sciences **University/ Company :** VIT, Vellore **Address :** India, 632014.
	**Resource Person 2 - Details** **Name :** Neelabja Chatterjee **Designation :** Assistant Professor Grade 2, School of Advanced Sciences **University/ Company :** VIT, Vellore **Address :** India, 632014.
	**Resource Person 3 - Details** **Name :** Dr Souvik Chakraborty **Designation :** Professor, Applied Mechanics **University/ Company :** IIT Delhi, Delhi **Address :** India, 110016.
	**Resource Person 4 - Details** **Name :** Dr Venkataramana Veeramsetty **Designation :** Professor, Computer Science **University/ Company :** SR University, Warangal **Address :** India, 506371.
	**Resource Person 5 - Details** **Name :** Dr Chandra Mohan Dasari **Designation :** Assistant Professor, Computer Science **University/ Company :** Indian Institute of Information Technology, Chittoor **Address :** India, Chittoor.
	**Resource Person 6 - Details** **Name :** Dr D Rakesh Chandra **Designation :** Assistant Professor, Electrical and Electronics Engineering **University/ Company :** Kakatiya Institute of Technology and Science, Warangal **Address :** India, 506015.
	**Resource Person 7 - Details** **Name :** Prof D Srinivasacharya **Designation :** Professor, Mathematics **University/ Company :** NIT Warangal, Warangal **Address :** India, 506004.
	**Resource Person 8 - Details** **Name :** Dr Bulent Karasozen **Designation :** Professor, Mathematics **University/ Company :** Middle East Technical University, Ankara **Address :** Turkey, 06800.

Resource Person 9 - Details

Name : Radhakrishnan Delhibabu

Designation : Associate Professor Sr., School of Computer Science and Engineering

University/ Company : VIT, Vellore

Address : India, 632014.

Resource Person's Profile :

1. Profile of Ragukumar P

Dr. Ragukumar P
Designation: Assistant Professor Senior Grade 2
School: School of Advanced Sciences
Department: Mathematics

2. Profile of Neelabja Chatterjee

Designation : Assistant Professor Grade 2
School : School of Advanced Sciences
Department : Mathematics

3. Profile of Dr Souvik Chakraborty

Dr. Souvik Chakraborty completed his Ph.D. in Civil Engineering from the Indian Institute of Technology Roorkee in the year 2017, after which, he worked as a postdoctoral research associate at the University of Notre Dame for two years and at the University of British Columbia for 04 months. In May 2020, he joined the Department of Applied Mechanics at IIT Delhi and leads the CSCCM. He is also a joint faculty at the Yardi School of Artificial Intelligence, IIT Delhi.

4. Profile of Dr Venkataramana Veeramsetty

Dr. Venkataramana Veeramsetty completed Ph.D. from NIT Warangal in 2018. Currently he is working as professor in the department of electrical and electronics engineering in SR University, Warangal, Telangana.

5. Profile of Dr Chandra Mohan Dasari

Dr. Chandra Mohan D is an Assistant Professor at Indian Institute of Information Technology, Sri City. His research focuses on the Bioinformatics with Deep Learning. He published 12 SCI international journals, 11 international conference papers and one book chapter in these research areas. He also has funded projects by SERB in these research areas.

6. Profile of Dr D Rakesh Chandra

Dr.D.Rakesh Chandra worked as Assistant Professor in EEED, VITS College, Karimnagar from 2010 -- 11. He did his PhD from NIT Warngal from 2011-2016. During his PhD he got selected in world prestigious Erasmus International Scholarship in 2013 and with that fellowship he worked towards his PhD for one year in Energy Laboratory Politecnico Di Milano, Milan, Italy. He received prestigious POSOCO Power System Award (PPSA 2017) for the best PhD thesis in February 2017.

7. Profile of Prof D Srinivasacharya

Professor D. Srinivasacharya is a distinguished faculty member in the Department of Mathematics at the National Institute of Technology (NIT) Warangal. He earned his PhD from the Regional Engineering College (now NIT) Warangal. His research interests encompass a wide range of topics including: Artificial Neural Networks (ANN) in Fluid Mechanics, Biomechanics, Computational Fluid Dynamics, Hydrodynamic Stability.

8. Profile of Dr Bulent Karasozen

Prof. Bulent Karasozen is a professor at the Middle East Technical University in Ankara, Turkey. He has a PhD in System and Control Engineering from the Technical University of Berlin. His research interests include numerical analysis, dynamical systems, and scientific computing. He has published numerous papers in these areas and has given many presentations at conferences. He is also the author of several books.

9. Profile of Radhakrishnan Delhibabu

Professor School of Computer Science and Engineering
VIT Vellore

The field of Scientific Machine Learning (SciML) has gained significant attention in recent years, as it offers a powerful approach to integrating scientific knowledge and data-driven modeling techniques. This FDP aims to provide insights into SciML, focusing on physics-informed neural networks (PINNs) and universal differential equations (UDEs). SciML integrates scientific knowledge and data-driven modeling, addressing limitations of traditional ML.

In the modern era of data-driven science and engineering, the ability to effectively leverage both empirical data and scientific principles is crucial. Traditional machine learning models often struggle to capture the underlying physical laws and constraints that govern natural phenomena. This limitation can lead to models that lack interpretability, generalizability, and the ability to extrapolate beyond the training data.

Physics-informed neural networks (PINNs) and universal differential equations (UDEs) address these challenges by seamlessly integrating scientific knowledge into the machine learning framework. These techniques have the potential to revolutionize the way we approach complex problems in various domains, including fluid dynamics, materials science, climate modeling, and beyond.

Key Topics:

- SciML overview and need for interpretable, generalizable models
- PINNs: Incorporating physical laws into neural networks for PDE problems
- UDEs: Learning differential operators and governing equations from data
- Hands-on workshops using SciML.ai and diffeqpy tools
- Expert panel discussions on SciML challenges and future directions

SciML.ai: Comprehensive SciML platform with documentation, open-source libraries, community support, and educational resources to advance scientific machine learning.

diffeqpy: Python package providing unified interface for solving differential equations, enabling seamless integration with ML frameworks like PyTorch and TensorFlow for developing PINNs and UDEs.

Coordinator's: **Prof. ASHISH BHATT 18015 - Assistant Professor Sr. Grade 1 - SAS**
Prof. PADIGEPATI NAVEEN 17100 - Assistant Professor Grade 2 - SAS