

About us

Birla Institute of Technology (BIT)

An unquenchable thirst for innovation and disruption; a rich legacy of technology and entrepreneurship; and a commitment to nurturing leaders who make a difference to the world has been the credo of BIT Mesra in the nearly six decades of its existence.

It has many firsts to its credit. It was the first in the country to establish a department dedicated to Space Engineering & Rocketry way back in 1964. It was also the first to develop a Science & Technology Entrepreneurs' Park (BIT-STEP), on campus to instill the spirit of entrepreneurship in its students. Today, it is a vibrant place, bustling with student activities and innovative teaching methods that make it home to thousands of aspiring leaders of tomorrow.

Department of Space Engineering and Rocketry

The Department of Space Engineering and Rocketry – the first of its kind in the country, was established in 1964 to train scientists and engineers in the important areas of Aerospace Engineering and Rocket Technologies. Since 1968, it has been offering a postgraduate degree course leading to M.Tech. in Space Engineering and Rocketry with in-depth specialization in Aerodynamics and Rocket Propulsion. The Department aims to provide state-of-the-art education and training to its students to enable them to contribute efficiently in the national efforts being made in Space & Defense technologies and challenging future missions.

Department of Computer Science and Engineering

The Department of Computer Science & Engineering was established in 1983 and is now recognized as one of the leading departments with infrastructure and facilities to match the very best in the country. The department remains committed towards its mission, which is twofold. One is to provide students with the fundamental knowledge and problem solving skills in Computer Science required for a fulfilling career. The other goal is to create and disseminate knowledge to improve Computer Science research, education and practice.

The department has had academic collaborations with University of New Brunswick, Canada, University of Melbourne, Australia and University of Manitoba, Canada.

For more information:

BIT: <https://www.bitmesra.ac.in>

CSE Homepage:

https://www.bitmesra.ac.in/Show_Department_Section?cid=1&deptid=70

SER Homepage:

https://www.bitmesra.ac.in/Show_Department_Section?cid=1&deptid=167

Machine Learning for Space Sciences

Short–Term Course

Organized by

Department of Space Engineering and Rocketry
and
Department of Computer Science and Engineering

Birla Institute of Technology Mesra, Ranchi



Machine Learning for Space Sciences

General Information

Mimicking the natural intelligence of humans using algorithms, computers, and machines has resulted in the emergence of technologies that are increasingly sophisticated and effective in solving challenges that are too difficult for conventional technologies. Artificial intelligence (AI) is an umbrella term for such technologies and machine learning (ML) is a discipline of the broader field of artificial intelligence that focuses on the tools and methods enabling the computers, robots, and machines to approach decision-making and problem solving tasks using some form of learning methods originally developed for natural intelligence.

Conventional technologies are being augmented with ML capabilities across the engineering disciplines at a fast pace. It has thus become imperative to introduce ML into curriculum in some form and encourage the use of ML-enabled technologies by students, research workers, and instructors in problem solving and practice. The proposed program addresses these needs.

Salient Features of the Program

- Instructs the participant on the basic concepts of ML
- Acquaints with a range of tools, methods, and algorithms
- Demonstrates domain-specific applications of ML: aerospace engineering and allied sciences, atmospheric and earth sciences, chemical engineering, and mechanical and thermal engineering
- User-centric approach; gives direction for application of ML in a chosen field of specialization with minimal prior exposure to ML
- The course offers multiple hands-on and demo sessions

Course Structure

Topics are contiguously arranged with increasing complexity and test the outcome at the end of the program.

• Introduction to machine learning (ML)

- Definitions
- Phases in ML

• Concepts in ML

- Data-driven versus model-driven predictions
- Learning methods
- Fuzzy logic, Bayesian inference, Learning rules
- Neural networks

• Tools for implementation

- Artificial neural networks
- Non-traditional optimization methods
- Principal component analysis

• Applications

- Aerospace engineering and allied sciences:** prediction of flutter from aeroelasticity data, combustion instability, engine and launch vehicle design, CFD, feature detection
- Atmospheric and earth sciences:** data analysis and modeling using deep learning
- Chemical engineering:** control of batch processes, CFD
- Mechanical engineering:** turbulence modeling, CFD

Duration of Course: 5 days (12-16 March 2024)

Venue: Birla Institute of Technology Mesra, Ranchi 835215, Jharkhand

Course Coordinators: Dr. Swarup Y. Jejurkar (SER) & Dr. Akriti Nigam (CSE), BIT Mesra

E-mails: swarup@bitmesra.ac.in; akriti@bitmesra.ac.in

The course will be delivered in four parts.

In the first part of the course, we would begin with a historical perspective and give an overview of the developmental phases of ML. We would concentrate on the developments, which are regarded as having profound impact on the future development of the ML technologies.

The second part covers important concepts and ideas that act as the building blocks for development of tools, algorithms, and methods. A number of related as well as independent concepts would be discussed in this phase and the relationships among them would be unraveled. We would extensively use examples from the mature ML-enabled technologies.

Third part concentrates on the tools used for building ML applications. We include theoretical basis, algorithmic development, available software, and a discussion of application areas in this phase. We would acquaint the participants with some of the mature technologies that have been developed using these tools.

In the fourth part, we discuss selected domain-specific applications that have benefitted from the use of ML tools and methods introduced in the third part. This phase is designed to present the applications in a case-study format and to highlight the state of the art.

Information for participants

Target audience: MTech and PhD students of Space Engineering and Rocketry, Chemical Engineering, Mechanical Engineering, and Remote Sensing, BTech students in their 6th semester

Number of participants: approx. 50

Registration fees (for external participants): INR 590 (incl. GST) (Fees should be deposited in:

<https://www.onlinesbi.sbi/sbicollect/icollecthome.htm?corpID=322526>)

Note: Please send an email to Swarup for registration stating your qualification; external participants to attach proof of fees submission.