IIT Mandi in collaboration with Control Society organises a Workshop on 'Learning and Control' from 22nd to 26th July 2019.

The aim of the workshop was to address the existing need for a sound analytical foundation for Machine Learning (ML) and Artificial Intelligence (AI) with Control Theory. The workshop was jointly sponsored by IIT Mandi, Control Society, and Council of Scientific and Industrial Research (CSIR) India.

The workshop on 'Learning and Control' is a platform to discuss current advances in the field of Machine Learning and Artificial Intelligence. The objective was to enhance the knowledge of participants who wants to become researchers and expert users of Machine Learning and Control Methodologies, the workshop is designed with a focus on senior B. Tech students, research scholars and junior faculty from engineering institutes and colleges.

Speaking about the significance of this workshop, Dr. M. Vidyasagar, President, Control Society, said, *"Presently, the whole world is consumed with Artificial Intelligence. The workshop on 'Learning and Control' will provide an exposure of some of the basic Artificial Intelligence concepts to the participants. The hands-on training sessions and open discussions after the lectures are the highlights of this workshop. This workshop will help participants in gaining knowledge of a rapidly increasing field in all engineering disciplines. The Control Society, which organises Indian Control Conference, an annual event, is organising this workshop for the first time and observing such a good response from the participants. We are looking forward to plan more such workshops in the future."*

The participants included faculties, research scholars and senior B. Tech students from reputed colleges and universities across the country, including IIT Mandi, IIT Delhi, IIT Madras, IIT Kharagpur, IIT Roorkee, IET Lucknow, SRM University Amaravati and Council of Scientific and Industrial Research - Central Scientific Instruments Organization (CSIR-CSIO). The workshop on Learning and Control will help the participants get familiar with research challenges in the broad areas of learning and control.

Speaking about the benefits of this workshop, Dr. Tushar Jain, Workshop Coordinator, and Assistant Professor, School of Computing and Electrical Engineering, IIT Mandi, said, *"This workshop is first-of-its-kind conducted at IIT Mandi, which focuses on the integration of Machine Learning and Control Systems and brings researchers from industry and academia on the same platform. Machine learning is a rapidly increasing field in all engineering disciplines with numerous applications such as natural language processing, medical diagnosis, etc. The main idea behind this integration is to enable the agent to learn how to react in the environment, possibly based on large data, to achieve the long-term rewards from that environment. This workshop is expected to cultivate the basic concepts of reinforcement learning through a coordinated set of lectures and hands-on demos. Seeing the list of participants, which mostly include professors and post-graduate students from institutes of national importance, this workshop gives a unique platform to initiate collaborative multidisciplinary research."*

The major topics that were being discussed in this workshop include:

- ➢ Deep Learning
- ➢ Game Theory
- ➢ Compressed Sensing
- ➢ Multi – Arm Bandit Problems
- ➢ Reinforcement Learning
- ➢ Generative Adversarial Networks

Reinforcement Learning is reminiscent of direct adaptive control which was introduced into control theory during the 1960s. Current approaches to reinforcement learning are based on viewing it as a problem in Markov Decision Processes (MDP) with unknown Markovian dynamics and unknown reward functions.

Deep results from statistical learning theory are used to estimate the unknown entities. Game theory and optimization can also be used to analyse the behaviour of two neural networks operating in an adversarial mode. In other words, the techniques and philosophy of control theory, optimization, and game theory have much to offer to the world of Machine Learning and Artificial Intelligence.