Dhirubhai Ambani Institute of Information and Communication Technology

DA-IICT

M.Tech. (ICT)
with specialization in
Machine Learning

Academics

Service to Society

DA-IICT

Research & Innovation

Since the beginning of this century, we witnessed the convergence of computing technology and communication technology. A new discipline emerged as information and communication technology (ICT). Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT) since its inception is committed to impart knowledge in the domain of ICT which is one of the most sought after disciplines in the current era. Towards this goal, we introduced M.Tech. in ICT. Now PG programs such as M.Tech. require more in-depth study in a vertical. Hence, we have many specializations under the M.Tech. ICT Program. One such most popular specialization is Machine Learning.

Machine learning (ML) provides computers the ability to learn from data and experience, and to act without being explicitly programmed. It brings together Computer Science, Statistics and Mathematics to harness predictive power. Computer algorithms for ML work by detecting patterns from historical data and using them to predict future data and outcomes in applications of interest. It is at the heart of several important applications such as "Searching the Internet" with other popular uses being Social Networks, Recommendation systems, Stock Market analysis and Medical Diagnostics.

Data is the most important information available in the current digital era. Data is available in the form of image, video, text and speech. All together these are called multimedia data. The collection, storage and analysis of such data is the key to success in today's world. At the same time, the development of computing devices makes data analysis more and more challenging and attractive. Towards this goal, researchers are working towards making the computing devices more capable of resolving real life problems in all domains of our society including business, industry and daily human life. Nowadays, the term artificial intelligence (AI) is present in every

corner of our society. The discipline machine learning (ML) is a subset of AI, and many times they come hand in hand, known as AIML.

The broad topics which are included in the curriculum of ML program are listed as image processing, computer vision, pattern recognition, information retrieval, natural language processing and speech processing with fundamentals in linear algebra, probability and random variables. Some more advanced topics which also included are deep neural networks, deep learning, adversarial machine learning and so on. It is also important that students get to know about hardware and software to handle large scale data. Towards this the curriculum includes lab courses. With such a complete curriculum which will be delivered by the well competent faculty, students are expected to join various research and development organizations as an employee after completion of the program. The program is well supported by placement process through a centralized placement cell of the institute. In the recent past, graduated students have also joined in higher studies such as PhD in many well recognized organizations in India and abroad. Many joined the research organizations for doing cutting edge research. The scenario of placement after completion of the program is very satisfactory.

The core research areas and on-going projects are in the areas of

- Bio-medical image segmentation including MRI, CT-scan data; Histopathological image enhancement and classification
- Object identification and tracking in dynamic environment; image segmentation with limited training data
- Person re-identification in surveillance video; anomaly detection in videos
- Content based video retrieval; multimedia data

content labelling; cross-modal remote sensing image retrieval; SAR image classification
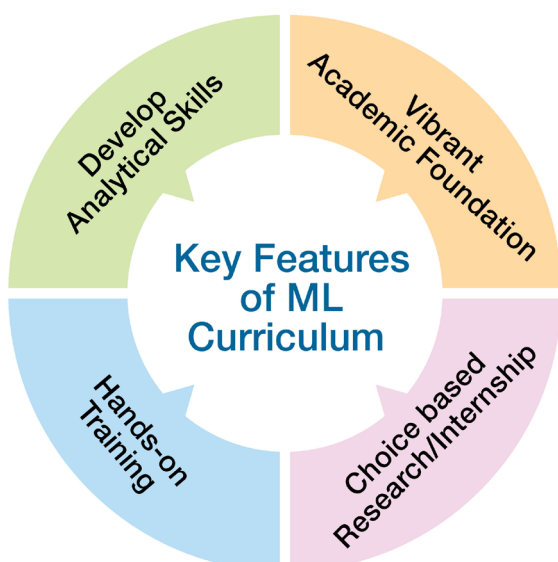
- Forecasting time series data with the help of sophisticated machine learning algorithms; wave height prediction
- Analysing adversarial attacks on neural networks; targeted adversarial attack generation; attacks on network traffic classification
- Image dehazing; real world image denoising; single image super-resolution using deep learning; shadow detection and removal from images
- Text detection and automatic text translation; text summarization

In summary, the M.Tech. (ICT) with specialization in Machine Learning program will help students in several aspects including the following:

- Academic foundations in Machine learning and Deep Learning with underlying mathematics
- Gives industry-ready technical skills in modern Machine Learning frameworks
- Develop analytical and problem solving skills
- Strong programming expertise for solving real life problems

The important takeaways of the M.Tech. program in Machine Learning are as follows:

- **Choice based curriculum**: Flexibility to register for courses of your choice along with other compulsory courses:

    -- To strengthen the foundation of ML through courses listed under Specialization Core and Specialization Electives

    -- To broaden knowledge through courses listed under General Electives

- **Hands-on Exposure through Minor Project-I**: Equips students to be ready for contesting job positions in industry.
- **Research Exposure through Major Project-I**: Allows students to get an exposure on how to handle a project through a systematic approach based on the principles of carrying out a formal research assignment.
- **Flexibility in Semester-IV to prioritize Research Track through Major Project-II (for higher studies) over exclusive Industry Internship or vice versa**: Students may extend their research progress culminating into a thesis, or may choose to pursue industry internships depending upon their inclination.

Key Features of ML Curriculum

- Develop Analytical Skills
- Vibrant Academic Foundation
- Hands-on Training
- Choice based Research/Internship

The key attractive features of **ML** curriculum at DA-IICT Gandhinagar are as follows:

- **To build a vibrant academic foundation**: Courses in the PG curriculum enable the students to get a fine grip over the foundation courses of Machine Learning.
- **Develop analytical skills**: The knowledge gained through coursework is further exemplified through extensive programming related to ML applications.
- **Familiarization with state-of-the-art skill sets**: Both Minor and Major projects are developed as part of the curriculum to enable students gain hands-on training of applying their theoretical knowledge to practice, thereby
  - -- Increasing the scope of employability in industry
  - -- Equipping students better to pursue higher studies
- **Uniqueness of the program**:
  - -- The fourth semester is made available for students to pursue internship in industry/academia, or to extend their research work from the previous semesters
  - -- Encourage students to enrich their curriculum knowledge with hands-on experience using Python including Keras, Tensorflow and PyTorch
  - -- Foundation course on Mathematics made compulsory in Semester-I to empower and broaden the knowledge spectrum and fulfill the current information technology demands

Program Structure and Objectives

Coursework Specific Details:

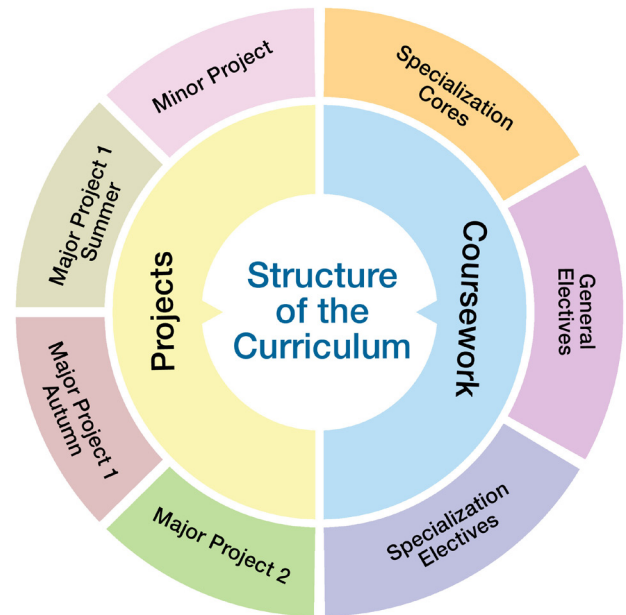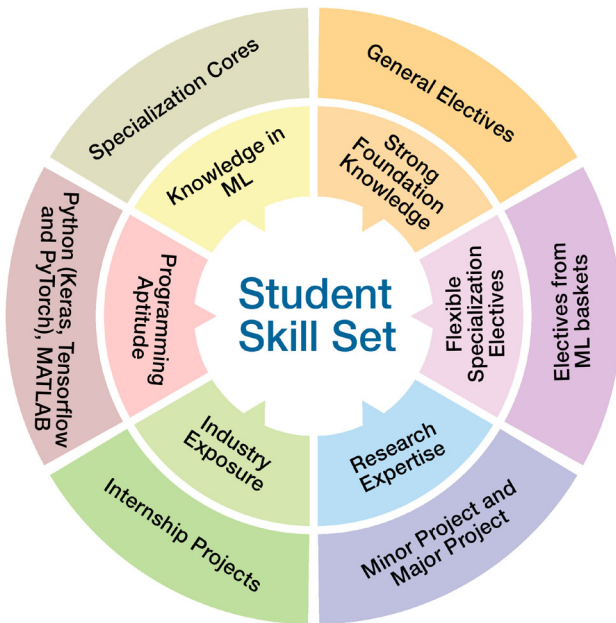The coursework subjects are categorized under 3 broad headings:

- **Specialization Core**: Courses in this basket are designed to build a strong foundation on ML specific courses
- **General Elective**: Courses in this basket are designed to broaden the knowledge spectrum in ML
- **Specialization Elective**: Courses in this basket shall enable to delve into the deeper realms of the curriculum, and aid in specializing across different sub-domains

Project Specific Details:

- **Minor Project (Hands-on experiments)**: ML coursework knowledge gathered in Semester-I are trans lated to hands-on experiments in minor project of Semester-II for enhancing the analytical capabilities of the students
- **Major Project I (Summer) (Research exposure)**: Comprises completion of literature survey, finalizing problem definition, and clearly defining the motivation, objective and scope of the project during the summer (after completion of the first year)
- **Major Project I (Autumn)**: Scheduled in Semester-III, it is preferably an extension of Major Project I (Summer)
- **Major Project II (optional)**: An extension of the project work carried out in previous semesters, culminating into a thesis

Student Skill Set

- Specialization Cores — Knowledge in ML
- General Electives — Strong Foundation Knowledge
- Python (Keras, Tensorflow and PyTorch, MATLAB) — Programming Aptitude
- Flexible Specialization Electives
- Electives from ML baskets
- Internship Projects — Industry Exposure
- Research Expertise
- Minor Project and Major Project

Structure of the Curriculum

Projects
- Minor Project
- Major Project 1 Summer
- Major Project 1 Autumn
- Major Project 2

Coursework
- Specialization Cores
- General Electives
- Specialization Electives

Autumn Semester (Semester-I)

Course Name	Credits (L-T-P-C)
General Elective – Mathematics	3-0-0-3
Communication Skills and Technical Writing	2-0-0-2
Programming Lab	1-0-4-3
Specialization Core I: Foundations of Machine Learning	3-0-2-4
General Elective – Technical	3-0-0-3
*Choose from the general elective baskets	

Winter Semester (Semester-II)

Course Name	Credits (L-T-P-C)
Specialization Core II: Advanced Machine Learning	3-0-2-4
Specialization Elective I-II: (Choose any two)	3-0-0/2-3/4
Digital Image Processing	
Information Retrieval	
Recommendation System	
Adversarial Machine Learning	
Deep Learning	
Multimedia Security & Forensic	
Speech Technology	
Minor Project	0-0-6-3

Summer

Course Name	Credits (L-T-P-C)
Major Project I (Summer)	0-0-8-4

Autumn Semester (Semester-III)

Course Name	Credits (L-T-P-C)
Specialization Elective III-IV: (Choose any two)	3-0-0/2-3/4
Computer Vision	
Natural Language Processing	
Reinforcement Learning	
Computational Shape Modeling	
Wavelet Image Processing	
Time Series Forecasting	
Major Project I (Autumn)	0-0-12-6

Winter Semester (Semester-IV)

Course Name	Credits (L-T-P-C)
Major Project II / Industrial Training Project	0-0-24-12

General Electives – Mathematics in the areas of:

Probability & Statistics, Linear Algebra, Optimization, Graph Theory

General Electives – Technical in the areas of:

Advanced Algorithm, Cloud computing, Artificial Intelligence, Human Computer Interaction

Total Seats: 32,   Seats through GATE : 24 and Seats through Non-GATE : 8

Eligibility Criteria

GATE Qualified candidates

A candidate with a qualifying degree in any one of the following:
- BE/BTech (CS/IT/EL, ECE, Electrical, Instrumentation)
- M.Sc. degree in Computer Science / Electronics / Mathematics / Physics / Statistics
- M.S./M.Sc. degree of DA-IICT
- M.C.A. degree (3 year program)

The aggregate marks in the qualifying degree should not be less than 60% or equivalent as per the norm set by the degree awarding Institute/University.

Non-GATE Qualified candidates

- MSc (CS), MCA, BE/BTech (CS, IT, CSE)

The aggregate marks in the qualifying degree should not be less than 65% or equivalent as per the norm set by the degree awarding Institute/University.

Candidates appearing in their final degree examination and expecting to complete it by July 2022 may also apply. However, their final admission will be subject to the condition that they obtain an aggregate of marks required based on mode of admission i.e. GATE/Non-GATE, or its equivalent as per the norms set by the degree granting Institute/University. All admitted candidates have to submit their degree certificates or proof of completion of degree, before 30 October 2022 failing which their admission is liable to cancellation.

There is no age limit applicable to this program.

Selection Process

Admission to M.Tech. (ICT) with specialization SS, ML and VLSI will admit candidates through two channels from this year: GATE and NON-GATE.

Candidates who have a valid GATE score in the disciplines of Electronics & Communication Engineering (EC), Electrical Engineering (EE), Computer Science and Information Technology (CS), only can apply. The ranking of candidates with GATE score of 425 or above will be on the basis of GATE score only. The candidates with GATE score less than 425 may be required to appear for an interview at DA-IICT in person/Online. Ranking of such candidates will be based on the GATE score and performance in the interview.

Non-GATE candidates selection will be based on their qualifying degree and performance in the interview. Weightage will be as follows:

      40% weightage -> qualifying degree
      60% weightage-> interview

Note: At the time of finalization of admissions, it is likely that some of the Universities in the country would not have announced the final year results of the qualifying degrees prescribed for admissions. In such cases, 40% weightage in qualifying degree will be assigned to the aggregate marks obtained in all the previous University examinations of the qualifying degree.   However, if the applicant fails to receive 65% aggregate marks in the qualifying degree after announcement of final year results, her/his admission will stand discontinued forthwith and no representation/appeal will be entertained.

The candidates can give up to two preferred specializations based on their eligibility conditions. Counseling for allotment of the specialization will be done online. Applicants are advised, from the date of announcement of first merit list, to check for e-mail communications from the Institute to learn about the admission status and steps they need to take to continue with the counseling process.

Note: The decision of the Competent Authorities of DA-IICT regarding eligibility and selection of any candidate shall be final.

How to Apply

Candidates submit an online application by clicking on the link given on the Institute website.

Admission Offer

Final merit list of the confirmed and wait-listed candidates (based on their performance in the entrance examination/interview) shall be posted in the website of the institute.

Important Dates

Online application website opens	11th March 2022
Last date for submission of online applications	30th May 2022
Date of Interview for Non-GATE category (tentative)	15th/16th June 2022
Announcement of first merit list for Admissions (tentative)	25th June 2022
Commencement of academic session	TBD

Fees Structure*

At the time of admission an amount of Rs. 89, 500/- (Rs.64, 500/- towards Tuition Fee for the First Semester and Rs. 25,000/- towards Caution Deposit) is to paid. The registration fee is payable at the time of registration and hostel rent on allotment of the hostel room.

Tuition fee	Rs. 64,500 per Semester
Registration Fee	Rs. 2,500 per Semester
Caution Deposit	Rs. 25,000 (Refundable at the end of the program)
Hostel Rent	Rs. 23,000 per semester
Food	On actuals. There are multiple food options available in the campus (The expense will be approximately Rs. 5,500 per month)

*Subject to revision

Education Loan

The Institute will facilitate the students to avail educational loan from selected Banks. The bank officials will be present on campus at the time of registration of admitted students so as to enable the students to obtain details on procedures and terms and conditions of the loan. The students can also avail loan from banks of their choice and in either of the case; the Institute will extend support in completing the loan documentation process.

Financial Assistance

All GATE admitted students would be eligible for a monthly stipend of Rs. 12400/- in the form of Teaching Assistants in the first semester. In subsequent semesters, the continuation would depend on their satisfying the academic requirements.

For Inquiries: Voice Call: 080 66 91 91 80

The Faculty

Blending academic excellence, research eminence & professional experience

DA-IICT successfully attracts the best teaching and research talents who have completed their doctoral studies at premier institutes in India (such as IISc, ISI, IPR, PRL, IITs, IIITs, NITs, HBNI, Central Universities etc.) or international institutes of repute (in USA, Canada, Europe, Australia, Korea, Singapore etc). All our faculty members are active researchers in their respective fields. Most of our faculty members have significant international exposure in terms of research and industry experience, and are involved in national/international collaborative research projects. They are an exceptional group of academicians in Mathematics, Statistics, Computer science, Physics, Data Science, Computational Science, Communication, Signal Processing, Electronics, Design, Humanities and Social Sciences who are determined to push the frontiers in research and technology. They conduct advanced research and the new knowledge they create routinely benefits classroom learning.

The complete list of our faculty members and their research interests can be found at:
https://www.daiict.ac.in/people/faculty/

Message to Prospective Students

The Post Graduate programme – MTech (ICT) with specialisation in Machine Learning (ML) is a unique fusion of foundation courses in Machine Learning (ML) and Deep Learning (DL) with underlying Mathematics and Statistics and exposure to the techniques, tools used in ML & DL to solve problems in Computer Vision, Image Processing and other related areas. The primary goal of this programme is to produce Industry ready quality human resources with strong Analytical Skills to take up challenges in data handling, processing using ML & DL.

Dr. K. S. Dasgupta
Director

Machine Learning has found a unique place across all the disciplines, where innovative research findings and insightful hands-on experience play around machines, data and inference logic. The MTech program with Machine Learning specialization provides a strong foundation in the field, imparting knowledge in industry relevance courses and a compulsory thesis training. I welcome all aspirants to take part in the journey of this fascinating program.

Dr. Maniklal Das
Dean (Academic Programs)

Essence of our ML specialization lies in teaching the fundamental as well as advanced courses in the ML area. Students have the freedom to choose a number of general as well as specialization electives. This makes it possible for the students to acquire necessary concepts to either choose industry jobs or opt for higher studies after completing their studies. DAIICT has quite a good number of experienced faculty working in the area of machine learning. Hence, I feel DAIICT is the right choice for you to learn.

Dr. Manjunath Joshi
Dean (Research & Development)