ADVANCED CERTIFICATE PROGRAMME IN MACHINE LEARNING

CONTINUING EDUCATION PROGRAMME (CEP), IIT DELHI

7 MONTHS | LIVE ONLINE LECTURES
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Indian Institute of Technology Delhi is one of the Twenty-Three IITs created to be Centres of Excellence for Training, Research and Development in Science, Engineering and Technology in India. Established as College of Engineering in 1961, the Institute was later declared as an Institution of National Importance under the “Institutes of Technology (Amendment) Act, 1963” and was renamed as “Indian Institute of Technology Delhi”. It was then accorded the status of a Deemed University with powers to decide its own academic policy, to conduct its own examinations, and to award its own degrees.

Since its inception, over 48000 have graduated from IIT Delhi in various disciplines including Engineering, Physical Sciences, Management and Humanities & Social Sciences. Of these, nearly 5070 received PhD Degrees. The number of students who graduated with B.Tech Degrees is over 15738. The rest obtained Master’s Degrees in Engineering, Sciences and Business Administration. These alumni today work as Scientists, Technologists, Business Managers and Entrepreneurs. There are several alumni who have moved away from their original disciplines and have taken to Administrative Services, Active Politics or are with NGOs. In doing so, they have contributed significantly to building of this nation, and to industrialisation around the world. For more details, please visit: www.iitd.ac.in
ABOUT CONTINUING EDUCATION PROGRAMME (CEP)

Executive education is a vital need for the companies to build a culture that promotes newer technologies, solutions and build a workforce that stays abreast of the rapidly transforming needs to the technological, business and regulatory landscape.

Committed to the cause of making quality education accessible to all, IITD has launched Online Certificate Programmes under eVIDYA@IITD (ई-विद्या@IITD): enabling Virtual & Interactive-learning for Driving Youth Advancement@IITD for Indian as well as International participants. These outreach programmes offered by the Indian Institute of Technology Delhi are designed to cater to the training and development needs of various Organisations, Industries, Society and Individual Participants at National and International level with a vision to empower thousands of young learners by imparting high quality Online Certificate Programmes in cutting edge areas for their career advancement in different domains of Engineering, Technology, Science, Humanities and Management.

For more details, please visit: http://cepqip.iitd.ac.in
WHO CAN BENEFIT FROM THIS PROGRAMME?

Professionals who have a basic understanding of Python and work with data on a day-to-day basis, who want to gain expertise in handling raw data and in using and optimising Machine Learning algorithms to make better business decisions. This programme will also help professionals understand the underlying mathematics behind ML algorithms and metrics to optimise and choose the correct algorithms for their business problems.

MID TO SENIOR LEVEL MANAGERS
who are looking to upskill in current trends in ML and Data Science, who are currently leading or working with ML projects or want to incorporate ML capabilities in their current or future projects.

TEAM LEADS
leading teams of developers or analysts and seeking to get hands-on experience in implementing Data Mining techniques and ML algorithms and learn resolutions to practical challenges teams face in handling such problems.

ANALYSTS
who want to advance their skills in Data Mining and Machine Learning and implement new ML models for better outcomes.

ENGINEERS
IT, Software, ML and Data Engineers who need hands-on experience in Data Mining and Machine Learning tools.

C-SUITE EXECUTIVES / START-UP FOUNDERS
who wish to implement or build ML capabilities in their organisations for solving specific business problems by understanding underlying mathematics, optimisation and evaluation metrics.
YOUR PROGRAMME
COORDINATORS

Dr. Sayan Ranu is an Associate Professor and Nick McKeown Chair in the Department of Computer Science and Engineering at IIT Delhi. His research interests span the broad area of network science with particular focus on graph neural networks, social network analysis, querying and mining spatio-temporal data, and bioinformatics. He obtained his PhD from the Department of Computer Science, University of California, Santa Barbara (UCSB) in March 2012.

Dr. Sandeep Kumar is an Assistant Professor in the Department of Electrical Engineering at the Indian Institute of Technology Delhi. He was a postdoctoral fellow at the Hong Kong University of Science and Technology, hosted by Prof. Daniel P. Palomar. He received the Ph.D. and M.Tech Degrees from the Department of Electrical Engineering at Indian Institute of Technology Kanpur. His research interest lies in the coherent interaction between optimization, signal processing, machine learning, and graphical models, with applications in networks and data ubiquity.
Dr. Mausam is a Professor and Jai Gupta Chair at the Department of Computer Science and Engineering at IIT Delhi, HOD of the School of AI (ScAI), and an affiliate faculty at the University of Washington.

He got his Undergraduate Degree from IIT Delhi in Computer Science in 2001 and completed his PhD work titled Stochastic Planning with Concurrent, Durative Actions from the University of Washington in 2007. Mausam’s work focuses on large-scale information extraction and text summarization, AI & ML applications to crowdsourcing and education, automated planning under uncertainty, machine learning, and probabilistic reasoning.
Going into the **Advanced Certificate Programme in Machine Learning** you will acquire a foundational understanding of Machine Learning tools, algorithms, and the mathematical underpinnings. The programme aims to equip you to intelligently apply Machine Learning methods to complex problems right from medical diagnostics to sport analytics. With a fine balance of theory and practice, this programme is loaded with contemporary case studies and practice sessions that have been curated to deliver hands-on advanced Machine Learning techniques’ application by game-changers like Google, Amazon, Netflix, Coca-Cola, Flipkart, Government Agencies, and then some.
COACHING

- Weekly real-time doubt clearing sessions with IITD faculties and TAs
- Live Discussion forum for peer to peer doubt resolution monitored by technical experts
- Access to the programme for 3 years post graduation & then updated content provided

FORMAT

- Live weekend classes: Weekly live interactive lectures from IITD faculty on concept building, hands on exercises and doubt resolution

MENTORSHIP

- Live interactive sessions with leading industry experts covering curriculum + advanced topics

PRACTICAL LEARNING

- Case studies based approach to ensure understanding of concepts through tangible problem statements
- Hands on exercises and assessments at regular intervals to test concept understanding and retention

STUDENT SUPPORT

- Your programme buddy will help personalise your learning experience by periodically engaging with you to ensure you are on track with upcoming deadlines, offer guidance, resolve non-academic queries, and lend a helping hand wherever required. However, in case you need to approach us, you can contact our Student Support Team available 7 days a week from 09 AM to 09 PM IST

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## Week 1 - Week 4: Python Fundamentals

### PROF. SANDEEP

**Week - 5**
- Introduction to Course, Intro to ML Paradigm
- ML Foundations: Linear Algebra

**Week - 7**
- ML Foundations: Linear Algebra
- ML Foundations: Probability and Statistics

**Week - 9**
- ML Foundations: Optimization
- ML Foundations (Hands on)

### PROF. SAYAN

**Week - 6**
- Association Rule Mining
- Association Rule Mining (Hands on)

**Week - 8**
- Clustering
- Clustering

**Week - 10 Assignment 1: Clustering**

**Week - 11**
- Clustering (Hands on)
- Anomaly Detection

**Week - 13**
- Anomaly Detection
- Anomaly Detection (Hands on)

**Week - 14**
- Decision Trees
- Hands on

**Week - 15**
- Distance Functions and Queries
- KD-Tree

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Note: A total of 3 weeks of breaks will be given during the programme.
Python Fundamentals

- Intro to Python
  Basics of Python: Data Structures, Control Structures, Functions.

- Python for DS
  Learn the Pandas package to manipulate data frames in ipynb; Learn Numpy for various matrix and vector manipulations.

- Programming in Python (Time Complexity)
  Learn how to approach and solve logical problems using programming.

M1 - Basics (10 hours)

- Introduction to ML Paradigms with Examples
  Introduction to ML, its core concepts and an overview of various ML paradigms such as Supervised Learning, Unsupervised Learning, Reinforcement Learning.

- Linear Algebra
  Fundamentals of Linear Algebra.

- Probability and Statistics

- Optimization Fundamentals
  Introduction to Optimization and its applications to drive maximum value.

M2 - Unsupervised Learning (12 hours)

- Association Rule Mining
  Introduction to Association Rule Mining, which will be used to find patterns, correlations, or associations from datasets found in various kinds of databases such as relational databases, transactional databases, and other forms of repositories.

- Clustering – k-means, hierarchical clustering, DBSCAN
  Learn when to perform clustering and which clustering algorithm for continuous and categorical data.

Topics are indicative only, and the suggested time and sequence may be modified to fit the total programme hours.

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Anomaly Detection and Hypotheses Testing
In this module, we’ll learn Anomaly Detection that will help you identify anomalies within data, and Hypothesis Testing would help you test results of a survey or experiment against certain hypothesis.

M3 - Supervised Learning (15 hours)

- **Linear Regression and Logistic Regression**
  Basics of Linear Regression, Best Fit Line, OLS; Metrics for Evaluation, Python & Spark Case Study. Understand the theory behind Linear Regression: RFE
  When and why do you need Logistic Regression? How to set, cut off and evaluate a model?

- **Decision Tree and its Variants**
  Learn how the human decision making process can be replicated using a Decision Tree and other variants.

- **SVM and its Variants**
  SVM is another type of classifier that will help classify the data using a hyperplane.

- **Generative Model: Naive Bayes and LDA**
  Naive Bayes and LDA (Linear Discriminant Analysis) are another type of classifiers that are best suited for certain classification problems.

- **Model Selection and Regularization**
  Introduction to Model Selection and Regularization will help choose the right model based on your problem and output statistics, regularization on the other hand will help your model not to over-learn from the training data.

M4 - Large Scale Machine Learning (2 hours)

- **SparkML**
  This module will help you scale your ML models on large datasets, we’ll learn what’s different when a traditional model is shifted to big-data and what tools are associated with the process.

M5 - Querying and Indexing (11 hours)

- **Distance functions (Lp Norm, Metric, non-traditional data) and Queries (top-k, range, Aggregate)**
  In this module, we’ll learn about the fundamentals of distance functions such as (Lp Norm, Metric, non-traditional data) and Queries(top-k, range, aggregate).

- **Index Structures (KD-tree, MinHash, Locality Sensitive Hashing)**
  Index structures are data structures with a wide variety of applications which are typically used in complex and state-of-the-art systems such as Google Search.

- **Dimensionality reduction and Curse of Dimensionality**
  In this module, we’ll first learn about the curse of dimensionality and how it affects our ML models, next up we’ll learn about various ways we could go for dimensionality reduction.

Topics are indicative only, and the suggested time and sequence may be modified to fit the total programme hours.

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M6 - Data Streams (3 hours)

- Applications and Challenges of processing Data Streams
  Streaming data is a time-bound data, with this module we'll about data streams, and the challenges in real-time processing of them.

- Sampling Strategies
  Sampling helps the applicant to conduct an experiment on a sample much smaller than the actual data, as part of this module, we'll learn various sampling techniques that will help us to do experiments efficiently.

- Bloom Filters
  Bloom filters is a type of data structure that helps store data efficiently, you'll learn more about its wide variety of applications in this module.

M7 - Introduction to Deep Learning (9 hours)

- Perceptron Model and Neural Network
  In this module, we'll introduce you to Deep Learning, and its core fundamental a perceptron, further we'll learn about deep neural networks that are the current state-of-the-art technology behind recent advancements in the field of AI.

- Language models for Text
  80% of the world's data is in form of unstructured text data, with this module we'll learn how to do text data analytics and build language models around that.

- CNN and its Applications
  CNN - Convolutional Neural Networks are the most prominently used deep learning models in the field of computer vision, this module is designed you to introduce you to CNN.

- RNN and its Applications
  RNN - Recurrent Neural Networks have primary application in unsupervised learning tasks, and are widely extended to text, pattern based AI models, this module is meant to introduce you to this area of Deep Learning models.

- Graph Convolutional Networks
  This module would introduce you to GCNs that are a very powerful neural network architecture for Machine Learning on graphs.

Assignments

- Assignment 1: Clustering
- Assignment 2: Classification
- Assignment 3: Deep Learning

Topics are indicative only, and the suggested time and sequence may be modified to fit the total programme hours.
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WHAT WILL BE THE OUTCOME?

A Win-Win for all!

- Master state-of-the-art Machine Learning techniques
- Gain mathematical insights of Machine Learning and Data Mining tools and algorithms
- Develop powerful models to generate actionable insights necessary for making data-driven decisions for complex problems

COMPLETION CERTIFICATE

If you achieve 40% overall in assessments and have 60% attendance.

Indian Institute of Technology Delhi
Department/Centre/School of........................................
Hauz Khas, New Delhi- 110016

Continuing Education Programme
on
“Title of the Programme”

This is to certify that Mr./Ms. ___________________________ (Your Name) has successfully completed the online certificate programme on “Title of the Programme” held from “Duration” by Indian Institute of Technology Delhi.

Prof. Course Coordinator

Prof. Head of the Department

Prof. Head/Associate Head, CEP

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PARTICIPATION CERTIFICATE

If you achieve less than 40% in assessments and have 60% attendance.
PROGRAMME DETAILS

DURATION: 7 MONTHS

PROGRAMME START DATE:
Please refer to the website for programme start dates.

PROGRAMME FEE: ₹100,000 + 18% GST

ELIGIBILITY:
At least 50% in Bachelor’s with a discipline in Engineering, Science, or Commerce with Maths/Stats. Must be familiar with programming.

SELECTION PROCESS:

STEP 1:
Online Eligibility Test
Fill out an application and take a quick 40-minute online test with 18 questions to assess your aptitude.

STEP 2:
Review and Shortlisting
Our faculty will review your application, considering your educational and professional background and review the test scores where applicable. Following this, Offer Letters will be rolled out so you are assured a great peer group to learn and network with.

STEP 3:
Payment and Enrollment
Details for payment and enrollment will be shared with your offer letter.

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IMPORTANT INFORMATION

Last date to apply: 31st July, 2021  APPLY NOW

Shortlisted candidates will be informed by: 5th August, 2021

Last date to submit the fee: 12th August, 2021

All fees should be submitted in the IIT Delhi CEP account only, and the receipt will be issued by IIT Delhi CEP account for your records.

Online Certificate Programmes are offered by the Indian Institute of Technology Delhi under the aegis of Continuing Education Programme (CEP) so that the Institute can realise its vision of serving as a valuable resource for industry and society, and fulfil its mission to develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

FOR FURTHER DETAILS, CONTACT:
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FOR ANY FEEDBACK, WRITE TO:
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