

# Artificial Intelligence in Healthcare and Applied Analytics

Online, live, interactive, hands-on classes on analysing Healthcare Data using Machine Learning & AI  
(120-hours)



**FORE School of Management**  
New Delhi

FORE School of Management, New Delhi

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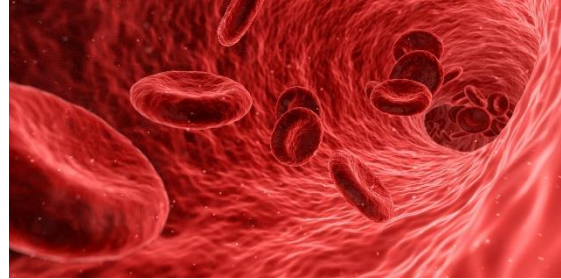
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## Program

If anything, COVID-19 has given a massive fillip to analytics in healthcare sector. It is not that healthcare sector was not using analytical tools earlier, just that use of

analytics has become more pronounced after the emergence of the global pandemic. Massive amount of data is being generated the World over on COVID-19 and such large data can only be analysed through Machine Learning techniques. ML technology helps to understand numerous aspects of this malady.

Health sector has generally been generating large amount of data. Today, many hospitals are computerised leading to massive volumes of patient data, sensor data coming out of electronic instruments, claims and cost data, inventory & drugs data, pathology and X-ray data. Machine Learning and Deep Learning techniques offer a way to explore and make sense out of this data and make very useful predictions or rather assist in fast and accurate diagnosis. Some questions that we try to answer pertain to Clinical problems, pharmaceutical and research challenges, patient behaviour or insurance and costs and even related to many other aspects. [Here](#) is a list of some of the possible questions.



The program is divided into three modules. Details about the Modules and the Type of Questions answered are given below.

### No Programming

We would like to highlight, at the very outset, that we cover ML&AI techniques using ‘No-code’ approach. We use the best, highly reputed and industry standard Visual frameworks that generally use drag-and-drop approach to build ML workflows—to process data, build models, test them and then deploy for production use. All these tools are open-source, have very liberal licencing policies (*copyleft*, so to say) and can be utilised even with very large data. We fully realise that many of our students are deeply busy in their core professional work and have little time to learn the intricacies of a programming language (such as python or R). And at the same time, they would like to apply power of analytics to assist them in their work. About the Visual tools used, please see below([here](#)).

We would also like to mention that very few Institutions in India offer program in *Healthcare Analytics* (though many do in *Healthcare Management*). And among those very few none offers a program using ‘No-code’ approach.

This program is also unique in its breadth of coverage. We cover both Machine Learning and Deep Learning, almost in their entirety. Of the very few programs in Healthcare Analytics, none has this wide coverage.

## About the Modules

We have three modules. The first covers Statistical Analysis and the other two cover Machine Learning and AI Techniques (ML & AI) as applied to health sector. These modules are **totally hands-on and practise based**. These are online, live, and totally interactive **lab oriented Modules** with the primary objective of disseminating techniques of Healthcare Analytics using Statistics, Data Visualization, Machine Learning & AI. These technologies enable a practitioner to apply them on data in numerous ways.

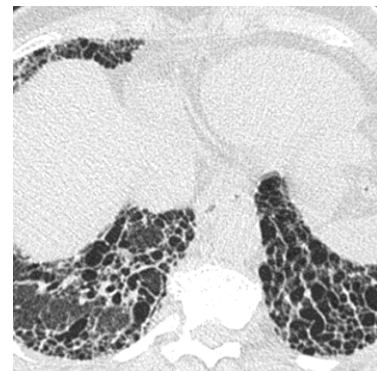


## Primary Objectives

- i. Develop insights into healthcare data through visual analytics
- ii. Discover if data has any structure
- iii. Learn techniques to group/segment data
- iv. Develop models for predictive analytics
- v. Optimize model performance, and
- vi. Single-out attributes that contribute most towards higher performance--  
>Explainable AI

## Types of questions answered

Here are several typical or atypical questions that we strive to answer in our classes. We will perform Statistical analysis, Segmentation analysis, Classification analysis and Regression analysis.



## Clinical Problems

- Classify fetal health in order to prevent child and maternal mortality
- Predict lung function decline—Pulmonary Fibrosis Progression
- Predict Possibility of Heart Attack
- Classify Pulmonary Embolism cases in chest CT scans
- Predict the onset of diabetes based on diagnostic measures
- Predict Age from X-rays
- Predict if an infant is likely to develop autistic tendencies
- Predict severity of epileptic seizure
- Detect Malaria through Infected Cell Images
- Detect Autism from a facial image
- Identify acute intracranial haemorrhage and its subtypes
- MRI Imaging Comparisons of Demented and Nondemented Adults
- Create an accurate model to predict the stage of Alzheimer.
- Distinguishing Different Stages of Parkinson's Disease

### Pharmaceutical and R&D Problems

- COVID-19 mRNA Vaccine Degradation Prediction
- Predict a biological response of molecules from their chemical properties

### Patient behaviour related

- Can you predict if a patient will keep his appointment?
- Prevalence and attitudes towards mental health among tech workers

### Insurance and Costs related

- Can you accurately predict medical insurance costs?
- Healthcare Provider Fraud Detection Analysis
- Explore Health Insurance Marketplace
- Predict length of stay in hospital
- Predict medical insurance costs
- Predict hospital readmission for diabetes patients

### Retail purchases and sale

- Forecast sales of drugs using store, promotion, and competitor data

## Course Modules

The plan for the three modules is as below. Teaching sequence will also be in this order. Details about each Module are given below under respective Module heads.

Module	Theme	Hours
Module---I	<a href="#">Statistical Analysis and Data Visualization</a>	40
Module---II	<a href="#">Machine Learning</a>	40
Module---III	<a href="#">Deep Learning and Natural Language Processing</a>	40
<b>Total</b>		120

### About Visual Tools used

We use the following Visual frameworks:

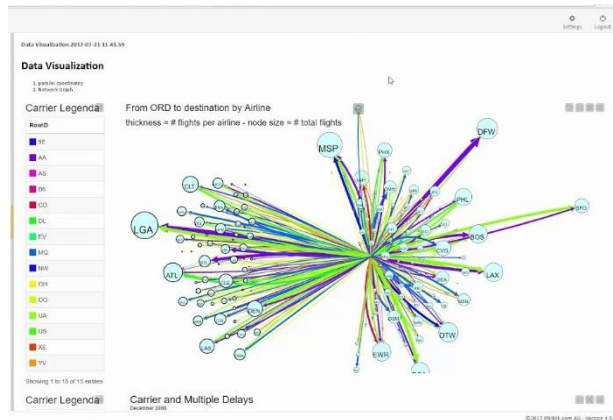
Software	Applied in
KNIME ; H2o.ai	Machine Learning
Deep Learning Studio	Deep Learning

All three have highly intuitive user interface to perform analytics. We describe each one of them below:

## KNIME

We use [KNIME](#) to implement ML & AI Techniques. *KNIME is to Data Science what SPSS is to Statistics*. Just as in SPSS, it is easy to import data, analyse it and generate reports for statistical analysis, so also it is equally easy (if not easier) to implement ML&AI techniques and publish results using KNIME--no matter how small or how large your dataset is. Also, just as results

from SPSS are recognised widely in research community, so also KNIME's credibility to Data Science is recognised the World over and for the sixth year in a row, Gartner has placed KNIME as a leader for Data Science and Machine Learning (ML) Platforms in its Magic Quadrant based on ability to execute and completeness of vision. See this [link](#). KNIME also offers a bonus for those who are familiar with Python--extending its utility. KNIME is being used extensively in Industries for research & production oriented work.



## H2O.ai

[H2O.ai](#) an Open Source, Distributed, Fast & Scalable Machine Learning Platform: Deep Learning, Gradient Boosting (GBM) & XGBoost, Random Forest, Generalized Linear Modeling (GLM with Elastic Net), Both KNIME and H2O.ai are open-source platforms, free to download and use ([GPL ver 3 licence](#)).

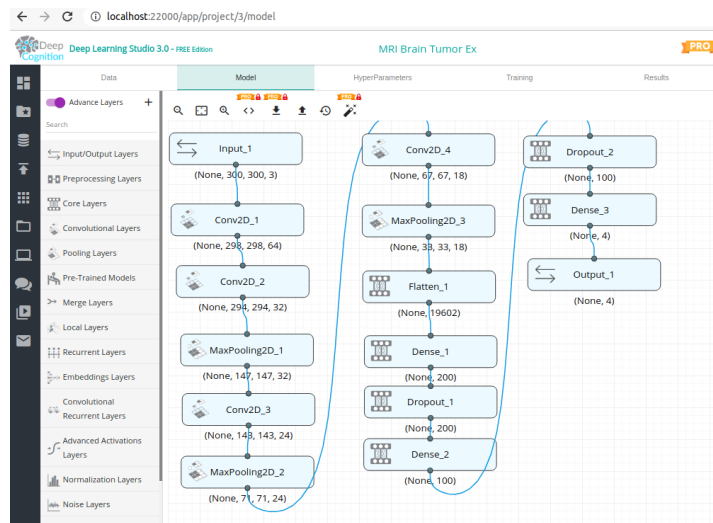
It is very easy to install them on one's laptop. They are installable on Windows, Mac or Linux platform (for example Ubuntu).



## Deep learning Studio

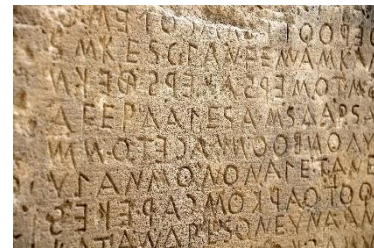
[Deep Learning Studio](#) is a software tool that aims to simplify the creation of deep learning models used in artificial intelligence. It is compatible with a number of open-source programming frameworks.

Deep Learning Studio can automatically design a deep learning model for any custom dataset. One can have a good performing model up and running in minutes. It's a tool for AI developers to build, train, and deploy their deep learning models. Deep Learning Studio is installable on Windows or Ubuntu.



### Detailed Contents

Module—I is the foundation module. Concepts taught here are universally used in ML and AI. Modules--II and III differ in their approach to Machine Learning. Module--II pertains to what may be called *Traditional Machine Learning* and Module-III pertains to *Deep-Learning and Natural Language Processing* techniques. Traditional techniques require much less data than Deep-Learning or NLP techniques. Both have their pros and cons. Traditional ML techniques generally deal with tabular data sets while deep-learning techniques also process Image or video datasets.



### Module—I

#### Statistical Analysis and Data Visualization

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Data Mining is intimately intertwined with Statistics. Knowledge of basic statistics is essential for a successful analyst. Many 'Small data' techniques such as correlation, testing of hypothesis, data-transformation and others need to be learnt to fully understand data. Concepts of inferential statistics are used in comparing machine learning models. Descriptive statistics is invariably used in data pre-processing. In this Course we refresh as also learn statistical fundamentals and essential inferential statistics.

1. Measures of Central Tendency and Dispersion
2. Probability Theory (Different Approaches, Rules of Probability, Bayes' Theorem)

3. Random Variables and Probability Distributions Discrete Probability Distributions
4. Continuous Probability Distributions – Normal Distribution
5. Correlation and Regression Analysis: Simple & Multiple Regression
6. Concept Of Hypotheses Testing, Type I & Type II Errors, Power Of The Test, Hypothesis Testing of Mean and Proportion, Two Sample Tests, Tests for Difference in Means and Proportions.
7. Chi-Square Goodness-of-Fit Test, Test of Independence

## Module—II

### Machine Learning (Traditional)

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We practice those modelling techniques that consistently garner high performance, are relatively fast and are well known in ML community. Thus, these will be of immense use in many predictive applications. These techniques do not perform that well with image or video data.

1. Introduction to Machine Learning Technology
2. Data visualization and discovering structure in data. (Techniques include t-sne, parallel coordinates, mosaic plots) and Feature importance
3. Unsupervised learning techniques
  1. K-means clustering
  2. Hierarchical clustering
  3. Expectation-Maximization algorithm
  4. T-SNE & UMAP manifold learning technique
  5. Dimensionality reduction
  6. Principal Component Analysis (PCA)
4. Supervised learning techniques for Classification and Regression
  - a. Decision trees
  - b. Ensemble modelling using Random Forest
  - c. Gradient Boosting Techniques
    - i. Gradient Boosting Learner
    - ii. XGBoost
    - iii. LightGBM
  - d. Handling imbalanced data—SMOTE, ADASYN & other methods
  - e. Performance measures: Accuracy, Precision and Recall, F-measure; Area Under the Curve, Cohen’s Kappa, Sensitivity, Specificity
    5. Hyper-parameter optimisation techniques—Bayes Optimization;
  6. Interpreting Machine Learning Models

## Module—III

### Deep Learning and Natural Language Processing

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In Module-III we practise Deep-learning techniques and Natural Language Processing. Deep Learning techniques are especially useful for image datasets, for example, chest-X-rays and CAT-Scans. These techniques are also used with sensor data (for example, ECG). If tabular data is sufficiently large, deep learning techniques can be applied for making predictions. Many a time, structured data has one or more columns of text data (for example describing patients' state of health etc). Natural Language processing techniques can be applied on such columns. Here is what we cover and learn:



1. Introduction to Neural Networks (NN)
2. Experiments with MLP networks
3. Regularising NN
  - a. Dropouts
  - b. Batch-normalization
  - c. l1 and l2 regularization
  - d. Starting weight initialization
4. Deep Learning with Convolution Neural Networks
  - a. Data Augmentation
5. Using very deep Convolution Networks
  - a. Transfer learning with VGG16
  - b. Transfer learning with ResNet50
  - c. Transfer learning with InceptionV3
6. Recurrent Neural Networks
  - a. LSTM, GRUs and Bi-directional LSTM
  - b. Working with complex sensor (time-series) data with multiple variables
  - c. Sequence Classification and text-classification
7. Natural Language Processing
  - a. Word2Vec transformation
  - b. Encoder-decoder networks
8. Experimenting with TensorBoard
9. Autoencoders and Anomaly detection
10. Automated Machine Learning (AML)

### ML & AI Modules Pedagogy:

We strongly believe that a course in Healthcare Analytics can only be practice-based rather than pure theory based. We also believe that a practice-based course requires constant interaction with the teacher during lecture hours in real time. Our teaching pedagogy is like this: First, the algorithm (or theory part) is conceptually explained without getting into mathematics and then a project is undertaken to implement the techniques. Healthcare datasets for implementation are made available in advance. During the lecture, we go through one of the visual frameworks such as KNIME workflow and explain the steps. At his end, the student goes through the same steps

on his laptop. Consequently, results are available at our end as also with the Students immediately. In short, *both the teacher and students are working on their respective laptops simultaneously*; students solve their problems and ask any questions to clarify. The whole experience is just as if everyone is sitting in a laboratory and working together. Students are required to have a laptop with minimum of 8GB of RAM. Workshops are a special feature of program.

## Who Should Attend?

Healthcare industry generates lots of data and this data is analyzed by professionals specializing in numerous fields. The program would be very useful for Medical Practitioners, Bio-technologists, bio-informatics or in general, students of [Life – Sciences](#)-- Biology, Biotechnology, Biochemistry, Bioinformatics, Cell biology (cytology), Ecology, Molecular biology, Microbiology, Marine Sciences —will find the program very useful.

Officers Managing Hospitals, Data Scientists or programmers, Doctors or those in academics or Healthcare workers will find program extremely beneficial.

## Program Timings and Duration

The total Duration for all Modules is 120+ hours spread over 4-5 months. The program will be delivered on Saturdays and Sundays (10am to 12:30pm). There are 5 hours of teaching per week. Students are expected to perform exercises. This methodology of "learning concept->performing class projects-->Do self-exercises" leads to better and stress-free absorption.

Program date: **August 26<sup>th</sup>, 2023**

## Program Requirements (for students)

Participating students should be having a laptop or desktop with minimum 8gb of RAM. More RAM is advisable. Preferably the processor should be not lower than i5.

## Program Director

Prof Ashok K Harnal

### Profile of Trainers:

**Prof. Ashok Kumar Harnal:** Graduated from IIT Delhi in Electronics and Communication, He is an expert in Big Data and Data Analytics. He has extensively taught faculty and students on the subject of big data technology and analytics. He has been conducting ML&AI programs (since last eight years) in collaboration with University of California, Riverside, for executives around the world. Prof Harnal has held programs for numerous organizations including Central Bank of India, Punjab National Bank, Union Bank of India, RITES and NABARD. He has been Program Director in the two earlier programs on Healthcare Analytics and one currently under progress. He has a very long experience in working with Opens Source Systems and has published two books: one Linux Applications and Administration and the other Techniques of Game Programming; both published by Tata McGrawHill.

Prof Harnal has conceived, planned & implemented in Defence Estates three country-wide information systems: Raksha Bhoomi to computerize land records; Knowledge Management of land-title related files/ maps in all Defence Estates offices; and Setting up of a Disaster Management organization, Archival Unit and Resource Center at Delhi for safe storage of land-title related records in paper, digital & microfilm forms.

**Dr. Vinaytosh Mishra** is an Associate Professor for Healthcare Management (Management, Digital Health, and Health Analytics) at the College of Healthcare Management and Economics, Gulf Medical University, Ajman (UAE). Dr. Mishra has done his engineering and Ph.D. from the prestigious India Insitute of Technology (BHU), Varanasi. He has more than 16 years of experience in industries like Healthcare, EdTech, Finance, and Information Technology. He is also a mentor for leading business incubators in India and UAE and a domain expert for AI implementation with AI Hathboor Bikal.ai, UAE.

Dr. Vinaytosh Mishra has published in journals of international repute (ABDC/Scopus/SSCI) and served as an editorial board member of reputed journals such as Hospital Topics, Frontiers in Digital Health, and Abhigyan. He also has an international patent in the field of image processing and NLP-based innovative solution in healthcare. His research interests include Digital Transformation, Healthcare Management, Health Economics, Healthcare Supply Chains, Complex Adaptive Systems, Healthcare Systems, and Digital Health.

## Program Fees:

The program fee is Rs. 42,000/- + GST per participant in two equal parts. Group discount for 3 or more is 15%, Corporate discount is 10%, Discount for MBBS/ BAMS/ BHMS working in a hospital is 10%. Anyone discount is applicable. These discounts are valid till Aug 05, 2023 only.

The program fee is Rs 36,000/-+GST in case of a lump sum payment. Group discount for 3 or more is 15%, Corporate discount is 10%, Discount for MBBS/ BAMS/ BHMS working in a hospital is 10%. Anyone discount is applicable.

## Registration Details:

1. Mark an email to Mr Mukesh Maheshwari at [exed@fsm.ac.in](mailto:exed@fsm.ac.in) and you will receive the registration form and fee payment link or call at +91-9166085159/ 011-4648 5562/ +91-9818790778.
2. Fill out the apply now form at [Healthcare Data Analytics Courses India |Data Analytics Courses in Delhi- FORE \(fsm.ac.in\)](#)
3. Last date of registration is Aug 16, 2023.

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