PhD program in CMInDS

The Center for Machine Intelligence and Data Science (CMInDS) at IIT Bombay, established in March 2020, is aimed at advancing the fields of Artificial Intelligence and Data Science, as well as their application domain through cutting-edge research and specialized education programs. More than seventy-five faculty members from fifteen departments are associated with the Center, with twenty-five of them actively involved in the direct functioning of the center.

The PhD program comprises an elaborate course-work for learning the required foundations and advanced concepts related to ML and AI, R&D projects, and a PhD thesis.

Admission Criteria

General eligibility criterion for admissions as mentioned in section A.5 of IIT Bombay's PhD admissions information brochure:

Candidates with First class or 60% (55% marks for SC/ST) marks in:

1. Master’s or equivalent degree in Engineering/Technology
2. Four years Bachelor’s degree in Engineering/Technology/Science
3. Master’s or equivalent degree in Science/Statistics/Mathematics
4. MBA (with B.Tech/B.E or an equivalent degree)

Note: The MCA (Master of Computer Applications) degree will be considered as being equivalent to a four-year BTech degree.

For candidates qualifying under (2) or (3), one of the following additional requirements must also be fulfilled:

a. Valid GATE score
b. A four-year Bachelor’s degree from the IITs (BTech), IISc (BS), IISERs (BS-MS) or a Master’s degree from ISI (any two year Master’s degree), with CPI (normalized to a 10 point scale) >= 8
c. Minimum of TWO years of professional experience (acquired after obtaining the qualifying degree and completed before the starting of the semester in which admission is sought)

Minimum marks/CGPA/CPI in qualifying degree would be as per current Institute norms. Among students admitted under criterion (b) above without a GATE score, only IIT BTech holders will be eligible for Teaching Assistantship.

The Center will additionally conduct a written test and an interview to shortlist candidates. The written test will include topics such as general aptitude, programming, probability & statistics, calculus, and linear algebra. The syllabus can be found in the Admissions section of the CMInDS website: www.minds.iitb.ac.in

Course requirements

Given the diverse academic backgrounds of the students, five breadth topics have been defined, and the students are required to obtain proficiency in each of them. The topics are:

1. Computing
2. Probability & Statistics
3. AI/ML
4. Linear Algebra
5. Optimization

A basket of IIT Bombay courses that provide the requisite background in each of these areas has been created.

PhD Qualifier

In order to qualify for the PhD program, students will have to fulfill the following criteria:

1. For students with a Master’s degree in Engineering/Technology (respectively, for those without), a CPI >= 8 averaged over 3 (respectively, 5) CMInDS courses taken at IITB within two semesters (respectively four semesters) of the start of joining. (By CMInDS courses, we mean courses that belong to our breadth/elective baskets.)

2. A grade >= 8 in the PhD seminar

Students unable to meet these qualifying criteria will be offered an exit option (M.S. by Research) as per prevailing Institute norms.

Further details about the program can be found in the Academics section of the CMInDS website: www.minds.iitb.ac.in

Research themes (not limited to):

AI/ML theory: Concept learning, generalization bounds, handling data imbalance, learning from noisy labels, memory networks, adversarial attacks and preventions, interpretable AI, Bayesian modeling, uncertainty quantification in deep learning, causality and counterfactual reasoning, domain adaptation and generalization, robustness, human-machine interaction.

AI/ML in Finance: Risk Analytics, Consumer Analytics, Customer Data Analytics, Real-Time Analytics, Financial Fraud Detection, Personalized Services, Algorithmic Trading, Data Auditing, and Currency Note Salvage Automation, Game theory in Finance, Anomaly detection, and data quality.

Speech and language technologies specifically for Indian languages: Machine (and Spoken) Translation, Speech Recognition, Models for Code-Switching, Cross-Lingual Audio-Visual Learning, Sentiment and Emotion Recognition, Information Extraction, Explainable and Human-in-the-Loop Systems, Natural language interfaces to data, Conversational data analysis

AI in transportation: Automation in Highway and Railway Alignment Design, Predicting Road Runoff Crashes from Vehicle Dynamics Data, As-Built Geometric Features of Highways from Instrumented Vehicle Data, Driving Style Recognition from Vehicle Dynamics Data, Security Ratings of Transportation Facilities using Multi-Source User Data, Safety Evaluation of Transportation Infrastructure using Multi-Source User Data

AI in visual computing: Image classification, segmentation, object detection, weakly-supervised image classification, zero-shot and few-shot learning, continual learning, transfer learning and domain adaptation, multi-modal learning, multi-task learning, human activity analysis from videos, 3D computer vision using deep learning, image retrieval, medical image analysis, image rendering, Shape analysis from image sequences, remote sensing image analysis

AI & ML in Manufacturing: IoT / IIoT framework, performance analytics, fault detection & diagnosis, prognostics & diagnostics, condition-based monitoring, performance monitoring, physics assisted knowledge representation, filtering and estimation theory, distributed
decision making, advanced and large scale optimization for prescriptive analytics, Regulation and Control, scheduling and decision support systems.