

# EdTech Internship

Learning Analytics and Learning Processes Group  
Educational Technology IIT Bombay

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**Note:**

1. The data and the problem statements fall under Educational Technologies
2. Most of the projects may use deep learning methods

## Machine and Deep Learning for Processing

Text Processing  
Image Processing  
Speech processing  
Sensor data Processing  
Multimodal Analysis

## Process Mining and Data Mining for Understanding

Supervised learning  
(classification • regression)  
Clustering  
Dimensionality reduction  
Structured prediction  
Anomaly detection  
Artificial neural network  
Reinforcement learning  
Business Process Management  
Process Discovery  
Conformance Checking  
Workflow Management  
Machine Learning  
Data Science  
Sequence mining  
Intention mining  
Data visualization  
Process analysis

## Environments

Classroom  
Collaborative Learning  
Online Learning  
Virtual reality  
Augmented Reality

## Sensors

Webcam  
Camcorder  
Kinect  
Tobii eye tracker  
Leap Motion  
Muse  
GSR  
EEG  
Interaction Log Data

## Areas at bird's-eye view

Computer Vision  
Natural Language Processing  
Signal Processing  
Multimodal Learning Analytics  
Augmented Reality  
Virtual reality  
Internet of things  
Web Technologies  
Human Computer Interaction  
Human Robotic Interactions  
Learning Analytics

## Sample Projects

### **1. Automatically detecting synchrony and equality (other low-level constructs) in collaborative discourse using audio features of speech**

- a. Speech Features: pitch, energy, speaking rate, acoustic features, mean audio level, prosodic and tone features, additionally entrainment and pause-turn taking gap etc
- b. Learning Environment: Collaborative Learning
- c. Sensor Used: Camcorder and Mike
- d. Processing: Speech and Text
- e. Learners: Simultaneous analysis of Multiple Learners
- f. Data: Video (images and audio)
- g. Methods: Machine and Deep Learning
- h. Modalities: Multimodal
- i. Duration: 2 Months (Part-time)
- j. Area: Signal Processing, Computer Vision and Learning Analytics
- k. Level of the project: For intermediate (Some exposure in signal processing)

### **2. Analysing Students' affective states in Augmented Reality Environment for language learning**

- a. Learning Environment: Individual Learning
- b. Sensor Used: Leap Motion
- c. Processing: Image
- d. Learners: Single learner
- e. Data: Images
- f. Methods: Deep Learning
- g. Modalities: Single
- h. Duration: 40 hours
- i. Area: Computer Vision, Augmented Reality and Educational Data Mining
- j. Level of the Project: Beginner

Similarly there are several projects that cover the above mentioned details and not all can be provided as the list is quite big. Hence I am providing the broader areas of the project below. In every area there are projects for beginner, intermediate and expert.

## List of current Projects but not limited to

1. Students' Microexpressions in online learning to optimise the edge computing aspects of vision based student emotional engagement analysis

2. Automatic prediction of NV indicators in co located collaborative learning for graduate student programming course
3. Design of 3d characters that are expressive and interactive for mathematics course content delivery
4. Temporal nature of learning centred emotion for primary school children
5. Monotone detection of teacher voice from online lecture videos
6. Blender and Unity 3D avatars in augmented reality based ed. App.
7. Addressing the challenges of multimodality for educational data
8. Tobii eye tracker based eye gaze analysis for student engagement in high school mathematics education
9. Summarization and alignment of interaction log data, facial expressions and eye gaze for cognitive and affective engagement in the METTLE study
10. Feature engineering for drop rate and performance prediction in longitudinal data obtained from high school students
11. Preserving Privacy of Face and Facial Expression in Computer Vision Data Collected in Learning Environments

## Areas of Projects but not limited to

- **AI-assisted and Interactive Technologies in an Educational Context**  
Natural language processing and speech technologies; Data-driven processing techniques (educational data mining, deep learning, machine learning,...); Knowledge representation and reasoning; Semantic web technologies; Multi-agent architectures; Tangible interfaces, Wearables; Virtual and augmented reality.
- **Modelling and Representation**  
Models of learners, including open learner models; facilitators, tasks and problem-solving processes; Models of groups and communities for learning; Modelling motivation, metacognition, and affective aspects of learning; Ontological modelling; Computational thinking and model-building; Representing and analysing activity flow and discourse during learning; Representing and modelling psychomotor learning.
- **Models of Teaching and Learning**  
AI-assisted tutoring and scaffolding; Motivational diagnosis and feedback; Learner engagement; Interactive pedagogical agents and learning companions; Agents that promote metacognition, motivation and positive affect; Adaptive question-answering and dialogue; Data-driven modelling (educational data mining, deep learning, machine learning,...); Learning analytics and teaching support; Learning with simulations; Explainability of models for teaching and learning.

- **Learning Contexts and Informal Learning**

Game-based learning; Collaborative and group learning; Social networks; Inquiry learning; Social dimensions of learning; Communities of practice; Ubiquitous learning environments; Learning through construction and making; Learning grid; Lifelong learning; Learning in informal settings (museum, workplace, etc.); Learning in the physical space; Learning of motor skills.

- **Evaluation**

Studies on human learning, cognition, affect, motivation, engagement, and attitudes; Design and formative studies of AIED systems; Evaluation techniques relying on computational analyses.

- **Innovative Applications**

Domain-specific learning applications (e.g. language, science, engineering, mathematics, medicine, military, industry, sports and more); Scaling up and large-scale deployment of AIED systems.

- **Equity and Inclusion in Education**

Socio-economic, gender, and racial issues; Intelligent techniques to support students from under-resourced schools and communities; Sponsorship, scientific validity, participant's rights and responsibilities, data collection, management and dissemination.

- **Ethics and AI in Education**

explainability, transparency, accountability, responsible AIED, adoption, involvement of teachers and learners.

- **Explore Design, Use, and Evaluation of Human-AI Hybrid Systems for Learning**

Research that explores the potential of human-AI interaction in educational contexts; Systems and approaches in which educational stakeholders and AI tools build upon each other's complementary strengths to achieve educational outcomes and/or improve mutually.

- **Online Learning Spaces**

Massive open online courses; Remote learning in k-12 schools; Synchronous and asynchronous learning; Mobile learning; Active learning in virtual settings; Video-based learning; Mixed reality and learning.

<b>Preferred Group Size: 3 (Not Mandatory)</b>
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**Duration of the Projects:** Depends can be from minimum 2 months to an year based on hours per week, part time full time and so on.

**Sample works** can be observed in the following google scholar profiles (Check the published works related to education)

<https://scholar.google.com/citations?user=E3WJWwUAAAAJ&hl=en>

<https://scholar.google.com/citations?hl=en&user=fzRGk70AAAAJ>

<https://scholar.google.com/citations?user=-Rdtw4oAAAAJ&hl=en>

[https://scholar.google.co.in/citations?hl=en&user=I7pOhHsAAAAJ&view\\_op=list\\_works&sortby=pubdate](https://scholar.google.co.in/citations?hl=en&user=I7pOhHsAAAAJ&view_op=list_works&sortby=pubdate)