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(Established by H.P. State Legislature vide Act No. 14 of 2002)

Centre of Excellence in Artificial Intelligence for Education (CoE-AIE)

Event:Monsoon-Mind: Predict the Rain — An AI Challenge on Climate Action

(17th April – 14th May 2025)

Introduction

The Monsoon-Mind: Predict the Rain — An AI Challenge on Climate Action was organized by the Centre of Excellence in Artificial Intelligence for Education (CoE-AIE) during 17 April –14 May 2025. This event is inspired by **United Nations Sustainable Development Goal 13: Climate Action** — *Take urgent action to combat climate change and its impacts*. Through this challenge, we aim to foster data-driven thinking and innovation in climate modeling using Artificial Intelligence.By aligning with **SDG 13: Climate Action**, this event empowers students to contribute meaningfully to one of the most pressing global challenges — climate change — through the lens of AI and sustainability.The competition was successfully conducted with the efforts of faculty coordinators Dr. Hari Singh (CSE & IT), Prof.Tirath Raj Singh (BT/BI), and Prof. Shruti Jain(Associate Dean – Inovation) (ECE), and M.Tech (DS) student coordinators Mr. Kunal Rathor

Over the course of four weeks, participants were tasked with developing machine learning and deep learning models to predict Indian Summer Monsoon Rainfall (ISMR) using historical climate and rainfall data. The core objectives of the challenge included:

- **Understanding and Preprocessing Monsoon Data**: Participants worked with historical rainfall datasets, potentially combined with other climate indicators like temperature, pressure, or Niño indices.
- **Building Predictive Models**: Competitors applied techniques such as:
    - Classical ML models (Linear Regression, Random Forests, etc.)
    - Deep Learning models (ANNs, LSTM, Bi-LSTM, etc.)
- **Evaluating Prediction Accuracy**: Models were judged based on accuracy metrics like RMSE, MAE, and visualizations comparing predicted vs actual rainfall.
- **Explaining Results**: In addition to model performance, participants were expected to explain:
    - Features used (e.g., rainfall trends, seasonal lags, climatic factors)

- Rationale behind model choices
- Interpretability or implications of predictions in a climate context

Event Duration and Format

The **Monsoon-Mind** competition ran from **17th April 2025 to 14th May 2025**, giving participants four weeks to develop, refine, and present their solutions.All activities were conducted **online** to allow flexibility in participation. Teams were given the freedom to work at their own pace, with access to datasets, feedback opportunities, and a final presentation session via virtual platforms.

Participants and Registration

A total of **8 teams** registered for the event, representing a diverse mix of students from second-year to pre-final-year students. The participants came with backgrounds in python programming, artificial intelligence, and related fields, bringing unique perspectives and skillsets to the competition.

Registration Period: The registration process remained open until **23rd April 2025**.
The broad diversity in experience levels and the collaborative spirit of the event led to the generation of innovative solutions that were both technically sound and creative.

Background and Motivation

India's economy, agriculture, water resources, and disaster management systems are heavily dependent on the **Indian Summer Monsoon Rainfall (ISMR)**. Accurate and timely prediction of monsoon rainfall is crucial for:

- **Agricultural planning and food security**
- **Flood and drought preparedness**
- **Policy-making and resource management**

Traditional forecasting methods, while valuable, often fall short in capturing the complex, non-linear patterns that govern monsoon dynamics. With the rise of **artificial intelligence (AI)** and **data-driven techniques**, there is an emerging opportunity to model monsoon behavior more accurately using **machine learning (ML)** and **deep learning (DL)** approaches.

Objectives of Monsoon Mind

1. **To promote the application of AI/ML techniques**
   Encourage participants to apply machine learning and deep learning models to real-world climate data, especially focusing on Indian Summer Monsoon Rainfall (ISMR) prediction.

2. **To enhance data handling and analytical skills**
   Provide participants with hands-on experience in working with large, temporal datasets—performing preprocessing, feature engineering, and model evaluation.

3. **To foster interdisciplinary learning**
   Bridge the gap between climate science and artificial intelligence by motivating participants from diverse academic backgrounds to collaborate and innovate.

4. **To encourage innovation in climate forecasting**
   Inspire novel approaches and creative thinking in monsoon prediction, going beyond traditional models and introducing AI-driven insights.

5. **To raise awareness about climate variability and its impact**
   Help students and researchers understand the broader context of monsoon variability, its socio-economic impacts, and the importance of predictive accuracy in climate-sensitive sectors.

6. **To build capacity for future research and development**
   Create a foundation for further research in climate informatics, encouraging participants to pursue academic or professional projects in this domain.

Phases of the Competition

The event was structured into three key phases:

Phase1: Introduction and Task Overview
The competition began with a detailed briefing mail sent out to the students of the institute where were introduced to the challenge. They were provided with a dataset of historical rainfall and temperatures, along with an explanation of the criteria for successful prediction.

Phase2: Development and Implementation
Participants were given four weeks to work on their solutions. They applied various data processing techniques, machine learning algorithms, and advanced deep learning frameworks to achieve prediction results. During this period, participants were encouraged to collaborate and refine their solutions through peer feedback.

Phase 3: Final Presentations and Judging
On the last day of the competition, participants submitted their final prediction models along with a report detailing their approach. Each team then presented their work, explaining the techniques used, the challenges they faced, and how they overcame these hurdles.

Judging Criteria

Participants were evaluated on several key criteria:

Prediction Accuracy: How effectively their models predicted the rainfall.

Innovation: Creativity in model design, use of ensemble methods, hybrid approaches, or unique handling of temporal and spatial data.

Interpretability and Insights: Ability to explain the model's behavior, interpret results meaningfully, and derive climate-relevant conclusions.

Efficiency: How computationally efficient their solutions were, considering the time and resources used.

Presentation and Documentation: How clearly and effectively they communicated their approach, the challenges they faced, and their results.

Judges assigned scores based on these categories, which determined the final rankings of the teams.

Presentation Day

The **Presentation Day** marked the culmination of four weeks of hard work, collaboration, and innovation. On this day, each team had the opportunity to showcase their prediction solutions, explained their methodologies, and share their experiences in overcoming the technical challenges they encountered throughout the competition.
Teams showcased their work through detailed reports, visual examples, and live demonstrations of the actual and predicted results of their models on the provided rainfall and temperature data. Judges evaluated the presentations based on the clarity of their explanation, the effectiveness of the models, the efficiency of their algorithms, and the innovation behind their solutions.

Here are the few glimpses of the day:


Literature Review - Key Findings
• Gaussian Copula: Superior multivariate dependence and realistic data. (2025 Elsevier)
• ARIMA & VAR: Moderate improvement using joint framework (RMSE =80.82). (2024 Elsevier)
• Holt–Winters: 10 mm reduction in test RMSE vs classical methods (RMSE= 87.76). (2025 Springer)
• Random Forest: Ensemble outperforms single-model baselines (Accuracy =81.27%). (2025 Elsevier)
• XGBoost: High precision on normalized data (RMSE= 0.0021). (2023 MDPI)


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Winners

The competition concluded with the announcement of the winners:

First Place: Team Hydrovision (Pre-Final-Year Students)
Members: Aditya Singh and Bhumika Gupta
Aditya and Bhumika developed the BiLSTM model on different configurations on lagged values of temperature and rainfall for the month of June, achieving highly comparable results with the existing models in the field

In Frame Prof. (Dr.) Shruti Jain (leftmost), VC - Prof. Rajendra Kr. Sharma (second from left), Prof. (Dr.) Tiratha Raj Singh (rightmost), Dr. Hari Singh (second from right), Aditya and Bhumika (in center)

- **Second Place: Ramandeep Singh Makkar (Pre-Final-Year Student)**
  In Frame Prof. (Dr.) Shruti Jain (leftmost), VC - Prof. Rajendra Kumar Sharma (second from left), Prof. Tiratha Raj Singh(rightmost), Dr. Hari Singh(second from right), Ramandeep (in center)
- Ramandeep developed a Random Forest + XGBoost based prediction model along with Gaussian Copula method for handling mismatched datasets resulting in highly comparable prediction accuracies.

Third Place: Team DRS (Pre-Final-Year Student)

Members: Deepankar Sharma

In Frame Prof. (Dr.) Shruti Jain (leftmost), VC - Prof. Rajendra Kr. Sharma (second from left), Prof. (Dr.) Tiratha Raj Singh(rightmost), Dr. Hari Singh (second from right), Ramandeep (in center)

Deepankar developed the LSTM based model for the months of June, July, August and September and their combination based on lagged values giving out comparable prediction results

जेपी उत्कृष्टता केंद्र में जलवायु कार्रवाई पर एआई चुनौती का सफलतापूर्वक समापन

आदित्य व भूमिका की टीम हाइड्रोविजन अव्वल

हिमाचल दस्तक ▮ सोलन

जेपी यूनिवर्सिटी के 'शिक्षा के लिए कृत्रिम बुद्धिमत्ता' उत्कृष्टता केंद्र ने 17 अप्रैल से 15 मई तक आयोजित अपने छात्र केंद्रित कार्यक्रम 'मॉनसून माइंड बारिश की भविष्यवाणी करें' जलवायु कार्रवाई पर एक एआई चुनौती का सफलतापूर्वक समापन किया। संयुक्त राष्ट्र सतत विकास लक्ष्य 13- जलवायु कार्रवाई से प्रेरित इस कार्यक्रम में प्रतिभागियों को भविष्य की वर्षा प्रवृत्तियों का पूर्वानुमान लगाने के लिए ऐतिहासिक वर्षा और तापमान डेटा का उपयोग करके एआई मॉडल विकसित करने की चुनौती दी गई, जिससे जलवायु पूर्वानुमान और स्थिरता में नवाचार को बढ़ावा मिला। इस चुनौती में कुल आठ टीमों ने भाग लिया, जिन्होंने जलवायु केंद्रित समस्याओं को संबोधित करने के लिए अभिनव मशीन लर्निंग और डीप लर्निंग मॉडल का प्रदर्शन किया। इस कार्यक्रम का समन्वय डॉ. हरि सिंह (सीएसई और आईटी), प्रो. (डॉ.) तीर्थ राज सिंह सिंह (बीटी/बीआई), प्रो. (डॉ.) श्रुति जैन और छात्र समन्वयक कुणाल राठौर (एमटेक - डीएस, चतुर्थ सेमेस्टर) ने कुलपति प्रो. आरके शर्मा के मार्गदर्शन और अनुमोदन के तहत किया। आदित्य (221030043) और भूमिका (221030044) की टीम हाइड्रोविजन ने पहला स्थान हासिल किया। रमनदीप सिंह मक्कड़ (221030276) ने दूसरा स्थान हासिल किया, जबकि टीम डीआरएस का प्रतिनिधित्व करने वाले दीपांकर शर्मा (221030101) ने तीसरा स्थान हासिल किया। इस कार्यक्रम में एआई के माध्यम से वैश्विक जलवायु चुनौतियों का समाधान करने में युवाओं और प्रौद्योगिकी की महत्वपूर्ण भूमिका पर प्रकाश डाला गया। इस तरह के आयोजनों से ऐसे शिक्षण वातावरण की आशा की जाती है जो विद्यार्थियों को डेटा-संचालित और टिकाऊ समाधानों के साथ वास्तविक दुनिया की समस्याओं से निपटने के लिए तैयार करते हैं।