

ANNOUNCEMENT

IIT Alumni Council announces AI Competition (Prognosis System using X-Ray and Ultrasound Imagery as Diagnostic as well as Therapeutic methodology)

Mumbai, May 25, 2020: The widespread of Covid19 pandemic is a worrisome scenario and a cause of major concern as the phase of exponential growth is almost unavoidable, though extremely quick and effective measures such as lockdown and social distancing are implemented by government authorities, nationwide. Indians believe in the philosophy of 'वसुधैव कुटुम्बकम्', meaning, 'The whole world is one'. Hence, we believe in our nation's responsibility to control the spread by effective detection of Covid19 cases with fast screening methodologies and by developing different testing techniques and prognosis systems using Artificial Intelligence technologies. With such systems it is possible to provide rapid screening, testing and scalable treatment infrastructure. With this scaled up infrastructure of rapid diagnosis and treatment, India can even offer some help to other countries in this grave situation of Covid19. IIT Alumni Council is already promoting research initiatives in the testing domain of RTPCR machine manufacturers, test kit manufacturers, pooling algorithm developers and AI based rapid diagnosis based on X-Ray and ultrasound imagery.

In pursuance to accelerate the work towards solving the diagnostic and treatment challenges and requirement of scalable treatment infrastructure, the IIT Alumni Council had launched the Pool Testing Competition within 24 hours of the lockdown on March 25th, 2020. Within fifteen days, the IIT Alumni Council started work with our C19 Task Force Doctors Group headed by Dr Mufazzal Lakadawala to act as technology and knowledge partners to a team of volunteers in Mumbai to help create a C19 crisis management infrastructure that would operate without government funding so as to create role model installations that could be replicated by other cities in the country as well as globally. Within hundred hours in an allocated space at the Poddar Hospital in Mumbai, the IIT Alumni Council partner organizations set up digital X-Ray systems that successfully used AI, to test C19 in contactless manner. The NSCI Center is now being upgraded to be a full-fledged contactless hospital with ICU facilities being built in shipping containers. Within a week's time the NSCI Center became fully functional. In association with the IIT Alumni Partner team, a regular passenger luxury bus is converted into a full-fledged Covid19 testing laboratory on wheels with a meticulous 100 hour conversion process, timed to perfection using the best available PERT analysis tools.

The C19 Test Bus was flagged off on 1st of May, Maharashtra day. On the same day, multiple teams were launched to understand and alter the RTPCR machine so as to make it amenable to mass testing. Pool testing recommendations were issued simultaneously and trials done on the same. On the 10th of May 2020, we started work on indigenization of the test kits. In order to facilitate this, an end to end indigenous technology stack was created by a partner organization to chart out the 64 steps from virus in the throat to virus zapped by UV post testing in a RTPCR. On the 12th of May, 2020, the two incubators

EBMI (focused on the genetic testing and biologics value chain) and STWA (focused on global IIT Alumni Cooperation) have rallied the support of hundreds of IIT Faculty members/students and thousands of IIT Alumni towards constructive technological warfare directed at C19.

Considering the spread of the Covid19 pandemic and the dreadful possibility of exponential growth of infected individuals in India, IIT Alumni Council has decided to throw challenges as a proactive measures and started AI based research activities under the guidance of some professors and researchers from eminent institutes and having expertise in the domain of AI, Computer Vision and Big data analytics. The floated challenges based on AI technologies are for the purpose of bringing up innovative solutions and to evolve and scale up the present systems/infrastructure for detecting, preventing and treating the diseases.

About AI X-Ray Ultrasound Contest

Considering the rampage of spread, the immediate necessity is rapid screening testing and diagnosis methodologies to cope up with the exponentially growing need of medical facilities. Doctors are heading the army of this Covid19 Task force and hence isolating them while treating the patients has been given prime importance by providing a scaled up Tele-radiology platform supported by AI based Prognosis systems using X-Ray and Ultrasound imagery.

With such AI systems and Tele-radiology platform the radiologist can provide treatment from remote isolated place and the diagnosis and treatment facility can be scaled up to a larger geographical area of India and also worldwide coverage to provide our expert doctors' service to other nations. Health workers are too on the frontier of the C19 task force and prone to infections in spite of precautionary measures. Hence minimum interaction with patients by the health workers by providing a solution through such AI based systems using Tele-radiology platforms (contactless service) will be very useful to larger section of health workers also.

A team of experts from industry, research institutions, academic institutions as well as doctors (radiologists) strongly believe that such AI based prognosis systems using X-Rays and Ultrasound imagery will scale up the present infrastructure for rapid screening, diagnosis and treatment of Covid19 cases. To give a single transparent platform for speedy assessment of deep learning architecture based AI models of participant teams HPC facility is provided to the participant teams.

Gratitude to IIT Delhi and IIT Guwahati for granting us with Supercomputing HPC and continuous help and support to address our queries to expedite the AI activities for this noble cause of Covid19.

About the AI X-Ray and Ultrasound Challenge

In order to address this need of scaling up diagnosis and treatment, the IIT Alumni Council's C19 Task Force has posed the following challenge to participants:

- To find efficacy and potential of the AI based prognosis system using chest imagery (X-Ray and Ultrasound) as an effective diagnostics and therapeutic tool
- i. For detecting and screening Covid 19 cases
(Additional further tests such as RTPCR are needed to be carried out for accurately screening out Covid 19 positive cases)

- ii. For finding the fast methods and tools for Covid19 diagnosis useful also for treatment decision as well as severity of the disease.
- iii. For finding suitability of these solutions if integrated with Tele-radiology platforms to provide diagnostics and therapeutic scalability, so that India will be equipped with the increasing demand of the same in this Covid 19 situation, as a proactive measure.

Submission requirements at the time of registration:

- 1 Details and credentials to be filled by team members (As mentioned in the registration form)
- 2 A report on: An overview of the proposed solution
 - a. Information about the training data in detail used for AI model training and testing
 - b. Information about the AI system and supporting environment for scalability: Whether the Tele-radiology system is capable to scan 1M+ cases/week/ machine. (Applicants need to share details of hardware/computation, storage, connectivity and other infrastructure support if any to justify the proposed scalability).
 - c. Throughput: Classification accuracy, Time required in seconds to obtain the prognosis output per case for the developed AI model for screening C19 patients, false negatives. (Ideal expected values are: C19 bucket classification accuracy nearing to 98%, zero false negatives, maximum 2 minutes time per case for final output from AI based prognosis system).
 - d. Proposed pricing mechanism for screening and prognosis and cost per person with breakup of every stage must be clearly articulated (with assumptions, inclusions & exclusions of various available resources).
- 3 Readiness to execute Minimum Viable Product (MVP) quickly
- 4 Highlights of deliverables and timelines

Shortlisting of registered teams by the expert Jury panel for the first round:

- 8 to 12 teams will be shortlisted for the first round. The dataset will consist of about 3000 X-Ray (Covid19+, Pneumonia, Tuberculosis, All clear and Unresolved for training and testing with equal percentage of images of each class) **and** 2000 Ultrasound Imagery of five different classes (Covid19+, Pneumonia, Tuberculosis, All clear and Unresolved for training and testing with equal percentage of images of each class)
- 5 to 7 teams' solutions will be shortlisted for the second round. The data set will consist of about 5000 X-Ray imagery (Covid19+, Pneumonia, Tuberculosis, All clear and Unresolved for training and testing of five different classes with equal percentage of images of each class) **and** 5000 Ultrasound Imagery (Covid19+, Pneumonia, Tuberculosis, All clear and Unresolved for training and testing of five different classes with equal percentage of images of each class).

In both the rounds the solutions will be assessed based on real C19 patients' X-Ray scans and Ultrasound imagery made available from the IIT C19 Research Centre.

Overview of HPC computing facility and round wise screening assessment scheme:

Training and testing of AI models with large imagery data such as X-Ray and Ultrasound require HPC facility. The HPC Environment setup will be made available by organizers for the multilayer deep learning AI models of the shortlisted participant.

Facilities** provided to the teams prior to first round for preparing, training and testing their AI system:

- HPC facility time for training the model (sufficient time (approx. 4 days) with sufficient resources by HPC coordinator of this AI contest)
- Absolute path of the data set on the HPC cluster, with controlled read only access for X-Ray and Ultrasound imagery of 5 different classes (approximately 3000 images of each type X-Ray and Ultrasound)

****No additional HPC facility will be provided to the participating teams after the first round.**

After training the AI model with the above said facility granted to each shortlisted participant team, following deliverables are to be submitted by each participating team.

Additional details about evaluation criteria and other HPC cluster details will be available to registered and shortlisted teams for the first round.

Deliverables to be submitted by shortlisted teams for the first round evaluation

The following key deliverables to be submitted (but not limited to only these) are as below:

1. Executable of AI system model
(Compatible software environment, software versions to be checked by the participant while making their executable. Check the link <http://supercomputing.iitd.ac.in/?soft>. The available modules and software belonging to that module will be given to the shortlisted participants of the first round).
2. Clearly specify, what kind of images are required as input data
 - X-Ray Images
 - Ultrasound Images
 - Both
3. If your AI model is developed for both kind of images then separate executable need to be submitted for each input kind of image format namely X-Ray and Ultrasound
4. If AI model with Ultrasound imagery then a report on, details of the security measures of your system to avoid issues related with Ultrasound imagery.
5. Additional demonstration is expected as a part of evaluation criteria if ultrasound imagery based AI system, to explain security systems for resolving issues related to Ultrasound imagery
6. Expected required resources from HPC cluster, module name (supporting the software requirements of your AI system) and approximate required time for training your AI model, for the input data of 3000 images of 2 GB size each.
7. Details of the resources on which the AI model is trained (hardware: total number of CPUs and/or GPUs, NVIDIA card with/without), used on the HPC cluster or any other environment.

Round I Submission Requirements:

- Participants need to submit classification of test data accuracy in a CSV file with each image mapped with its class number between 1 to 3 for the images given in the test imagery data. Three classes are:
 - 1 Class 1: Covid19+
 - 2 Class 2: All clear
 - 3 Class 3: Other (any other diseased including multiclass classification are 'Other' class 3)

(Input data format and output CSV format templates will be given to the registered and shortlisted participants.)

Round I Major Objectives as shortlisting criteria:

1. Internal assessment program will be assessing the output of the participant teams (provided by the participants in a CSV file format for computing evaluation parameters
 - I. Three class classification with each image identifier mapped with the class number as an output in a CSV file format.
 - II. Each class: true positives, true negatives, false positives, false negatives.
 - III. Overall classification accuracy.
 - IV. AUPRC (Area Under Precision-Recall Curve)
 - V. Sensitivity and Specificity of each class

Round II Submission Requirements:

- Participants will submit classification of test data accuracy in a CSV file with each image mapped with its class number between 1 to 5 of test imagery data in classes:
 - 1 Covid19+
 - 2 Tuberculosis
 - 3 Pneumonia
 - 4 All clear
 - 5 Unresolved (which has more than one class that is mix class classification)

(Input data format and output CSV format templates will be given to the registered and shortlisted participants).

Round II Major Objectives as shortlisting criteria (for final three participants):

- 1 Internal assessment program will be given input as a CSV file and all the following evaluation parameters are computed
 - i. Each class: true positives, false positives, false negatives.
 - ii. Overall true classification accuracy.
 - iii. Sensitivity and Specificity of each class
 - iv. AUPRC (Area Under Precision-Recall Curve)
 - v. Improvement of Covid19+ class accuracy using approaches such as
 - Multi-stage AI Approach: to reduce false positives C-19 cases with different classification algorithms.
 - Evolution of AI model using predictive AI algorithms for further refined classification of C-19 cases as on C-19 cases to classify as Acute/Moderate/Mild
 - Data correlation and dimension reduction approaches for avoiding over fitting of the AI model.
 - Data co-relations based on Geography, age, gender, vocation, hotspots, etc.

Shortlisted 3 teams' solutions will get a chance to show their work to government officials if recommended by Jury panel. They may get a chance to work as a pilot project to enhance and scale

up the existing Tele-radiology platforms. IIT Alumni Council websites will offer publicity to the winning teams.

It is expressly clarified at the onset that the IIT Alumni Council operates in an open source kind of format and all applications received may be put up on a website for consultation with various stakeholders. No confidentiality of any kind is being provided to the contestants. The proposals received will become the exclusive property of the IIT Alumni Council and the Council may choose to use the information contained therein for designing and operationalizing the AI based Tele-radiology platform through any partner organization, who may or may not be a contestant in the Challenge. No monopoly of any kind is offered to the designer or operator. The objective of this challenge is to solicit expressions of interest which would be evaluated by an eminent jury for appropriateness to the C19 screening, testing and treatment need in India. There is no certainty that the Challenge will lead to any kind of a working arrangement or otherwise between the IIT Alumni Council initiative and the contestant. IIT Alumni Council has not been authorized by any Government Agency or department to run this challenge nor has any kind of government subsidy been sought or assured for the same. The Indian Institutes of Technology are in no way connected with this AI X-Ray Ultrasound contest other than providing supercomputing and other resources for the Challenge. Faculty members where engaged are working as volunteers for the IIT Alumni Council in their personal capacities and not on behalf of the IITs or any other institution. Winning the challenge would in no way confer acceptance of the design or its validation by the IITs or members of the C19 Task Force.

AI X-Ray Ultrasound Challenge Documentation

The AI X-Ray Ultrasound Challenge Documentation would be available from the website of the council at www.iitalumnicouncil.org to qualified applicants only. Applicants are required to register interest and file documentation as required in the application form. This would include KYC details of all consortium members and net worth details of the consortium lead partner. At this stage, consortia desirous of participating in the competition are required to send an email to Alcontest@iitalumnicouncil.org. Emails will be replied to within 24 hours with a tentative docket number and date of formal registration.

“I do look forward to commented PadmaShri Professor who would chair the Jury for the Challenge.

Mr., of the IIT Alumni Council stated, “It is explicitly clarified that the AI X-Ray Ultrasound Challenge is a unique opportunity for companies to contribute to nation building in India. No monetary award of any kind is offered and the information submitted as part of the Challenge remains copyright of the participating team. Credit worthy participants in the Challenge will be honored with a commendation certificate. No cash award or commercial contract of any kind is guaranteed or assured to the participants. Three shortlisted platforms may get a chance to present their work to government authorities and may get a chance to launce as a pilot project as a AI based Tele-Radiology platform.

About the Jury

The selection of the Jury for the AI X-Ray Ultrasound Challenge was ratified by the Council of **Directors of IIT Bombay with Professor of IIT Bombay as Chairman of the Council**. The Jury consisted of eminent faculty members and IIT Alumni from around the world. Here is a brief about them:

	Jury Member	Career Highlights
1.	Prof Subhashish Choudhari	Director, IIT Bombay
2.	Prof Uday Desai	
3.	Prof Surya Durbha,	Professor, CSRE, IIT Bombay, Indian Institute of Technology Bombay (IITB). Before joining IITB, he worked as an Assistant Research Professor at the Center for Advanced Vehicular Systems (CAVS), Geosystems Research Institute (GRI) and also held an adjunct faculty position with the electrical and computer engineering department at Mississippi State University (MSU). Worked as a Scientist at Indian Institute of Remote Sensing (IIRS), ISRO, Govt. of India. He received NVIDIA Innovation Award 2016 for his work in Image Information Mining and High Performance Computing (HPC). He also received the State Pride Faculty and Outstanding Research awards earlier at MSU.
4.	Dr. Jayashree Kalpathy-Cramer	Associate Professor of Radiology at MGH/Harvard Medical School who works at the intersection of computer science and medicine. She is an electrical engineer by training, having received a B.Tech in EE from IIT Bombay and a PhD in EE from Rensselaer Polytechnic Institute. She has many years of industry experience in semiconductor industry. She is a Scientific Director at the MGH/BWH Center for Clinical Data Science.
5.	Shri Atul Kunwar	Ex CTO, Tech-Mahindra
6.	Shri P Balaji, India Alumni	An Alumni of IITR and IIMA, he heads the Vodafone Foundation & Regulatory Affairs for Vodafone India. He has been CEO of companies like Nokia and Sony Ericsson before joining Vodafone.

About the Mentors to the Challenge

The selection of the Mentors for the AI X-Ray Ultrasound Challenge was ratified by the Council of Director IITs with Ex Director of IIT Hyderabad, Professor Uday Desai as Chairman of the Council. The Mentor panel will act as the bridge between the contestants and the jury to help fine tune the proposed solution and if need be try to create a solution by combining the inputs received from multiple consortia. The Mentor Panel consists of eminent IIT Alumni from around the world:

	Mentor	Career Highlights
1	Shri Atul Kumthekar	
2	Prof Jayashree Kalpathy-Cramer	Associate Professor of Radiology at MGH/Harvard Medical School who works at the intersection of computer science and medicine. She is an electrical engineer by training, having received a B.Tech in EE from IIT Bombay and a PhD in EE from Rensselaer Polytechnic Institute. She has many years of industry experience in semiconductor industry. She is a Scientific Director at the MGH/BWH Center for Clinical Data Science.
3	Shri Atul Kunwar	Ex CTO, Tech-Mahindra
4	Shri P. Balaji, India Alumni	An Alumni of IITR and IIMA, he heads the Vodafone Foundation & Regulatory Affairs for Vodafone India. He has been CEO of companies like Nokia and Sony Ericsson before joining Vodafone.

IIT Alumni Council

IIT Alumni Council is the largest global organization for alumni, students and aspirants of the twenty-three Indian Institutes of Technology. The IIT C19 Task Force was set up in February 2020 by the Global Board of the IIT Alumni Council. The objective of the Task Force is to rally the technological and venture capital prowess of alumni of all the IITs to launch a frontal attack on the Sars Cov2 virus that leads to the Covid19 disease. The IIT C19 Task Force is chaired by IIT Kanpur alumnus Dr K Vijay Raghavan, Principal Scientific Officer of the Government of India. It is financially supported by PanIIT Fund, a Rs 3,000 crore domestic social fund registered with SEBI under the AIF Regulations 2012

With over 20,000 active technologist participants and over one hundred city chapters, the IIT C19 Task Force set up by the IIT Alumni Council aspires to lead the fight against C19 by supplementing and complimenting the efforts of the central and state governments. The Council has rallied the considerable resources of the global IIT alumni to catalyze technological and financial interventions in Mumbai city, with a focus on central and south Mumbai