AI-Based Student Emotion and Engagement Level Detection Framework

Chinar Amit Deshpande

Measuring engagement levels

- Engagement levels decreased post Covid pandemic after students returned to school

- High student-to-teacher ratio in India
  - Difficult for teachers to assess individual student needs

- Teaching is more beneficial for high-engaged students

- Studies show higher levels of engagement are consistently associated with
  - better academic performance
  - lower dropout rates
  - higher levels of student satisfaction

Tools to measure Student Engagement levels

- Non-Technological Tools
    - Surveys and Questionnaires
    - Observation and Behavioral Data
    - Experience Sampling Method (ESM)
    - Qualitative Methods (Focus Groups, Interviews)

- Technological Tools
    - Wearable Devices
    - Eye-tracking Technology
    - ***Emotion to Engagement - New***

Emotion to Engagement process
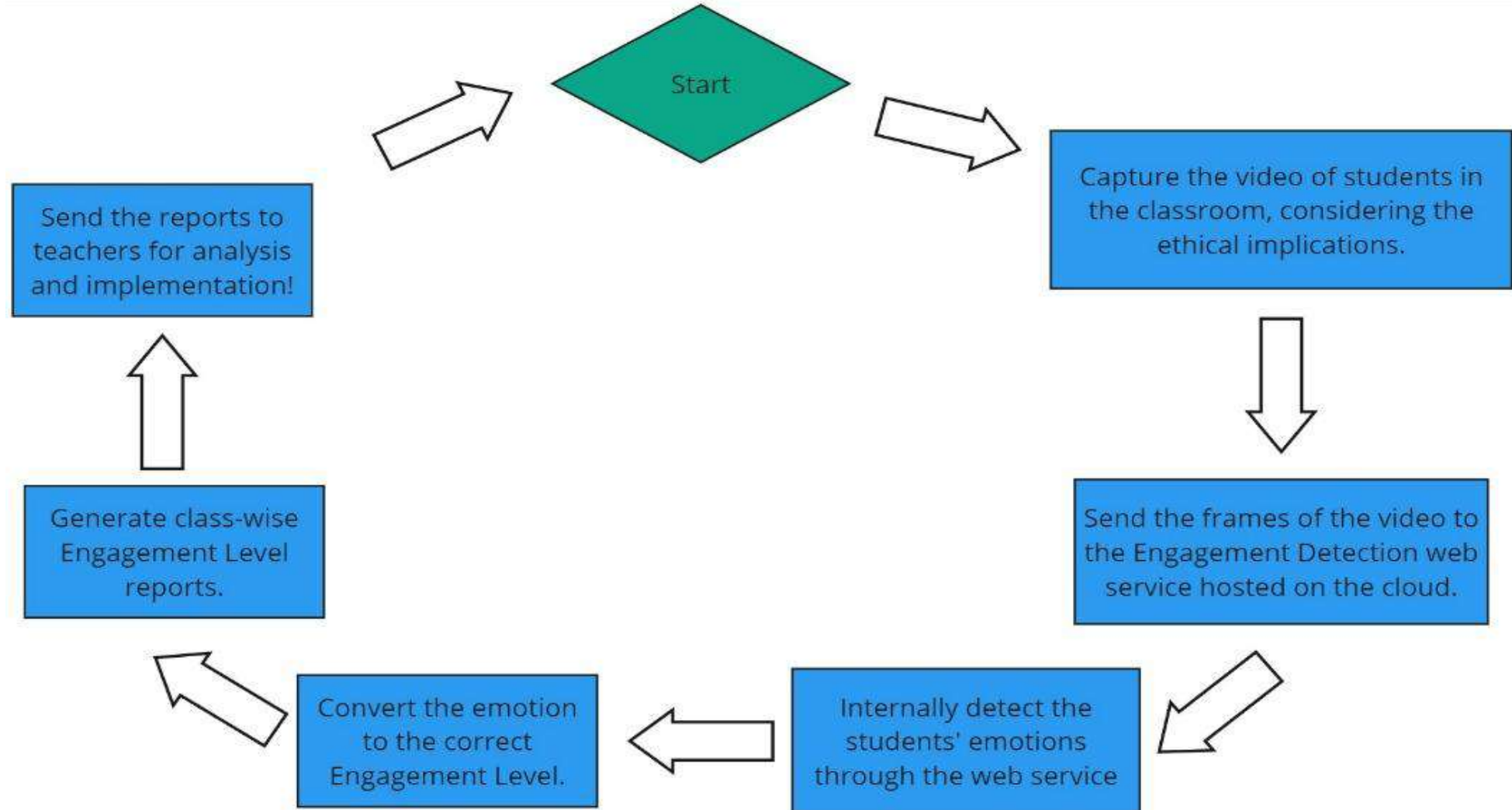
Detecting Emotions using Facial Emotion Recognition

- Haar-Cascade Classifier
  - Identifies faces in the image

- Face identification within a frame
  - Non Max Suppression

- Individual Face Processing
  - Each face is processed individually
  - CNN identifies displayed emotion and intensity

Datasets used for FER training

- DISFA: Faces of participants were partially covered with electrodes.

- SAVEE: Action Units (Spots) on the faces of participants hindered the model.

- DEAP and AMFED: Were used to make the model stronger.

- FER-2013: The main dataset used. Comprised of various emotions/ participants, making it optimal.

Emotion to Engagement Model
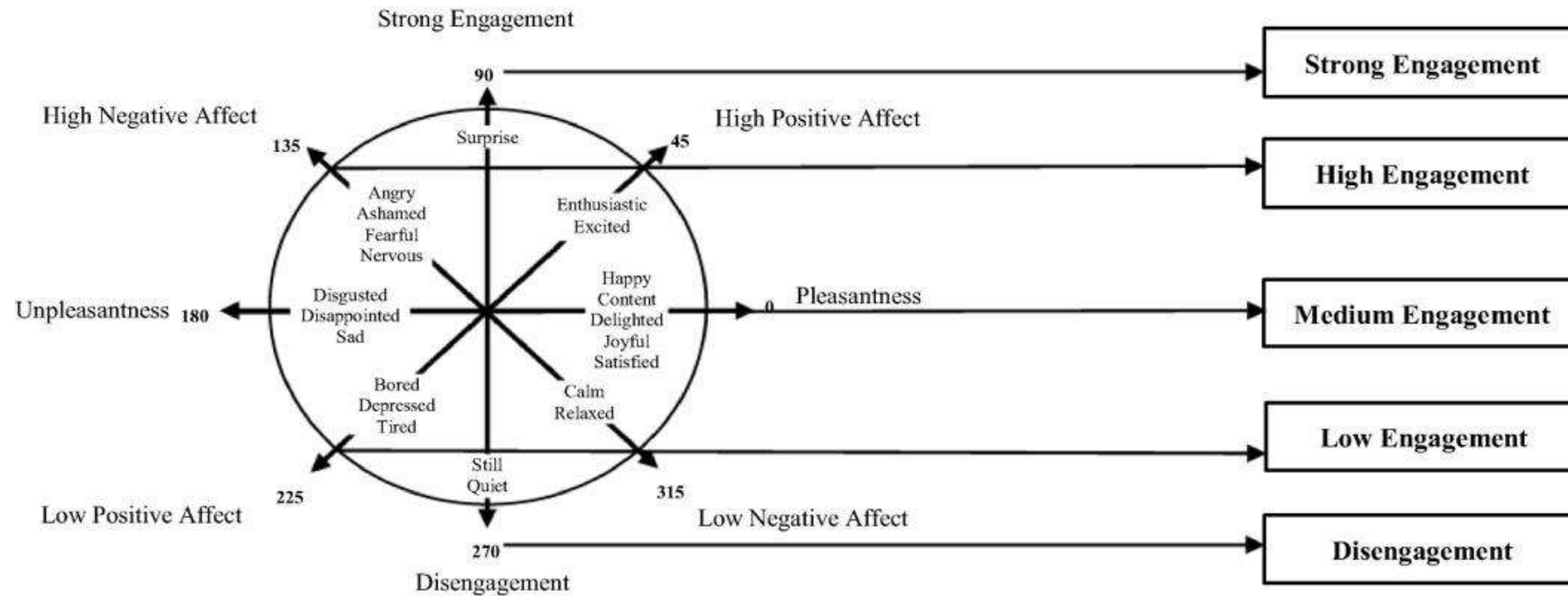
- Proposed by Altuwairqi et al for online setting
- Tested this in a classroom setting by observing classroom recordings frame by frame

Emotion - Engagement Index

Emotion	Engagement Level	Engagement Numeric Value
Surprise	Strong	5
Fearful, Excited, Anger	High	4
Happy, Sad	Medium	3
Disgust	Low	2
Neutral	Disengagement	1

Results

- Tested in high school (Aditya English Medium School, Pune, India)
  - Analyzed and discussed results with the teachers

- Model Architecture
  - 6 Convolutional Layers, 6 Batch Normalization Layers
  - 6 Dropout layers, 3 Dense layers
  - 3 MaxPooling layers, and 2 Flatten Layers

- Accuracy
  - FER Current accuracy stands at 86%

Sample Output

Time vs Engagement Level
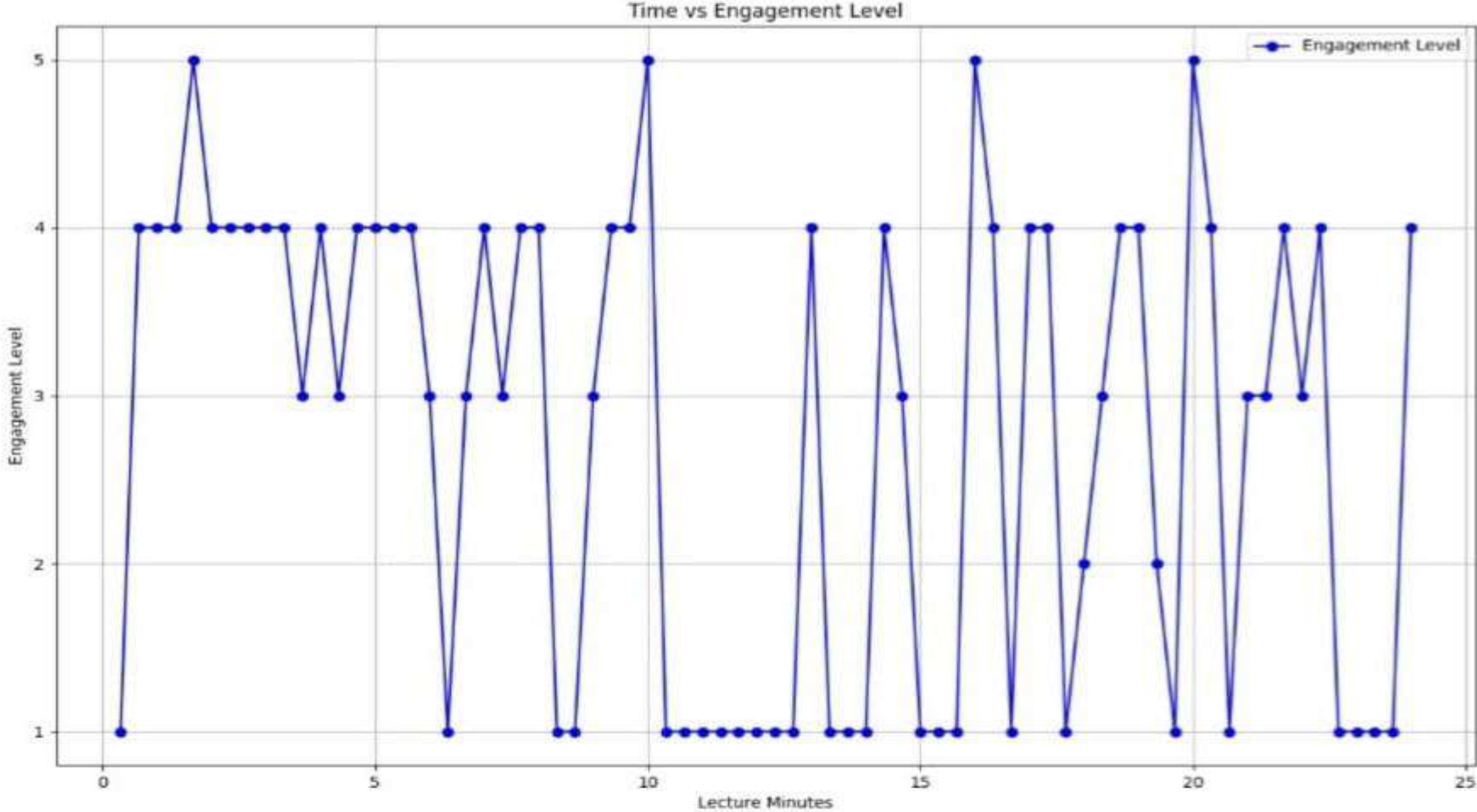
Challenges

- Ethical
  - Consent of students, parents/guardians, and school authorities required for recording
  - Recording needed to be deleted immediately after use.

- Recording Requirements
  - Backlight and improper lighting can skew data

- Student facial detection
  - Better results when student is looking up
  - Difficulty in predicting engagement level when student is reading or writing on his desk

Next steps

- Technology

    - Template matching to identify specific student

- Working with Eagle Robot Lab based in Bangalore, Karnataka, India

    - Private Robotic organization in India building Teaching robots

Working with Pune Knowledge Cluster

- Document detailing the recording instructions created.

    - Uploaded to PKC Google Drive

- Admin app for Student Engagement Detection Service created and ready for use - need to decide whether it should be on Play Store or App Store.

    - Videos can be selected from the Google Drive to get the Engagement Time graph.

    - Image can also be selected for a

- Working with Eagle Robot Lab based in Bangalore, Karnataka, India

    - Private Robotic organization in India building Teaching robots

Next Steps with Pune Knowledge Cluster

- Need to decide whether the Engagement Service App will be on Play Store or App Store

- Should we start with the recordings from schools?

Swachha Shala Initiative

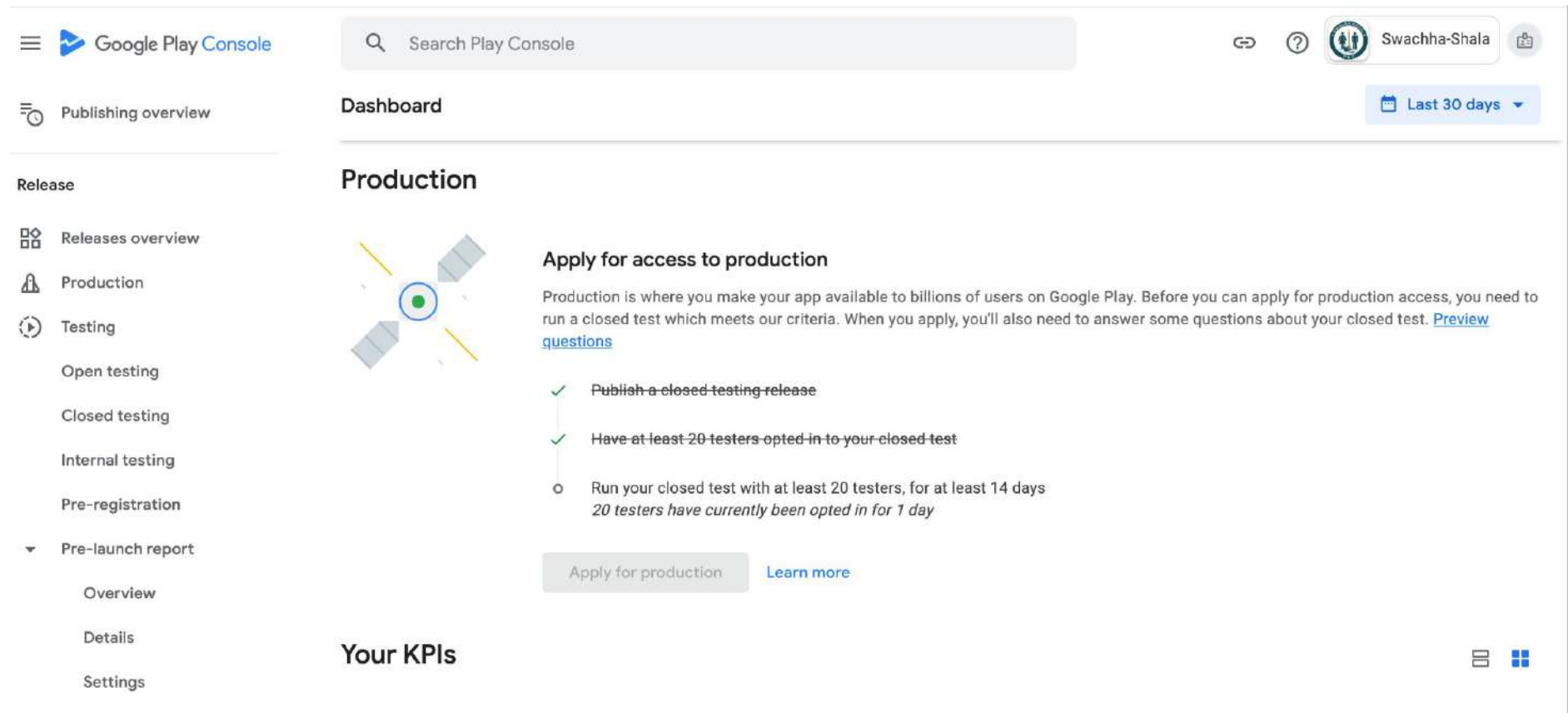## Chinar Amit Deshpande

Swachha Shala Initiative

- Maintain hygiene and cleanliness of the bathrooms
  - Can be extended to kitchen and other school areas in the future

- There is a direct correlation between cleanliness of bathrooms and attendance of female students.

Approach

- Creating Android and iOS app to collect bathroom images of schools.

- Collected images will be used to train the Machine Learning model to automatically determine if the bathroom is clean or dirty.

Status of the Project - Android App

- PKC Play Store Account created
- Created Android App to collect data from various schools
- App is in the testing stage in the Play Store
  - Closed testing is over; 20 testers have used the app.

Status of the Project - iOS App

- Current Codebase supports both Android and iOS apps.

- However, iOS app creation is paused
  - PKC Apple Developer Account creation in progress

Next Steps with Pune Knowledge Cluster

- Complete registration of PKC Apple Developer Account.

- Release Android app to schools so image collection process can start.

- Start working on Machine Learning Model - Chinar

THANK YOU