

IVANI

AI enabled Image & Video Analytics by NIC for effective & efficient eGovernance

Edited by Dr. DIBAKAR RAY

Organisations are increasingly making use of computer vision across domains, from autonomous driving to healthcare, in order to improve operations and enhance productivity. This has been made possible due to the rapid increase in computing power and the availability of large data sets in recent years. This is why computer vision, with the help of deep learning algorithms, is giving highly accurate results, thus, boosting confidence among users in this aspect.

Technology Brief

Computer Vision (CV) can be defined as a field of Artificial Intelligence (AI) that enables machines and systems to derive meaningful information from images, videos and other visual inputs – and take actions or make recommendations based on the information. One of the major challenges CV has to face is that a machine needs to scan through an infinite number of images taken from

Computer Vision is a field of Artificial Intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs with help of Deep Learning Networks in Ideal Conditions. Some of the major applications of image analytics are object detection, face recognition, image classification among others.

AI Model Development – Steps

Annotation: Annotation means the image needs to be annotated or labelled with classes that one wishes the model to detect or not. If one wants the system to detect a beneficiary in an image, one needs to detect a face first for labelling the image with a bounding box where the said face needs to be carried out through thousands of images. For example, to detect COVID-19 in a Chest X-Ray (CXR) image, the model has to be trained by keeping the CXR with COVID-19 in a separate folder to that of a normal CXR and further one needs to do lung segmentation to extract the lung portion, so that model does not learn from the periphery of the images. (Refer Fig. 8.1)

Model Training: The next step is to transfer learning from pre-trained models that have been trained on large datasets (i.e., for face or COVID-19 detection). There may be more than one model and a preliminary study needs to be done to find out which is giving better performance. After downloading the model, one needs to further train the last few layers of that model again with the type of records that the model is going to predict. Deep Learning algorithms help in learning the patterns from the images without requiring us to do feature engineering, which is usually the case with machine learning where domain experts select the attributes that go into modelling.



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different angles under different illuminations and still be able to define what is meaningful.

Of late, CV is showing potential solutions to major problems faced by the end users. Some of them are:

- Document Analysis with tasks like optical character recognition, text localisation, and layout analysis
- Image Classification, Object Detection and Segmentation
- Face Detection and Recognition

Let us look at some of the major tasks to understand the results that deep learning is capable of achieving in the field of CV:

Object Detection: It deals with detection of semantic objects of a certain class and classifies them accordingly.

Automatic Image Classification: It helps the system to classify the photographs / visuals into one or more known categories.

Automatic Face Recognition: It helps the system either identify a person in the photographs / visuals based on their face or verify that person in the photographs is the same person who they claim to be.

▼ Fig. 8.1: Chest X-ray Images Preprocessing – Preparation for detecting Tuberculosis through Lung Segmentation and AI Modelling



IVANI in eGovernance

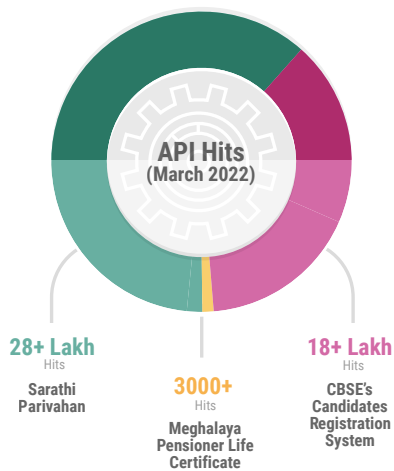
Satyapikaanan

Satyapikaanan is an API-based service for Face Verification that has been made available over MeghRaj Cloud. It is utilised in various governance projects like:

- Face Recognition Based Attendance System (FRBAS) Mobile App that facilitates Contactless Attendance in Utkarsh Bangla Program for Skill Development Trainees & Trainers Attendance in West Bengal
- Face Verification & Liveness Detection for Life Certificate for Pensioners through a mobile app provided to Meghalaya
- RTO's Online eLearners License Exam & Automatic License Renewal Services
- Real Time Face Quality Analytics in candidate registration for various examinations conducted by National Testing Agency (NTA)

AI Satyapikaanan
API based Face
Verification Service

Total of
46.50 Lakh
AI Requests Served



▲ Fig. 8.2: An overview of AI Satyapikaanan

IVANI in Sanitation

In Swachh Bharat Mission (SBM) Urban, there were approximately 16000 constructed toilet images with beneficiaries in the background and toilet seats visible or otherwise. With these many images, one can expect around 99% accuracy in prediction. Hence, a binary classifier with two classes "toilet seat" and "beneficiary detection" modules were designed for SBM Urban. It was launched as a mobile app to help citizens upload correct images so that workflow cycles in receiving scheme benefits or waiting time in queue can be reduced, which would otherwise be longer with sanitary inspectors individually going through each and every photograph and rejecting them. The citizens, otherwise, have to reload the correct images and get back in the queue for approval.



▲ Fig. 8.3: Identification of SBM Urban Beneficiaries through IVANI

IVANI in Healthcare

AI has found its application in medical training, monitoring, imaging, early detection, diagnosis, decision making, and treatment.

It is envisaged that triaging of patient care can be done through one or more AI models.

Recently, a tripartite MOU between ICMR, NIC and Central TB Division (Ministry of Health & Family Welfare) has been signed for providing AI Services in the National Tuberculosis Elimination program. The proposed AI based model will be used for identifying potential TB patients for follow-up testing. The risk profiling of patients along with Cough Spectral Analysis as well as Sputum Molecular Image Analytics will help in checking First and Second Line Drug Resistance in tuberculosis patients.

▼ Fig. 8.4: Tuberculosis detection from Chest X-rays through AI can help in early detection of TB in Primary Health Care Centres

Radiologist Annotated Images	Model Prediction Results
	With segmentation (0.99992657. 'Normal')
	Without segmentation (0.86889344. 'Abnormal')
	With segmentation (1.0. 'Normal')
	Without segmentation (0.8339354. 'Abnormal')
	With segmentation (0.9997485. 'Normal')
	Without segmentation (0.7004077. 'Normal')
	With segmentation (0.9999757. 'Abnormal')
	Without segmentation (0.766502. 'Normal')

I am happy to inform you that the Contactless Attendance through Smart Mobile App (FRBAS-PBSSD) designed by National Informatics Centre (NIC) has been a very convenient end-to-end application that has been incorporated into Utkarsh Banela Skill Development Program. I am told it is built with highly accurate deep learning models for AI based face verification, Liveness detection and other technologies like Geo fencing. It is proving to be a good tool with a high value proposition. I would like to congratulate team NIC for developing such a cutting edge technology solution which is more meaningful in the post-pandemic era where contactless services are more required.



Anoop Kumar Agrawal, IAS
Principal Secretary
Government of West Bengal

Advantages

Some of the advantages of IVANI are:

- **Reduced Workflow Cycle & Process Automation:** AI-driven automatic verification of records helps in reducing the workflow. It reduces human intervention and errors. This results in productivity enhancement and cost reduction
- **Citizens facilitated:** Citizens are greatly benefitted through some AI enabled services which may be made available at their homes
- **Fraud Detection:** AI greatly facilitates fraud detection in various eGovernance use cases
- **Transparency:** AI-enabled Faceless Services usher in more transparency
- **Better & Faster Reach:** Reducing the human interaction in the workflows and providing services over the network has enabled users to enjoy service
- **New Paradigm of Efficiency:** The AI driven Image & Video Analytics tools as developed by NIC facilitate in achieving a new paradigm of efficient and effective eGovernance

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