WADHWANI AI

ANNUAL REPORT

2023

Contents

Taking AI to Millions of Indians in 2023

For Wadhwani AI, 2023 was a year of moving from the development of AI models to their deployment–the final and most significant step in our journey of creating impact. We have made steady progress towards this goal. Seven solutions have now been deployed in our domains of focus–health, agriculture, and education–with rapid adoption allowing us to reach nearly ten million people in 2023. This is a humbling beginning. We are dedicatedly working towards increasing the footprint of the adoption of these solutions to make them reach the underserved people who can benefit from this technology. We have 20 more solutions that will start their journey into deployment in 2024 onwards.

We have been working with the ecosystem to shape the overall strategy and direction for adopting AI. This includes areas of data governance, responsible and accountable AI, identifying and defining critical systems as precursors for using AI, and applied AI training to socialize the use of AI in the areas of health, agriculture, and education. This has been a strong pillar of enablement for the definition of new opportunities and support for the deployment of solutions. As an institute that understands pragmatic, ground-level AI with the ability to translate these into meaningful policies, controls and communication regarding the adoption of AI, we will continue to work with the ecosystem to provide roadmaps and direction in this space.

Coming Full Circle

Artificial intelligence has a long tail. As an institute, we are committed to continuously retraining our models and augmenting our solutions with proven and leading approaches. We have provided a first-hand experience of using AI to the underserved. We have experienced their joy and surprise at what technology can do to improve their lives. We measure our success in the millions of people impacted by our solutions–this is what spurs us on. On this journey, we have now performed the complete lifecycle of applied AI several times across multiple domains–from problem definition, AI solution design and development to user design, engineering development, integration into national platforms, formal measurement and evaluation, program support and training, and finally to supporting scaled deployment.

These represent important milestones for us and validate the most important reason for our existence–to deliver applied AI to the people who need it the most. Whether it is using Oral Reading Fluency to build foundational speaking skills and instill confidence in children, utilizing a systematic approach to integrate AI for clinical decision support on a national platform, discovering possible outbreaks by automatically analyzing millions of web pages across multiple languages, providing the first ground level intervention for cotton farmers with a pest

management solution, or providing a host of LLM-based solutions–each of these represents a journey of AI deployment at various stages of scale.

In the upcoming pages, you will see these and other AI interventions. We hope you too can experience what we do as an institute–a simple sense of joy and gratitude for being *nimmita-matram* (an instrument) in bringing about a meaningful change in society.

Archimedes had said, "Give me a lever long enough and a fulcrum on which to place it, and I shall move the world." AI is the lever, and we are the fulcrum working with the entire ecosystem to move the world.

Onwards and Upwards

In 2024, we will continue our journey towards deeper and broader adoption of our solutions. We also plan to engage with the international marketplace to seek opportunities for our approach to policy and data matters, coupled with solutions that can allow nations in the Global South to experience AI. These will represent our first steps towards Make AI in India in the social sector.

As always, our institute is immensely grateful to the government, our donors, partners, and all stakeholders who have been instrumental in making this happen. Without them, our journey of bringing AI to the underserved would not be possible.

Shekar Sivasubramanian
CEO, Wadhwani AI

THE YEAR AT A GLANCE 2023

JANUARY

WADHWANI AI AT G20

Our AI solutions were featured at various engagements during India's G20 Presidency, starting from January 2023.

APRIL

ROLLING OUT PATO

Deployed Prediction of Adverse TB Outcomes (PATO) at nearly 160 health facilities in Haryana.

MAY

MOU WITH NIUA

Signed MoU with the National Institute of Urban Affairs (NIUA) to enhance digital technology for urban governance.

'NEW' DELHI OFFICE

Launched our new office in New Delhi.

JUNE

LAUNCHED VAACHAN SAMIKSHA

Vaachan Samiksha, an AI solution for oral reading fluency, was launched in Gujarat with the support of the education department.

AUGUST

SCALING PATO

Expanded deployment of PATO in 5 regions–Haryana, Mumbai, Chandigarh, Dadra and Nagar Haveli and Nagaland.

SEPTEMBER

TIME 100/AI

Founders Romesh and Sunil Wadhwani recognized in the global TIME 100/AI list.

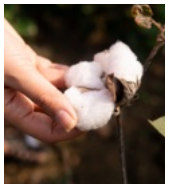
OCTOBER

US AMBASSADOR VISIT

Showcased our AI solutions to the US Ambassador to India, Eric Garcetti, at our New Delhi office.

MOU WITH MOWCD

Signed MoU with the Ministry of Women and Child Development (MoWCD) to strengthen POSHAN 2.0 with AI solutions for enhancing child growth monitoring.



COTTONACE REACHES 100K

CottonAce, an early pest warning and instant advisory system for cotton crops, reached 100,000 farmers with the support of over 30 partners.

NOVEMBER

Krishi 24/7

LAUNCHED KRISHI 24/7

Krishi 24/7, our AI solution for automated news monitoring and analysis, was launched by the Ministry of Agriculture and Farmers Welfare (MoAFW).

DECEMBER

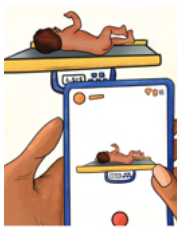
SWIFTCHAT INTEGRATION

Vaachan Samiksha bot integrated with Swiftchat application, used by 2.2 lakh teachers across Gujarat.

GPAI

GPAI SUMMIT 2023

Supported the Ministry of Electronics and Information Technology (MeitY) in seamlessly conducting the Global Partnership on AI (GPAI) Summit 2023.



MOUs WITH UNION TERRITORIES

Signed MoUs with the Union Territory of Dadra and Nagar Haveli, and Daman and Diu for the adoption of Newborn Anthropometry.

Abbreviations

A

ABW	American Bollworm
ANC	Antenatal Care
ANM	Auxiliary Nurse and Midwife
API	Application Programming Interface
ASER	Annual Status of Education Report
ASHA	Accredited Social Health Activist
ASR	Automatic Speech Recognition
AWW	Anganwadi Worker

C

CDSS	Clinical Decision Support System
CDST	Culture and Drug Sensitivity Test
CICR	Central Institute for Cotton Research
CLAMP	Comprehensive Lost to Follow-Up and Mortality Prediction
CTD	Central TB Division
CXR	Chest X-ray

D

DD	Differential Diagnosis
DR	Diabetic Retinopathy
DR-TB	Drug-resistant Tuberculosis
DS-TB	Drug-sensitive Tuberculosis

E

EWS	Early Warning System
ELT	Economic Threshold Limit

F

FTA	Farm Tele-Advisor

G

GT	Ground Truth

I

ICMR	Indian Council of Medical Research
IDSP	Integrated Disease Surveillance Program
IHIP	Integrated Health Information Platform
IPM	Integrated Pest Management

K

KCC	Kisan Call Center

L

LFU	Loss to Follow-Up
LLM	Large Language Model
LPA	Line Probe Assay

M

MDS	Media Disease Surveillance
MEL	Monitoring, Evaluation and Learning
MMR	Maternal Mortality Ratio
MNCH	Maternal, Newborn and Child Health
MoAFW	Ministry of Agriculture and Farmers Welfare
MoHFW	Ministry of Health and Family Welfare
MoWCD	Ministry of Women and Child Development
MUAC	Mid-Upper Arm Circumference
MVP	Minimum Viable Product

N

NBA	Newborn Anthropometry
NCDC	National Centre for Disease Control
NHM	National Health Mission
NHSRC	National Health Systems Resource Centre
NIRT	National Institute of Research in Tuberculosis
NMR	Neonatal Mortality Rate
NTEP	National TB Elimination Program
NPSS	National Pest Surveillance System
NPCBVI	National Program for Control of Blindness & Visual Impairment

O

OCR	Optical Character Recognition
OPD	Outpatient Department
ORF	Oral Reading Fluency

P

PAF	Patient Assistance Form
PATO	Prediction of Adverse TB Outcomes
PBW	Pink Bollworm
PHC	Primary Healthcare Centers
PIH	Pregnancy Induced Hypertension
PoC	Proof of Concept
PROS	Pregnancy Risks and Outcomes Stratification

S

SOPs	Standard Operating Procedures

AI for Health

AI for Education

AI for Agriculture

Solutions At A Glance

Health

★ Clinical Decision Support System (CDSS)

A solution that enhances medical decision-making and streamlines diagnosis and patient management, thereby helping combat shortage of trained medical personnel, especially in peripheral areas.

★ Cough Against TB

An solution that analyses cough sounds and symptoms of patients to identify presumptive pulmonary TB.

Line Probe Assay

A solution that improves laboratory workflows for drug resistance detection by automating the interpretation of LPA strips through computer vision techniques, enhancing the reading and reporting of LPA test results.

Newborn Anthropometry (NBA)

A solution for frontline healthcare workers that captures tamper-proof anthropometric measurements of newborns between 0–42 days using a basic smartphone.

★ Media Disease Surveillance (MDS)

A solution that enables media scanning units at the centre and in states to capture real-time health alerts to identify possible outbreaks across India.

Pregnancy Risk and Outcome Stratification (PROS)

A risk assessment solution that facilitates early identification of mothers with high risk of non-adherence to antenatal care visits (ANC) and adverse clinical outcomes for both mother and child.

Vulnerability Mapping for TB

A predictive model that identifies vulnerable areas and optimizes targeted TB screening activities for effective public health interventions.

AI Assistant for Primary Healthcare Workers

An in-service conversational agent to assist day-to-day operations for healthcare workers.

★ Prediction of Adverse TB Outcomes (PATO)

A solution that predicts the risk of adverse health outcomes in TB patients, including the risk of abandoning treatment mid-way.

AI-Powered Detection Of Radiological Feature In Chest X-ray (CXR)

An X-ray analysis application that detects signs of pulmonary TB, silicosis and major radiological features in chest X-rays. The application assists in screening efforts for pulmonary conditions in peripheral healthcare settings.

AI-Powered Screening of Diabetic Retinopathy

A solution that enables minimally trained healthcare professionals, such as optometrists and ophthalmic assistants, to detect and grade diabetic retinopathy to facilitate efficient screening.

★ *Deployed*

Education

★ **Oral Reading Fluency (ORF)**

A solution that provides automated insights based on voice recordings of students reading passages of text, by assessing reading comprehension and oral reading fluency in children.

Early Warning System (EWS)

A solution that identifies children who may be at the risk of dropping out from the school system, thereby enabling the government to implement early response strategies.

Agriculture

★ **CottonAce**

An early pest warning and instant advisory system for cotton crops that identifies pests based on images, and provides immediate and localized advisory.

Kisan-eMitra

A grievance redressal chatbot that assists farmers in addressing complaints under the PM Kisan Samman Nidhi Yojana.

Krishi Sathi

An agriculture advisory chatbot that aids Farm Tele Advisors (FTAs) and farmers–powered by Large Language Models (LLMs) and Language Translation Models (LTMs).

★ **Krishi 24/7: News Monitoring in Agriculture**

A solution developed in collaboration with the Ministry of Agriculture and Farmers' Welfare (MoAFW), that enables media scanning by capturing agriculture alerts and events of interest.

National Pest Surveillance System (NPSS)

A computer vision based early warning and advisory system that helps farmers manage pests and diseases in a timely manner. This offers personalized advisories from experts, helping mitigate the risk of crop loss.

Agri AI Collect

A data collection application that records farmers' actions at different crop production stages in a simplified manner.

Crop Yield Prediction

A solution for administrators and farmers that predicts crop yield based on digital farm records and contextual data.

Krishi Decision Support System

A portal that enriches ground truth data collection using AI models to digitize and standardize farm-level data collection for decision-making.

Artificial Intelligence for Health

Since Wadhwani AI's inception in 2019, we have dedicated ourselves to changing the public health infrastructure in India by leveraging AI. We work closely with the Ministry of Health and Family Welfare to develop and deploy AI-led solutions in three key domains:

- **E-Health**
- **Tuberculosis**
- **Maternal and Newborn Child Health (MNCH)**

As an official AI partner of the Central TB Division (CTD), we are actively involved in developing multiple interventions across the TB-care cascade, and helping India's National TB Elimination Program (NTEP) become AI-ready. We are creating AI solutions to reduce maternal and child morbidity and mortality rates in resource-constrained settings, by enhancing primary care quality and fortifying the first thousand days of life for infants. In collaboration with the Ministry of Health and Family Welfare and other partners, we are designing a range of AI solutions to mitigate the impact of a lack of trained medical personnel and resources and augment the public health ecosystem for greater effectiveness and resilience.

Supported by: USAID FROM THE AMERICAN PEOPLE BILL & MELINDA GATES foundation

Media Disease Surveillance

Deployed

Supported by: USAID FROM THE AMERICAN PEOPLE | TRACETB | MINISTRY OF HEALTH AND FAMILY WELFARE

In 2023, Wadhwani AI's Media Disease Surveillance (MDS) solution emerged as a powerful innovation in India's public health landscape, empowering stakeholders with real-time and actionable insights on disease surveillance.

The solution enables media scanning units at the Centre and state levels to capture unusual health alerts in real time. The Media Disease Surveillance solution is used to identify potential disease outbreaks across India.

In August 2023, the solution was officially launched at the National Conference of the Integrated Disease Surveillance Program (IDSP) in Visakhapatnam. We engaged with stakeholders from 36 states and Union Territories and identified active and inactive states based on outbreak data and resources.

Highlights of 2023

34,337
health events extracted

1,163
health events shortlisted

80.5%
of flagged health alerts published using AI

156
potential outbreaks acted upon

The solution's integration with the Integrated Health Information Platform (IHIP) assisted district surveillance officers and on-ground rapid response teams in taking proactive measures to control these outbreaks. The adoption of MDS increased in 2023, with 120 district surveillance officers from 26 states and Union Territories responding to alerts—as opposed to 54 officers in 2022.

Innovations

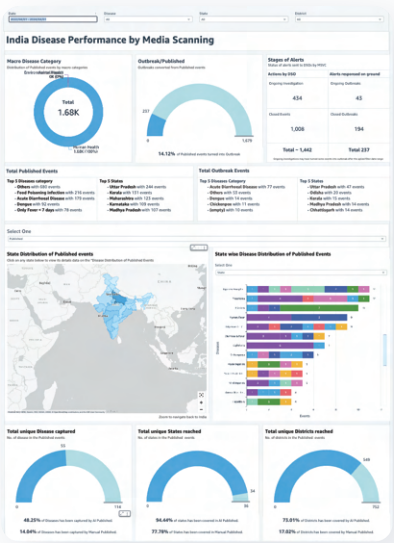
We have continually enhanced MDS for better performance.

Automatic deduplication improved the efficiency of event extraction by 55%, ensuring articles about the same event were clubbed together.

AI translation models expanded coverage to 11 languages, which led to enhanced scanning of local disease alerts published in native languages.

Evaluation of the automated process optimized precision and recall metrics, ensuring robust model performance.

Our collaboration with the National Centre for Disease Control (NCDC) expanded disease/incident/symptom coverage from **33 to 114**. This embraces the holistic "One Health" approach that covers human, animal, and environmental health.



In this image: MDS dashboard

Objectives for 2024

In 2024, MDS is transitioning to multi-relevance classification for improved relevance, integrating advanced large language models for relevant information extraction, and improving translation accuracy. We aim to expand the coverage of news sources, leverage Optical Character Recognition (OCR) for scanned documents, and look to introduce WhatsApp community sharing for Ministry officials.

Clinical Decision Support System

Deployed

Supported by:

The limited availability of trained healthcare personnel contributes to inconsistent treatment quality and fragmented care, reducing access to services and hindering effective clinical decision-making. Inefficiencies in taking patient history, misclassifying symptoms as diagnoses, patient flows to inappropriate OPDs, and lack of structured clinical data severely compromise the quality of primary health care consultations.

The Ministry of Health and Family Welfare (MoHFW) is trying to mitigate the impact of these through various interventions. While rapid progress is taking place, AI can play a key role in supporting existing technology that provides last-mile access to medical facilities.

Since March 2023, eSanjeevani, the telemedicine app by MoHFW, has been utilising our CDSS system. eSanjeevani manages 200-250k consultations daily. Users in India can access it via mobile or visit local health facilities, where healthcare providers assist them using the app. With approximately 150k HWCs nationwide, each center caters to roughly 5k people.

Healthcare providers in primary health settings use our Patient Assistance Form in eSanjeevani, which is validated by AIIMS Rishikesh. This form captures patient health information as per healthcare standards (SNOMED CT) and assists doctors in diagnosing patients based on patient data.

Highlights of 2023

76M
eSanjeevani consultations recorded

1m 4s
average time taken to complete the PAF

67M
consultations on eSanjeevani using PAF

4.3M
AI-based diagnoses recommendations

Innovations

- *The development of the Differential Diagnosis (DD) model expanded diagnostic capabilities, offering tailored recommendations based on patient symptoms, age, and gender. Demographic data has been incorporated into the model for more comprehensive clinical evaluations of patient conditions.*

- *Dermatology images can now be uploaded to increase the scope of diagnosis.*

- *An e-OPD recommendation system has been designed under the CDSS umbrella to recommend relevant OPDs to patients.*

- *The Patient Assistance Form (PAF), validated by AIIMS Rishikesh, has been expanded to include 301 symptoms, up from 115.*

Objectives for 2024

In 2024, our focus will be on increased AI-based offerings to help doctors and patients. We will use LLM capabilities in the rule-based PAF. This can streamline the capturing of patient health information. We aim to develop adjacent solutions to contribute to eSanjeevani's mission to enhance healthcare delivery across India.

Cough Against TB

Deployed

Supported by: USAID FROM THE AMERICAN PEOPLE | TRACETB | MINISTRY OF HEALTH AND FAMILY WELFARE

NTEP is a testament to India's commitment towards reducing the high burden of tuberculosis. To assist the Central Tuberculosis Division (CTD) in this endeavor, we developed Cough Against TB–an application that analyses cough sounds and symptoms to identify presumptive pulmonary TB. The application, developed in partnership with the Central TB Division (CTD) and USAID-supported TRACE-TB project, enables the early detection and treatment of TB.

Highlights of 2023

Deployment unit	*Individuals screened*	*Identified by app as Presumptive TB cases*	*Diagnostic tests completed*	*TB+ cases detected*
Nagaland	5,399	867	165	21
Mumbai	77,002	6,672	843	5
Kashmir	16	4	N/A	N/A
Chandigarh	159	96	10	2
Delhi	402	80	7	5
Total	**82,978**	**7,719**	**1,025**	**33**

82,978
beneficiaries screened by the app

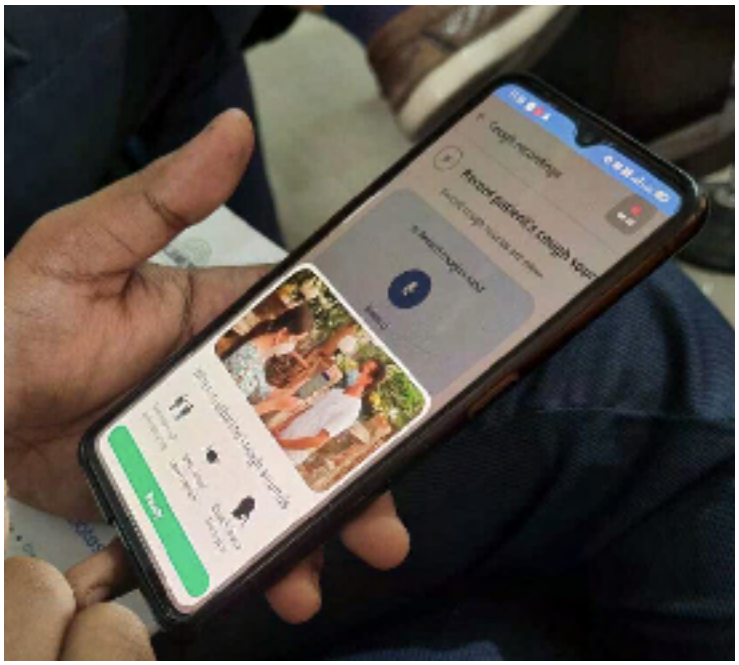
307
healthcare workers trained to use the app

210
healthcare workers used the app across 5 states

Innovations

- *The enhanced AI model eliminates the effect of background noise in cough recordings by isolating and retaining only the segments with cough sounds.*
- *Model compression enables offline usage, ensuring deployment in remote locations with sporadic internet connectivity.*

Objectives for 2024



In this image: *A health worker using 'Cough Against TB' application.*

In 2024, we plan to expand to Punjab, Chhattisgarh, Uttarakhand, Himachal Pradesh and Mizoram. We also plan to widen our data collection efforts to include more data from community settings. We will make the application available on Google Play Store. Additionally, we will address challenges to factor in background noise through advanced AI techniques.

Prediction of Adverse TB Outcomes (PATO)

Deployed

Supported by: USAID FROM THE AMERICAN PEOPLE | TRACETB | MINISTRY OF HEALTH AND FAMILY WELFARE

Despite increased efforts to curb non-adherence to TB treatment regimens, over 2.6% people affected by TB were lost to follow-up (LFU) in 2022. Besides facing a higher risk of developing and amplifying drug-resistant TB, LFU patients can be at increased risk of mortality (5% of total) due to inadequate care in the early stages of treatment.

With support from USAID and the CTD, we developed a solution to predict the risk of adverse outcomes (loss to follow-up and death) for people affected by TB, at treatment initiation. The solution, PATO, consists of a web portal called TB-CLAMP and a mobile application called ECLAMP. Ni-kshay data is uploaded to TB-CLAMP, where the AI model assigns a risk score (High/Low) for adverse outcomes. High-risk patients are auto-populated to the ECLAMP application to track their intensified interventions by the field staff.

Highlights of 2023

As of December 2023, the solution has been deployed across eight regions, with support from the NTEP field staff. The solution caters to drug-sensitive Tuberculosis (DS-TB) patients in Haryana (since May 2023), Chandigarh (since August 2023), Nagaland, Tripura, Dadra and Nagar Haveli, 12 districts of Mumbai (since August 2023), Punjab and Kashmir (three districts each, since November 2023).

20,528
patients identified as high-risk

10,249
patients followed up with, via calls and home visits

125
ECLAMP app users (including district-level NTEP officials)

630
ECLAMP app users (primarily field staff)

These deployments have aided the states' efforts to reduce adverse outcomes and improve public health interventions provided to patients by directly addressing the massive human capital crunch in public health and by empowering field staff.

Innovations

ML innovations include algorithmic fairness for uniform performance across sensitive categories such as gender, model interpretability using counterfactuals and feature importance, and calibration and conformal scores for uncertainty estimation and abstention.

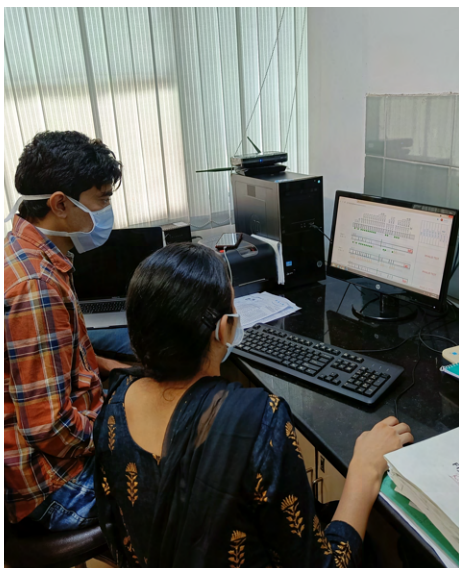
Deployment-related enhancements included adaptation to the new data schema, state-specific models through data augmentation, pseudo-labeling and retraining to address distribution shift, and a new threshold update protocol ensuring a steady targeting fraction.

Objectives for 2024

In November 2023, the solution was presented as a poster at the Union Conference on Lung Health, held in Paris. Taking a step forward from the success of this presentation, we also aim to highlight the deployment of PATO in public health journals in 2024.

In 2024, we plan to evaluate the solution in field settings. We also plan to integrate the solution into the Ni-kshay application for pan-India deployment. Standard Operating Procedures (SOPs) will be designed for states to define programmatic interventions.

Solutions in Pre-Deployment Stage



Line Probe Assay (LPA)

Line Probe Assay is a rapid molecular diagnostic method for drug-resistant tuberculosis. In India, approximately 400,000 LPA tests are performed annually across 103 Culture and Drug Sensitivity Test (CDST) laboratories. The manual interpretation and recording of results introduce errors and delays in initiating TB treatment. Our solution employs computer vision to automate the reading, interpretation and transmission of LPA test results—aiming to reduce processing times and manual errors and improve the accuracy of test results. This assists early diagnosis and determination of appropriate treatment regimens for DR-TB patients.

Latest

- *The LPA solution has been evaluated and validated by ICMR (National Institute of Research in Tuberculosis, Chennai), yielding approval for the deployment of the solution.*

Radiology: Chest X-ray

TB Screening Solution: Chest radiography is an important tool for the screening and triaging of pulmonary tuberculosis and is useful in cases where the disease cannot be confirmed through microbiological testing methods. The lack of radiologists, along with limited access at the last mile, poses a challenge in public health efforts towards early and accurate TB diagnosis in India. This solution uses advanced AI techniques to detect signs of pulmonary TB using chest X-rays.

Feature Detection Solution: Developed in association with the Department of Radiology, AIIMS Delhi, it screens for key radiological features in chest X-rays indicating various lung diseases, improving turnaround time for diagnosis and treatment initiation.

Silicosis Solution: Analyzes chest X-rays to screen for silicosis, aiding radiologists and medical officers in clinical diagnosis.

Latest

- *TB screening solution is currently under evaluation with support from the Government of Madhya Pradesh.*
- *Silicosis solution is currently integrated into the RajSilicosis portal handled by the Department of Social Justice and Empowerment, Rajasthan.*

Vulnerability Mapping for TB

Currently, vulnerable zones for tuberculosis are identified based on reported caseloads and local intelligence for active case-finding activities. This can lead to areas with increased vulnerability to TB potentially being overlooked. Our predictive model identifies these vulnerable areas, thus enabling optimization of targeted TB screening activities for effective and focused public health interventions.

Latest

- *Further model development is now enabled with the acquisition of the TB-mukt Panchayat Dataset (certified low-case count Panchayats across India).*

Health Vani

Frontline healthcare workers are vital to India's public health system, but pre-service training often fails to ensure adequate comprehension and retention, eroding trust and jeopardizing healthcare seekers' well-being. We are developing an LLM-based conversational agent for in-service use to complement pre-service training.

Latest

- *An MVP based on NHM documents was developed for showcasing at G20. NHSRC and MoWCD to adopt the solution for ASHAs and AWWs.*
- *We collected 5 hours of audio in local dialects from over 50 ASHA workers in Uttar Pradesh to evaluate the performance of the current speech-to-text models.*

Automated Screening for Diabetic Retinopathy

According to the All India Ophthalmology Society, in 2021 there were 23,000 registered ophthalmologists in India. The burden on ophthalmologists is high, necessitating an AI solution that can screen diabetic patients for diabetic retinopathy (DR). Our AI solution analyzes retinal images captured by a fundus camera to screen DR severity and enables healthcare professionals to refer high-risk cases to an ophthalmologist. The solution was developed under the aegis of the MoHFW and in collaboration with AIIMS Delhi and AIIMS Rishikesh.

Latest

- *Evaluation of our solution conducted on AIIMS retrospective data set demonstrated 93% sensitivity and 95% specificity.*
- *Along with AIIMS Delhi, we prepared a manuscript detailing the evaluation findings of our DR solution for submission to a peer-reviewed journal.*

Skin Condition Detection

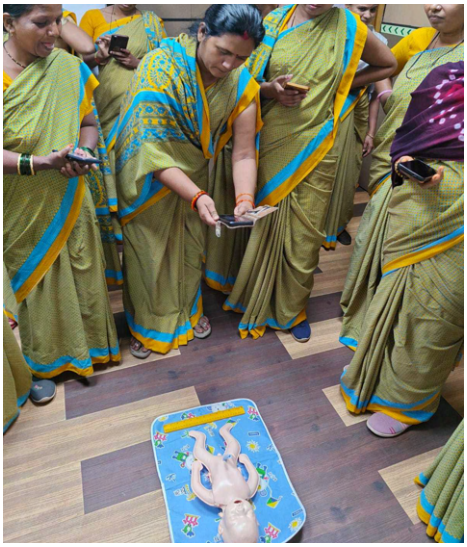
This solution, developed in conjunction with the Department of Dermatology at AIIMS Delhi, analyzes images captured via mobile devices for skin conditions. It will enable healthcare workers to identify and deliver suitable care for a variety of skin conditions. Integration into telemedicine platforms, such as eSanjeevani, will also help close gaps in dermatological care.

Latest

- *In the initial phase of the project, we are working to address 14 common skin conditions.*

Newborn Anthropometry

Reducing the neonatal mortality rate (NMR) is a critical target as a part of the Global Sustainable Development Goal (SDG) 3. To help further this cause, our solution uses AI for newborn (0-42 days old) anthropometric measurements of weight, height, chest circumference, head circumference, and MUAC using short videos through basic smartphones. It is intended to address challenges regarding usage and errors in conventional methods in community settings to enable tamper-proof digitization of anthropometry data.



Latest

- *MoU signed with Dadra and Nagar Haveli and Daman and Diu for phased deployment of the AI solution through 450+ ASHAs as a part of HBNC visits in 2024*
- *Ongoing collaboration with Jhpiego to pilot test the solution in the State of Madhya Pradesh through 70+ ANMs in selected blocks in 2024*

Image credits: Jhpiego

Pregnancy Risks and Outcomes Stratification

Pregnancy Risks and Outcomes Stratification (PROS) is a risk assessment tool for the early identification of mothers with a high risk of non-adherence to antenatal care (ANC) visits and adverse clinical outcomes for both mother and child. This can empower frontline workers (FLWs) to make informed decisions about differential care thereby ensuring effective allocation of resources and timely care.

Latest

- *We partnered with Jhpiego and the state of Madhya Pradesh to develop AI models. An early model to predict ANC visits adherence was developed. It will be refined, validated and deployed in pilot blocks in 2024. AI models for clinical adverse outcomes in mother and child will be developed in 2024.*

Artificial Intelligence for Education

The possibilities of what applied AI can achieve in the field of education are endless. For us, 2023 marked the beginning of using artificial intelligence to augment service delivery in the public education ecosystem. Our AI solutions in the domain currently focus on two key areas:

- **Helping educators improve the oral reading fluency of students with the ORF solution**
- **Enabling educators to reduce dropouts in the public school system with the EWS solution.**

In partnership with the state of Gujarat and ConveGenius, we have deployed ORF in nearly 10,000 schools–reaching over thirty thousand teachers who have used the solution to assess the oral reading fluency skills of 500,000 students. Gujarat is also the site for EWS' maiden deployment, where we are working with UNICEF for on-ground training and developing relevant intervention guidelines.

With preparations in full swing to scale our work, 2024 is primed to be a year of growth and impact for our solutions in the education sector.

Supported by:

Oral Reading Fluency

Deployed

Supported by:

Reading accurately and with expression is one of the most important foundational skills children must possess to hold effective conversations as they grow older. However, according to the Annual Status of Education Report (ASER), released in 2023, barely 42.8% of grade 5 students in India can read at grade 2 level. While a lot of factors contribute to this statistic, the lack of personalized feedback to students and the high pupil-to-teacher ratio in schools add to the challenge.

The Oral Reading Fluency (ORF) solution, developed and deployed in 2023, aims to solve this challenge by using artificial intelligence to equip students with this crucial skill—particularly in rural and peri-urban public schools. ORF is deployed in over 9,500 public schools in Gujarat, with development underway to expand to states like Maharashtra and Andhra Pradesh.

How does ORF work?

The ORF solution prompts students to read out a passage chosen by teachers according to their grade level–analyzing their voice recordings for parameters like correct words per minute, incorrect words, missed words, and extra words spoken. Accessible via smartphone, the solution is currently meant to be operated by teachers who can log in with their credentials, choose a language for assessment, and get individual reports on the reading fluency of students based on voice analysis.

> **Deep learning**–a subset of machine learning–is the foundation of ORF. Once a student's audio is recorded, it is analyzed by Automatic Speech Recognition (ASR) models that generate transcripts, which are further processed to determine alignment with the target paragraph to identify hits, misses, substitutions, insertions, and deletions.

How is ORF helping teachers?

The Oral Reading Fluency solution enables educators to personalize their learning plans according to students' individual needs. It also equips them with data to measure their pupils' progress and allocate resources more effectively.

In the Indian public education setting, where meeting the prescribed student-to-teacher ratio (35:1 as per the Right to Education Act, 2009) in many regions is difficult—ORF can act as a powerful teacher's aid automating assessments and insights into how students read at their specific grade level.

Highlights of 2023

Adoption in Gujarat: In partnership with the Department of Education, Government of Gujarat, ORF was integrated into G-Shala–the state's ed-tech platform. Additionally, the solution was also integrated with SwiftChat, a learning content application widely used in the state, to reach more students and teachers.

9.5K+
schools onboarded

477K+
students onboarded

32K+
teachers onboarded

575K+
reading assessments

Enabling Action: Based on data from the assessments, the Gujarat Government initiated special training for students in Grade 2 who needed additional support to improve their fluency in Gujarati.

Highly Accurate Results: An evaluation study of the ORF solution conducted between September and October 2023 yielded encouraging results–pegging the accuracy of the solution in gauging fluency in Gujarati at 87.4%. The model correctly identifies 82.4% of all words spoken correctly and 99.1% words pronounced incorrectly.

Objectives for 2024

With encouraging results from Gujarat, ORF is poised to be deployed in other states in India. Goals for 2024 include:

- *Deployment in Andhra Pradesh with assessments in English, with support from ConveGenius.*
- *Deployment in three other states in collaboration with ConveGenius and other partners.*
- *Integration of remediation solutions for Gujarat to enable educators to bridge learning gaps for students with AI-enabled tools.*

Solutions in Pre-Deployement Stage

Early Warning System

A 2023 survey conducted by the Ministry of Education, Government of India, suggests that nearly 3.5 million Indian students drop out of the school system after class X. The Early Warning System–currently under pilot testing in Gujarat–uses data points like attendance, student performance, records, and assessments to predict and prevent dropouts. The tool identifies patterns and trends, enabling timely interventions to support at-risk students.

Latest

- *A stable EWS model for Gujarat has been successfully developed.*
- *We are currently working with UNICEF and Vidya Samiksha Kendra to enable access to school-wise lists of at-risk students for stakeholders.*
- *The EWS model has 78% sensitivity and 77% specificity.*

Artificial Intelligence for Agriculture

We believe that using AI to solve problems for farmers can lead to a better, more equitable world for all. We work closely with the Ministry of Agriculture and Farmers' Welfare (MoAFW) to design and deploy holistic and practical AI solutions to solve problems across four key domains:

- **Pest and Disease Surveillance**
- **Agricultural News Monitoring**
- **Crop Yield Prediction**
- **Conversational Agents for Agriculture**

Working in conjunction with MoAFW, we're building AI models for upcoming Ministry portals.

Our Vision

- Build and scale sustainable systems to improve the lives and livelihoods of farmers.
- Connect farmers with best practices for yield improvement through personalized farm and farming-based advisories curated by experts.
- Reduce the risk of monetary losses due to pre-adverse and post-adverse events affecting farmers.
- Enable direct benefit transfer/monetary support/loan advisories and instant grievance redressal services to facilitate support in yield improvement.

Supported by: H&M FOUNDATION giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Google.org

CottonAce

Deployed

Supported by: Google.org H&M FOUNDATION giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

An estimated six million cotton farmers in India lose 20 - 30% of their crop every year because of pests such as pink bollworms (PBWs) and American bollworms (ABWs). This leads to a significant loss in crop yield and farmer income. The American bollworm (*Helicoverpa armigera*), also known as corn earworm or sorghum head worm, poses a significant threat to cotton cultivation. Its primary feeding targets include cotton squares (buds), flowers, and bolls. Pink bollworm (*Pectinophora gossypiella*) is a small dark-brown moth whose pinkish larvae inflict considerable harm to cotton crops by boring into flowers and bolls.

How is CottonAce helping farmers?

Wadhwani AI's CottonAce is an early warning and advisory app that uses artificial intelligence to help cotton farmers tackle pest infestations on time.

Lead farmers who have Android smartphones install the CottonAce app on their devices. They also set up pheromone traps on their farms and monitor them regularly. Pheromone traps contain synthetic versions of the pheromones emitted by female insects to attract males for mating. Farmers place these traps in the field to monitor pest populations. Male insects are captured when they are attracted to the trap and enter it.

Farmers empty these traps once or twice a week onto a white sheet of paper and take photos of trapped moths, which are then uploaded onto the app. The AI model identifies and counts the pests in the uploaded photographs and determines the level and type of infestation, based on which a set of actionable advisories are generated.

The lead farmers and extension officers are encouraged to share the advisories generated by the app with cascade farmers, who are not directly using the app but may benefit from it. The advice is formulated by experts at agriculture universities, and government-led research and development agencies.

CottonAce can be used on basic Android smartphones and is **available in English and eight Indian languages**. Taking into account network accessibility issues for farmers in remote parts of the country, the application has been developed for offline usage in regions with low network coverage.

CottonAce has a dedicated user management portal, a dashboard with deep data-driven insights and CICR–accredited monitoring protocol management. It also provides personalized pesticide management guidance and detailed weather information with an inbuilt forewarning system. There is a web-based dashboard for program administrators, which enables them to regularly monitor app usage and infestation at the farm and village levels in real-time.

Highlights of 2023

113K
farmers onboarded

50K
lead farmers

63K
cascade farmers

3200
extension workers

The transformative impact of the CottonAce app in the agricultural landscape is evident from its impressive user metrics and solution adoption statistics.

In 2023, Wadhwani AI forged partnerships with 31 organizations across all cotton-growing states, benefiting over 100,000 cotton farmers. Nationwide training sessions were conducted for field deployment that have empowered farmers, extension workers, governments, and organizations working at the grassroots level.

Implementing a sophisticated multi-stage system of models–including offline inference on phone models, cloud-based inference, and expert inference–has significantly improved the solution's effectiveness and reach.

CottonAce alerts–categorized into 5,800 red alerts, 2,500 yellow alerts, and 6,500 green alerts in 2023–have provided timely insights and interventions to farmers.

More than 8,200 image uploads and over 15,400 installations signal the growing faith reposed by farmers in CottonAce..

Objectives for 2024

Wadhwani AI is currently developing models to be hosted on MoAFW's cloud servers to help identify more varieties of pests and diseases for crops as identified by the ministry. This will ultimately empower farmers with timely, localized, and precise weather-related information, crop management advisory insights, and other essential agricultural data that helps in taking smart decisions and mitigating risk of crop loss.

Deployment Partners:

Krishi 24/7

Deployed

Supported by: Google.org

On November 6, 2023, Wadhwani AI launched Krishi 24/7, an AI solution developed in collaboration with the Extension division of the Ministry of Agriculture and Farmers Welfare. Krishi 24/7 assists the MoAFW in promptly monitoring and identifying pertinent agricultural events nationwide by scanning real-time news articles in multiple languages.

This enables the MoAFW to take action for significant agricultural events. Krishi 24/7 uses online media in 12 languages (news websites, agricultural magazines, Google Alerts) as sources to identify incidents of interest to help the MoAFW plan interventions to safeguard the interests of farmers. To validate the authenticity of the information, a human-in-the-loop approach is followed.

Highlights

10
categories of agriculture news

150
sub categories

12
indic languages

Krishi 24/7 is capable of generating personalized and concise summaries of agriculture breaking news across 10 categories and 150 sub-categories.

It automatically converts news from 12 languages into English, ensuring accessibility to a broader audience. Moreover, a live, personalized feed of the latest agricultural news lets users stay updated in real time.

It also has a dedicated portal to manage users, track agricultural news alerts, and action status on investigations.

Objectives for 2024

In 2024, Krishi 24/7 will be scaled in collaboration with the MoAFW by onboarding additional divisions to expand its operational scope. Integration with external agencies by sharing APIs can foster collaboration among various stakeholders for robust pest management. Furthermore, including more categories and sub-categories and introducing more languages will ensure that the app remains inclusive and accessible to a diverse range of users.

Solutions in Pre-Deployment Stage

National Pest Surveillance System (NPSS)

Periodic pest surveillance ensures regular monitoring of the spread of pests, and facilitates timely interventions so that pest populations remain controlled and do not cause widespread economic losses for farmers.

Wadhwani AI's pest management solution CottonAce relies on area-wide pest surveillance to prevent major crop loss by detecting early indicators of damage to cotton crops. Owing to CottonAce's successful implementation over the years, MoAFW conceptualized the idea of the National Pest Surveillance System (NPSS), which is an advanced warning and advisory system utilising computer-vision technology. NPSS has been designed for farmers and agricultural experts to promptly detect and address pests and diseases affecting crops of national importance.

To aid the Ministry's efforts, Wadhwani AI is building an AI model to augment NPSS functionality. With the AI model at its core, NPSS will enable farmers and field experts to receive reliable advisories on how to safeguard crops from the attack of pests.

Latest

- *The AI models for detecting multiple pests on the NPSS app have an average detection accuracy of more than 80%.*
- *The pest surveillance app with real-time, expert-verified crop protection advisories empowers farmers with timely and accurate information to combat pest infestations effectively.*
- *The application also provides immediate insights from agricultural experts so farmers can swiftly implement targeted strategies to mitigate crop damage and minimize yield losses.*
- *NPSS enables a proactive approach that safeguards farmers' livelihoods and can ensure long-term resilience against pest-related challenges.*

Agri AI Collect

This user-friendly data collection application automates farm record collection and maintenance using speech, language, and computer vision AI models. Agri AI Collect seeks to simplify data-gathering processes for farmers and policymakers.

Latest

- *Agri AI Collect has personalized AI-powered voice recording features to help farmers plan and manage their daily farm activities using intuitive voice commands.*
- *It collects agricultural voice data in two Indic languages and automatically translates the information into English, ensuring ease of use, aggregation, and accessibility.*
- *The app customizes data collection using dynamic forms and offers contextual insights on topics such as pesticide usage and soil quality. The application is ready for pilot implementation.*

Kisan-eMitra: Grievance Redressal Chatbot for PM Kisan Beneficiaries

The Pradhan Mantri Kisan Samman Nidhi is a direct benefit transfer scheme with 90 million registered farmer-beneficiaries. Under this scheme, an instalment of Rs 2,000 is transferred to each beneficiary thrice a year.

Currently, the system relies heavily on manual processes for handling grievances and the turnaround time for resolving them increases significantly during peak time, thus burdening program officials. Kisan-eMitra is a grievance redressal chatbot designed to assist them and eliminate delays in the resolution of farmers' complaints related to payments, registration, eligibility, and eKYC updates related to the scheme. The chatbot also lets users raise queries in local languages.

In this image: *Kisan-eMitra chatbot*

Latest

- *The APIs are ready for performance testing with the MoAFW's Kisan-eMitra chatbot. The functional demo for integration approval is complete.*
- *The chatbot has features such as 24/7 access to resolve scheme-related queries, prompt and accurate responses, suggestions and FAQ assistance, and multilingual capabilities in five Indic languages.*
- *The chatbot lets farmers address scheme-related inquiries promptly and effectively. Its user-friendly interface–supporting both text and voice input–aids accessibility and ease of use for farmers with diverse backgrounds and literacy levels.*

Krishi Decision Support System

The Mahalanobis National Crop Forecast Centre (MNCFC) currently employs a manual process for collecting, processing, and analyzing GIS and ground truth data from diverse sources. This time-consuming process can lead to significant delays in generating accurate crop forecasts.

We are developing an AI solution intended for integration into MoAFW's Krishi Decision Support System (KDSS). This solution aims to automate ground truth data collection and curation processes by digitizing, organizing, and standardizing farm-level data collection activities across India, facilitating informed decision-making by policymakers.

Latest

- *A PoC of a visualization tool has been created that emphasizes Ground Truth (GT) points and Normalised Difference Vegetation Index (NDVI) visualization to provide users with precise and actionable insights into crop health and land productivity.*
- *An enhanced crop classification model, incorporating a GT correction algorithm and a spectral library, has also been developed to enhance accuracy and reliability in crop identification and classification.*

Crop Yield Estimation

In India, where agriculture continues to be heavily dependent on weather cycles, the absence of reliable crop-yield estimation methods create challenges for farmers in terms of optimizing resource allocation, negotiating fair prices, and effectively mitigating risks. This ultimately impacts their profitability and livelihoods.

Our Crop Yield Estimation solution enables administrators and farmers to predict crop yield using digital farm records and external data feeds like genetic, cultivar, and environmental, geospatial parameters—among others. It also recommends best farming practices based on the available data.

Latest

- *Data for 20 states and 32 crops has been successfully utilized to build a crop yield prediction model.*
- *The app provides preseason and in-season yield predictions for proactive decision-making and crop management.*
- *It has a user-friendly interface and generates simple, easy-to-understand yield prediction reports to ensure widespread adoption by farmers. Also, the app's capability to create localized and instant advisories can help administrators implement relevant agricultural strategies and support initiatives to enhance crop yields.*

Krishi Sathi: Advisory Chatbot for Kisan Call Centers

Farmers often face challenges in accessing quality information due to various factors such as geographical constraints, language barriers, and limited resources. The Kisan Call Centre (KCC) was launched by the government to alleviate this pain point. KCC is the national helpline for farmers that provides access to farming-related information and lets farmers raise queries.

KCC receives around 15,000 calls per day, which are handled by approximately 400 Farm Tele Advisors (FTAs), leading to long waiting times. The helpline is operational seven days a week. Farmers' queries are often so complex that each response typically takes at least a couple of minutes.

Krishi Sathi is an AI/ML conversational agent designed to reduce call response times and provide farmers with accurate, instant and summarized advisories in their preferred language. This can significantly decrease the effort that FTAs have to expend on answering each query which in turn will speed up grievance redressal for farmers.

Latest

- *A Large Language Model (LLM) has been successfully developed using a repository of officially **documented datasets for 60+ plant protection advisories**, and government schemes such as PM Kisan. It can also answer weather and mandi price-related queries.*
- *Krishi Sathi is capable of identifying **the intent of the query for 5 query categories (plant protection, mandi price, weather forecast, crop insurance, and government scheme)**.*
- *A dataset curated by agricultural experts has been created **containing 294 queries with three crops (wheat, rice, maize)**, to analyze the chatbot's performance.*

AI Readiness

Over the course of 2023, Wadhwani AI led initiatives on training and development that played a crucial role in empowering public sector officials with the necessary knowledge and understanding of AI technologies.

> The AI Readiness training program, is an in-person structured training program that is curated to prepare individuals, teams and organizations for the adoption and implementation of AI technologies.

We make AI knowledge and applications accessible to public entities including the Ministry of Health and Family Welfare, AIIMS, and the Ministry of Agriculture and Farmers Welfare, among others.

11 Workshops

525 People

5 States

Following the success of our first AI Readiness Workshop in November 2022, we took AI Readiness workshops nationwide across different sectors. In 2023, 11 workshops were conducted, training a total of 525 people including doctors, policymakers, education experts, crop scientists, teachers and government officials. The trainings were conducted across five states–Maharashtra, Delhi, Gujarat, Punjab and Himachal Pradesh. Participants included officials from central ministries—Health, Agriculture, Women and Child Development, state education departments, bilateral organisations, and private foundations among others.

These one-day trainings establish the core concepts of AI, with a focus on applied AI and a holistic understanding of the AI life cycle, including–design research, monitoring and evaluation, machine learning, engineering and product. The workshops have helped attendees develop basic skills necessary to initiate and manage AI projects, including data literacy, AI applications, and the risks and challenges associated with AI. We've also helped them gain practical experience navigating diverse real-world AI use cases and problem-solving within an AI framework through hands-on case study sessions.

Date	Organisation	No. of participants	Location
25-26th February	PGI Chandigarh	38	Chandigarh
20th April	AIIMS Rishikesh	57	Rishikesh
6th July	Ministry of Health and Family Welfare	43	Delhi
25th August	Maharashtra Higher Education Department	44	Mumbai
29th August	Lady Hardinge Medical College	180	Delhi
12th September	ICMR NIOH Gujarat	19	Gandhinagar
16th September	Project Concern International	29	Delhi
26th October	Ministry of Women and Child Development	15	Delhi
2nd November	Ministry of Agriculture and Farmers' Welfare	28	Delhi
25th November	AIIMS Delhi	16	Delhi
29th November	IIPH Gandhinagar	56	Gandhinagar

Knowledge about the implementation and deployment of AI is pertinent for the public administration machinery for seamless adoption. With the aim to equip the country's decision makers with AI knowledge–particularly for initiatives in health, agriculture and education–our goal by 2025 is to conduct over 100+ AI workshops.

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