Case Studies of AI in action - The First Mile of Healthcare delivery

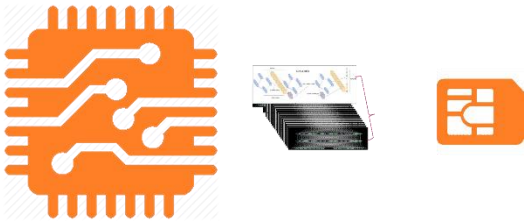
Executive Summary

Artificial Intelligence (AI) can be used to address the growing patient-physician gap and provide healthcare service delivery to the forgotten billion – the billion plus people who lack access to basic healthcare. With Artelus' state-of-the-art deep learning algorithms and user-friendly suite of products, trained operators can provide primary screening for a variety of conditions like Diabetic retinopathy (DR), Glaucoma, Tuberculosis (TB), Pneumonia etc. in remote areas lacking healthcare facilities. Use of technology ensures wider reach and lower cost resulting in better outcomes for everyone involved in the healthcare ecosystem.

In this paper, we present four use cases for our suite of DR products which highlight the benefits of AI powered screening in improving healthcare.

The Technology

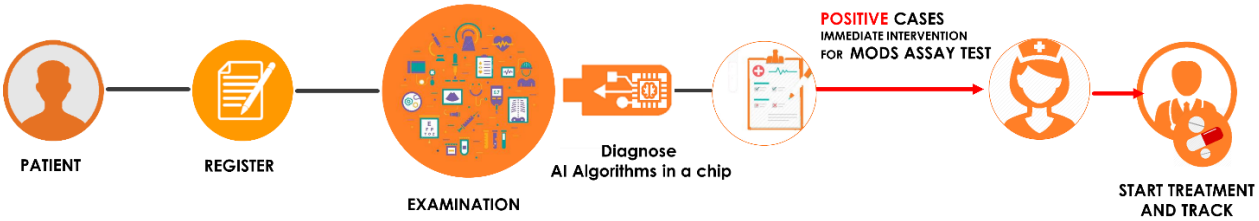
Advances in AI –specifically deep learning - have the capacity to significantly improve patient outcomes because it allows algorithms to be trained to make predictions from a variety of sources like medical images, blood sample data, doctor reports etc. Artelus has developed a proprietary framework – Tefla – and trained our algorithms to detect various conditions like DR, TB, Pneumonia and cancer.



Recognizing that most AI solutions require access to the internet, Artelus has developed a solution where our algorithms are embedded on chips so that geographies which don't have access to internet aren't deprived AI-powered healthcare screening. Algorithms read medical images in under 30 seconds an provide results.

In addition to the core AI algorithms, Artelus has developed integrated solutions to ensure a seamless experience from patient data capture to reporting ensuring that healthcare providers guide patients through the entire treatment pathway.

Our AI solutions are commercially available and in use in India, Middle East and Malaysia. The following case studies illustrate use cases for our solutions. Following are our case studies that demonstrate the effectiveness of our AI solution for Diabetic Retinopathy (DR) detection.



Case Study 1: Improving customer conversion rates

Location: 38 locations across North India

Summary

A chain of tertiary eye care clinics in North India had a conversion rate of 6%. Per their analysis, long lead times was one of the main causes for the low conversion rate. This led to lost business and a potentially bad outcome for patients who had DR or other conditions.

The institute initiated a pilot of Artelus' AI solution – DRISTi – in one of their clinics. After a successful pilot, the integrated solution was rolled out across all their clinics in early 2018 to improve patient footfall and conversion rate.

29588 patients screened for Diabetic retinopathy over span of 9 months

More than **15%** identified with abnormalities

Results

Over the course of 9 months, the clinics screened **25000**+ patients of which approximately **15%** were found to have some disorders in eye (our AI solution flags a patient if any abnormality is found in the eye).

The suspect cases were referred to specialists within the chain leading to a **2x** improvement in customer conversion rates.

2x improvement in customer conversion rate

Case Study 2: AI powered screening in public healthcare

Location: Dubai Innovation Week - Dubai

Summary

Dubai Health Authority (DHA) in collaboration with Artelus piloted our DR screening solution in City Walk Mall were the week long Dubai innovation week was showcased for general public.

Demonstrated screening for Diabetic Retinopathy outside hospital and clinic setting for general population. Walk-in people across all age groups and background expressed interest in getting their retina screened and were delighted to know how AI helped in screening and get their reports almost instantaneously.

Most young people learnt that diabetes could cause permanent vision loss, and brought their elderly parents to get screened the next day

Results

A total of **209** patients were screened every evening for 5 hours over a period of 5 days (25 hours) using a **single** Non-Mydriatic fundus camera and one trained operator who was **neither a nurse nor an optometrist**.

Out of the 209 patients screened, **7** were diagnosed with various abnormalities and were referred to specialists. These images were also sent to a certified grader and retina specialist for further diagnosis.

The AI system developed by Artelus performed very well with **specificity 100% and sensitivity 97%** against the certified grader. The accuracy was measured for both detecting abnormalities and also reading a normal retina.

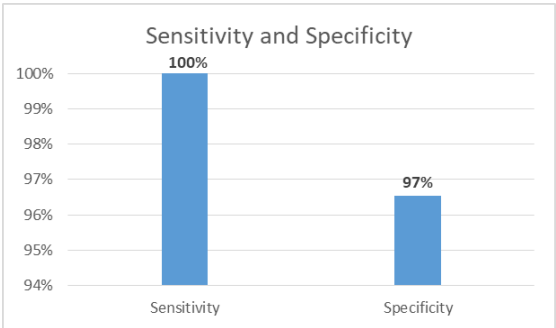
209 patients screened for Diabetic retinopathy in **25 hours**

7 were diagnosed with various abnormalities and referred to specialists

67 % DR Prevalence among the Diabetic Patients*

*patients that disclosed their Diabetic Condition

Total number of patients screened	**209**
Number of patients with DR	2
Number of patients with other abnormalities (Drusen etc.,)*	5
Number of patients with referable DR	0



Case Study 3: Bridging the patient- specialist gap

Location: Sree Renga Hospital Chengalpattu – Diabetes Specialty Hospital

Summary

Sree Renga Hospital in collaboration with Artelus piloted a Project in Artificial Intelligence (AI) for screening Diabetic Retinopathy (DR) from 23rd January - 23rd March, 2018 at their hospital in Chengalpattu – a town in Kancheepuram district, TN.

The results were presented at **CAHOCON 2018,** the 4th international Conference of the Consortium of Accredited Healthcare Organizations (CAHO).

AI Screening helped in screening and get their reports almost instantaneously.

The Screening results show that there is 9% prevalence of DR among Diabetic Patients among the people Screened in the hospital. IDF data shows that 1 in 3 people develop Diabetic Retinopathy which is 30 % prevalence rate.

Created awareness amongst people that Diabetes can also cause blindness, and showcased the latest advances in Sree Renga Hospitals' effort to bring latest technologies to the Small and remote places with aim to provide high quality affordable health care for all

AI innovation shows much promise to be used in large scale screening and **small hospitals in remote areas**

154 Patients screened **8** patients were DR suspected one of them had **sight threatening** DR

9% DR Prevalence among the Diabetic Patients*

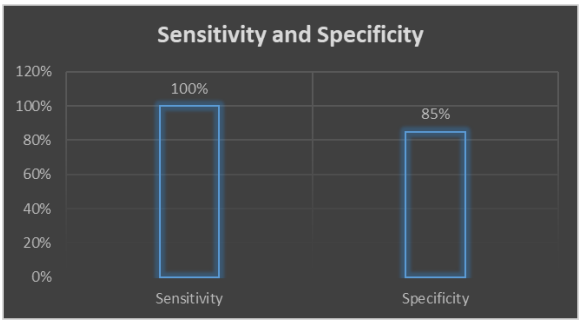
*patients that disclosed their Diabetic Condition

Results

A **total of 154** patients were screened using a single Non-Mydriatic fundus camera and one operator at the Hospital Premises. 8 patients were DR suspected of which one of them had sight threatening DR and at the verge of losing eye sight any time.

This technological innovation shows much promise to be used in large scale screening and small hospitals in remote areas to identify diabetic people with potential sight threatening diseases while filtering people with normal retina**.**

Use of AI helped bridge the patient-physician gap to a large extent



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Case Study 4: AI Powered Social Missions

Location: Multiple camps across India

Summary

Artelus was founded with the mission of using advances in AI to bring healthcare to the forgotten billion – the billion plus people who lack access to healthcare. In line with our mission, we have regularly conducted camps using our AI solutions.

Between November 2016 when we first conducted our camp and Feb 2019, we have screened over **20000** people across **300+** locations in free camps conducted in partnership with Sushrut Hospital, Agarwal Eye hospitals, Lions Club, Rotary Club, and Free Masons club – many of which are remote areas of India. Our screening has identified **5000+** patients who had some abnormalities in their eyes including DR. The patients were referred to specialists and this has prevented thousands of patients from potentially going blind.

In 2019, we have a mission to screen a million people for various conditions using AI and are partnering with NGOs and institutions that share our mission

First AI based DR screening conducted in **2016**

Over **20000** people screened across India for free

Identified more than **5000** DR positive cases and referred to specialists