



Innovative Artificial Intelligence Solutions

Xen Medical360.ai - an Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning based solution for utilizing artificial intelligence technologies in all aspects of medical care.

Overview

Hospitals and medical labs generate enormous amounts of data. The volume of data produced is expected to increase at a [CAGR of 36% through 2025](#). Automation and machine learning will help reduce turnaround time for analysis of these large datasets. This is critical in areas where a timely response can save a life as in an ICU. Automating analysis of historical time series data, predicting diagnosis from radiology imaging and predicting propensity to illness and hospitalization will help physicians making effective decisions.

The [cost of healthcare in US](#) outstrips inflation. The bulk of this burden is pushed to patients. An aging population adds to healthcare burden. Optimization of operational costs through better predictive modeling and analytics will become necessary for hospitals to help reduce cost to patients.

Goals of Xen Medical360.AI Solution

1. Disease detection and diagnosis from radiology imaging. This encompasses a vast array of diseases like screening for cancers, cardiovascular abnormalities, detection of musculoskeletal injuries, neurological and pulmonary problems.
2. Improve ICU care by providing faster response times for large dataset analysis and anomaly detection.
3. Identify pre existing conditions from genetic data and update with new research.
4. Combine machine learning models in Xen Medical360.ai with Xen Patient360.ai applications to make precision medicine recommendations.

Web: www.Xen.ai
Email: support@xen.ai

USA
501, Gibson Dr, #2624
Roseville, California - 95678, USA
Phone: +1 408 221 6976

INDIA
ES 11, Heavenly Plaza, Kakkanad
Kochi – 682021, Kerala, India
Phone: +91 701 261 9339



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Xen Medical360.AI Solution Overview

Medical Imaging

Diagnostic medical imaging or diagnostic radiology consists of the following technologies today:

- [X-Ray Imaging](#): The basis of X-Ray imaging technology is that tissues absorb photons from X-Rays transmitted to them. The absorption rate of photons is proportional to the electron density of the tissue. The photons that pass through the body are either captured on film or by photon detectors to construct an image of the body that X-Ray passes through. X-Ray diagnosis can be used to detect bone fractures, dislocation, development of arthritis, osteoporosis, pneumonia, emphysema, lung cancer, heart failure and metallic objects embedded in the body.
- [Ultrasound Imaging](#): High frequency ultrasound waves are directed at a part of the body that needs to be imaged and the reflected waves are detected and recorded to create an image of the internal anatomy of the body. Ultrasound is commonly used to do scans of the abdomen, pelvis, pregnancy and other musculoskeletal parts. Ultrasound technology is less invasive as it's a non-ionizing radiation.
- [Computer Tomography scan](#): Computer Tomography (CT) scan is used to create 2D and 3D images of body part structures. CT scan can effectively image blood vessels, bone and soft tissue simultaneously. It's the most effective imaging technique to detect cancer. It is extensively used to diagnose trauma and injury, aid surgeries and radiotherapy. The technology uses multiple X-Ray beams across thin cross sections of the body and reconstruct the complete 3D image from multiple scans.
- [Magnetic Resonance Imaging](#): Magnetic Resonance Imaging (MRI) uses the principle of nuclear magnetic resonance to generate EM signals from tissues and record them to reconstruct the anatomy of the area scanned. Different tissues have different molecular structures and using a strong static magnetic field, the protons in the molecules are excited to states at different energy levels in different molecules. Since it doesn't use X-Rays or other ionizing radiation, it is considered a safer alternative. Neuroimaging (brain), cardiovascular, musculoskeletal, liver, gastrointestinal and angiography benefit from MRI scans.
- [Nuclear Medicine scans](#): Nuclear medicine involves taking radioactive substances internally and detecting radiation emitted from these substances to understand physiological function of tissues

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and organs. It differs from radiology imaging in that the anatomical imaging is not the primary goal. PET (Positron Emission Tomography) and SPECT (Single Photon Emission Tomography) are the two most commonly used methods in nuclear medicine. Nuclear imaging allows for whole body imaging using certain cellular receptors.

2D and 3D images from radiology and nuclear imaging aids doctors to diagnose diseases. It helps to monitor your body's response to treatment as well as screen for possible illnesses like breast cancer, lung cancer and heart disease.

Xen Medical360.ai is a suite of applications where each application serves a specific purpose be it diagnosis, prevention or cure. In the area of imaging diagnosis, the following applications can be prioritized:

1. **Screening for cancers:** Lung cancer detection from lung scans (MRI, CT and PET). Lung cancer has a high mortality rate in later stages of cancer. [Five year survival rate](#) for lung cancer based on stages - 35% (Stage 1), 20% (Stage 2), 6% (Stage 3) and 0% (Stage 4). It makes a big difference to survival the earlier lung cancer is detected. We will prioritize lung cancer detection from scans and continue with a suite of models for each cancer type.
2. **Cardiovascular abnormalities from heart structure measurements:** Heart structure and function can help in early detection of cardiovascular diseases as well as estimate risk of cardiac arrest. In addition to imaging, EKG measurements may also be used to aid diagnosis.
3. **Detection of fractures and musculoskeletal injuries:** These injuries can lead to long term chronic pain if not treated properly. Detection of fractures (hairline), dislocations and soft tissue injuries could aid physicians in treating these injuries.
4. **Neurological diseases:** Degenerative neurological diseases like ALS if flagged early have the potential to help patients with long term care. Cognitive impairment in Alzheimers when detected early has the potential to be managed better - [Alzheimer's Disease Neuroimaging Initiative](#) is one such project.
5. **Pulmonary diseases:** Pneumonia and Pneumothorax are conditions that require quick response. Detection of these diseases when there are pre-existing conditions like cystic fibrosis become hard. AI can assist radiologists in effective detection of these diseases.

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Intensive Care Unit

Critical care decisions sometimes are made with a high degree of uncertainty and physicians have very little time to make a decision. There is little data in the value of treatments and interventions in ICU. A few scoring systems (APACHE, MPM, SAPS) have been used to measure ICU performance (predicted vs outcome) and [they have only been used 10% to 15% of the time](#). The Multiparameter Intelligent Monitoring in Intensive Care (MIMIC) database is a public database with ICU time series data from various measurements. It is a good starting place for a schema to model ICU dataset.

There are many potential use cases in ICU. We plan to prioritize the following:

1. Utilize waveforms and time series data generated from monitors (pulse, oxygen, temperature, pressure) to detect anomalies
2. Predicting shock and sepsis for hypotension patients
3. Prediction of heart or lung failure from vitals time series data
4. Prediction of ventilation related problems like lung infection
5. Predict length of stay and mortality

Genomic applications

This is another vast area of research with potential for many applications and use cases. A fully sequenced genome for a patient is a prerequisite to use genomic applications developed by Xen.ai. In addition relevant sequence data from tumors (ctDNA) for oncology applications may be necessary. Our focus will be clinical applications using patient and population genome data.

The following use cases will be prioritized:

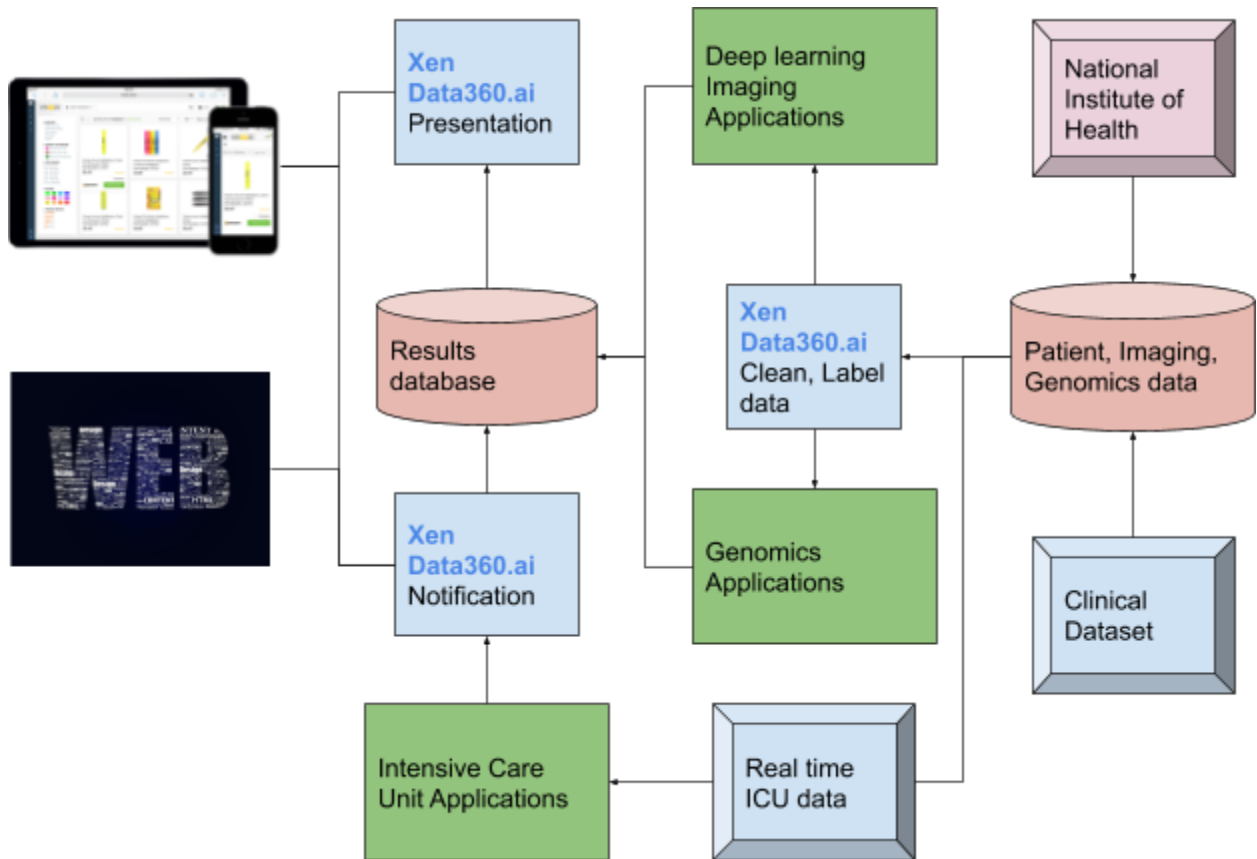
1. Discovery of mutations for monogenic disorders
2. Predict drug response side effects
3. Predict response to therapy from biomarkers in tumors
4. Predict risk for diseases from population data

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Xen Medical360.AI Solution Architecture



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Key Benefits of Xen Medical360.AI Solution

- Save physician and staff time analyzing big data
- Using accurate prediction models hospitals can better plan hospital and ICU visits
- Enable higher patient satisfaction
- Save costs in all aspects of hospital care with quicker turnaround time

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