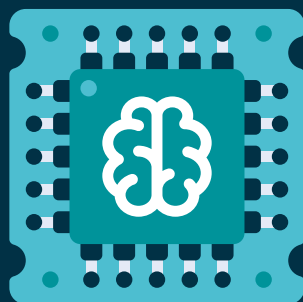


Creating Realtime Evidence Based Patient Care



Machine Learning & AI

The Egghead
Creative

Content

Industry Snapshot	2
Evidence-Based Patient Care	3
Real World Evidence	5
Implementation challenges	7
Application of machine learning	8
Information gathering and Sensing (IoT)	8
Alerts and diagnostics from real-time patient data	9
Pattern recognition for the identification of diseases	9
Patient triage optimization	9
Our Synopsis	10
About Egghead Creative	11

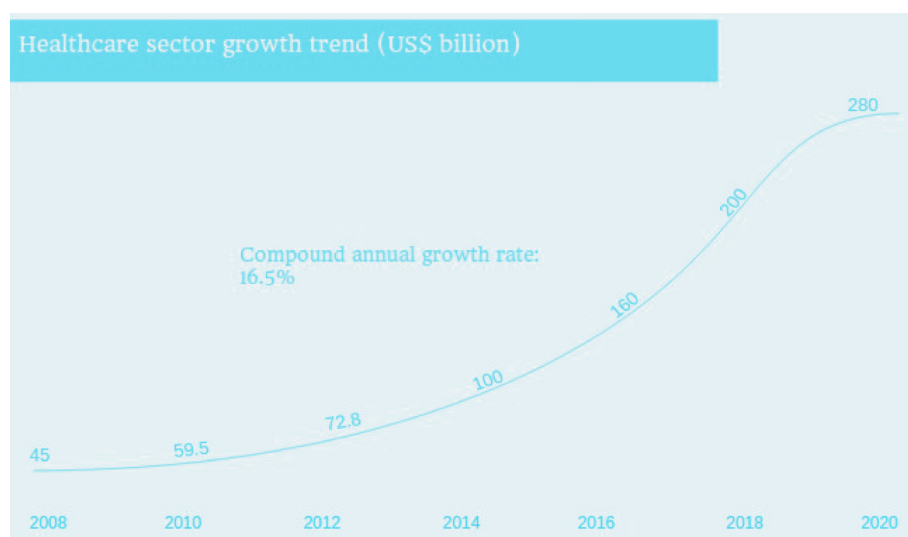
Industry Snapshot

Healthcare sector has surged itself with regard to revenue and employment in recent years. Industry consists of clinics, hospitals, medical devices and applications, pharma, retail, insurance, medical equipment, government bodies outsourcing services to private sector and telemedicine. With the introduction of new advanced technology all across the industry, it's growing rapidly, care reaching to every single individual in one or the other way with a major concentration in metros, tier I and tier II cities.

As millions of consumers has deeply embedded smartphones into their daily lives, Healthcare industry is adapting itself to the emerging technologies and applications to reach out to this immense market more effectively.

Thereby focusing on accountability, affordability, customer centric and quality outcome, thus cost effectiveness and high quality care have become critical factors for building robust systems to deliver Healthcare services and products.

Advanced economies like the U.S., Europe, and Japan spend about twice as much of their income (12% of GDP) on health care as emerging markets. The Industry's market today in India is worth \$100 billion and is estimated to reach \$160 billion in 2017, accounting for about 4.2% of GDP which is poised to grow further to \$280 billion by 2020.



The Global Healthcare in specific to IT Market is Valued at USD 228.8 Billion in 2020 over the forecast period of 2015 to 2020. India at US\$ 1 billion currently is expected to grow 1.5 times by 2020.

Evidence Based Patient Care

“Where is the life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?”

- T.S. Eliot's *The Rock* (1934)

The healthcare industry collects large amounts of data from different sources which includes EMR, sensors, mobile devices and wearables. These large data gives an opportunity to provide advanced care and research. Predictive Analytics uses this humongous amount of data to forecast individual health risk, clinical course or outcome. Predictive modeling can be approached using statistical methodologies or machine learning that improves through experience. When compared to statistical methods, machine learning gives more accuracy prediction with less/strict assumptions.

Although the field of machine learning is still evolving, it has found its way through applications like Google Maps that presents accurate geographical data and other applications like Netflix suggesting movies based on viewing habits. Infrastructure and computations ability not being a constraint anymore, processing large volumes of data are accelerating the growth of machine learning.

Machine learning techniques are able to examine and extract knowledge in an automated way and integration of AI tools derive meaningful data thus improvising decision-making capabilities. It increases the efficiency of treatments and reduces costs by minimizing the risks of false diagnosis, facilitating more targeted pre-operative planning, and reduce the risk of intraoperative complications.

Clinical decision support system is one of the first applications of AI. It helps in making better decision based on patient symptoms and demographic information.



Evidence	Constraints	Factors
<ul style="list-style-type: none"> Patient Data Basic, Clinical and Epidemiologic Research Randomised Trial 	<ul style="list-style-type: none"> Formal Policies and laws Community Standards Reimbursement Time 	<ul style="list-style-type: none"> Cultural Beliefs Personal Values Experiences Education

AI and Machine learning techniques are used for building predictive models, making real-time inferences and generating significant insights of immense data from the large patient population. Thereby gives a better quality of medical charting, higher ICU risk predictions scores, less administrative workload, positive impact on healthcare practitioner satisfaction and nursing retention and hence more time available for patient care.

Real World Evidence

Real World Evidence (RWE) is an important component in decision making and building new products. It gives us a broader picture on how the product would perform based on the data collected over a long timeframe changing/ correcting the approach.



Real World Evidence

Data Analytics transform real-world data sources like electronic medical records (EMR), social media, pharma data, claims, consumer data, mortality information and lab records into evidence that can help build applications with more efficient patient-centric care and pharmaceutical firms to develop effective drugs and be smarter in commercialization.

Collecting and analyzing real-world patient experience, improving the quality of care delivered, reducing costs and improvise the outcome by understanding how best to incorporate new therapies and technologies into medical care. Real-World information helps in building and validating new products that creates value and improves efficiency which are cost effective.

Predictive analytics provides value in many real world evidence areas. Listed below are few of the RWE areas

1) Patient profiling

- Identifying patients responding positively to treatment
- Identifying treatment that is most appropriate for a specific patient profile

2) Detecting undiagnosed disease

- Identifying patients likely to be undiagnosed for a given disease
- Early disease detection

3) Risk stratification, including identifying patients most likely to

- Non-adhere to treatment
- Experience disease onset or progression

4) Propensity scoring

- Machine learning well in presence of complex confounding bias

5) Making better use of data assets through imputation

- Instead of only using intersection between large claims data and small clinical data
- Use all patients with imputations for selected variables

Machine Learning also helps in planning for targeted treatment, in 2016, an estimated 246,660 new cases of invasive breast cancer are expected to be diagnosed in women in the U.S., along with 61,000 new cases of non-invasive breast cancer. Predictions / Statistics like these help in preparing a better cancer awareness plan and identifying the disease at an earlier stage.

Implementation Challenges

The rapid evolution of technology in big data and its nascent introduction to Healthcare industry has given us hopes for robust patient-centric care. There are several areas where we optimize, here are a few

1) Complexity

Medical issues don't appear in isolation and coordination of care is difficult.

2) Cost

The high costs for developing, testing, certifying, and implementing can be a barrier.

3) Workflow

How do AI solutions fit into existing workflows? How much effort is required to use it? Does it interfere unnecessarily?

4) Competing Priorities

EHRs, portals, Meaningful Use, Payment Report, ACOs.

5) Regulation

How do we deal with the changing regulation and find the right balance of health protection and foster innovation?

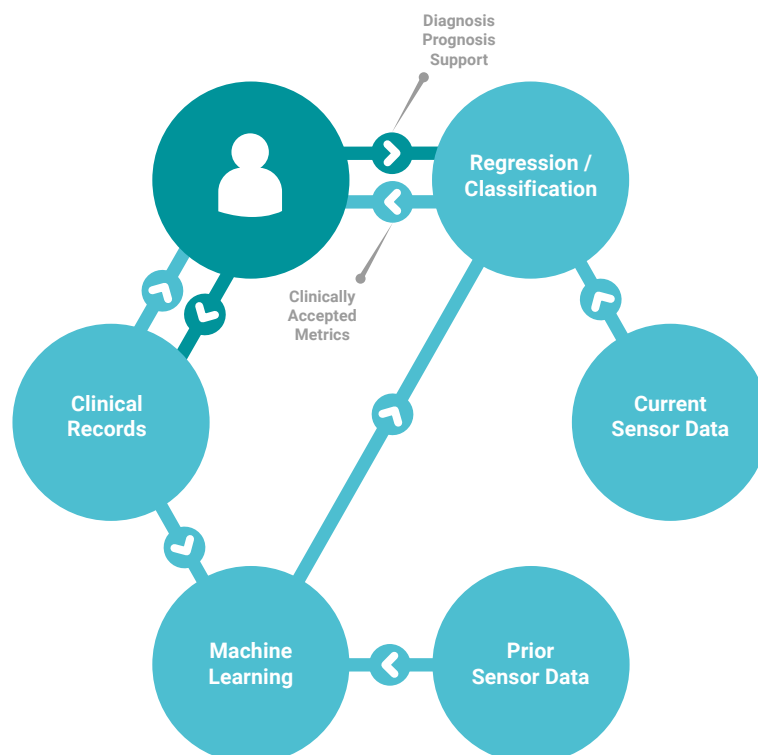
6) Data Security

How do we deal with computer failings? It raises the issue of data de-identification, privacy, security, and espionage.

Application of Machine Learning

Information gathering and Sensing (IoT)

As an example, Masimo Radical-7®, a health monitor for clinical environments that collects patient data and wirelessly transmits for ongoing display / notification purposes and provides complete, detailed picture of patient status for clinicians to review wherever they may be. The monitor incorporates Freescale technology in the form of an i.MX applications processor with enhanced graphics capabilities that enables the extremely high-resolution display of information, as well as a touch-based user interface that makes the technology easy to use.



Application of Machine Learning

Analytics on wearable sensor data utilizes a wide-range of pattern recognition and machine learning techniques such as Sequential algorithms targeting online support vector machines (SVMs). It is a classifier method that performs classification tasks by employing clairvoyant learning schemes with SVM which efficiently minimizes the errors due to missing data/false input. Thus giving meaningful insights to physicians for better diagnosis.

The advantage of creating the linkage with the clinical records is that ongoing clinical practice can provide training data for the machine learning with little or no additional burden on the physicians.

Alerts and diagnostics from real-time patient data

Decision trees and neural networks are used to generate binary classifiers of the patient current state and determine when to issue an alert in case of emergency or change in medication. For example, medics developed a physiological assessment score for preterm newborns, using time-series data captured from newborn's first three hours of life using hierarchical Bayesian model and time series to accurately estimate the probability of an infant's risk of infections and cardiopulmonary complications. Physiological parameters such as short-term variability in respiratory and heart rates had greater predictive power than invasive laboratory studies.

Pattern recognition for the identification of diseases

Data Mining and Pattern Recognition Models to identify and classify the inherited and other possible diseases. For ICU's Electronic Health Records data is mainly a Logistic regressions model employed to predict the risk attached to a particular medication, risk of infection post surgery and length of the stay by extracting thousands of variables from each hospital admission for each day

Patient triage optimization

Machine learning predictive models increases the operational efficiency of hospitals and improve patient care by helping staff make better choices about how resources are allocated.

Real-time analytics platform predicts changes in demand based on environmental conditions, infrastructure capacity, social events, emergency call button data and many so that resources such as extra staff and beds can be brought in before they are needed to prevent long emergency room waiting times without affecting the quality of patient care.

— Our Synopsis

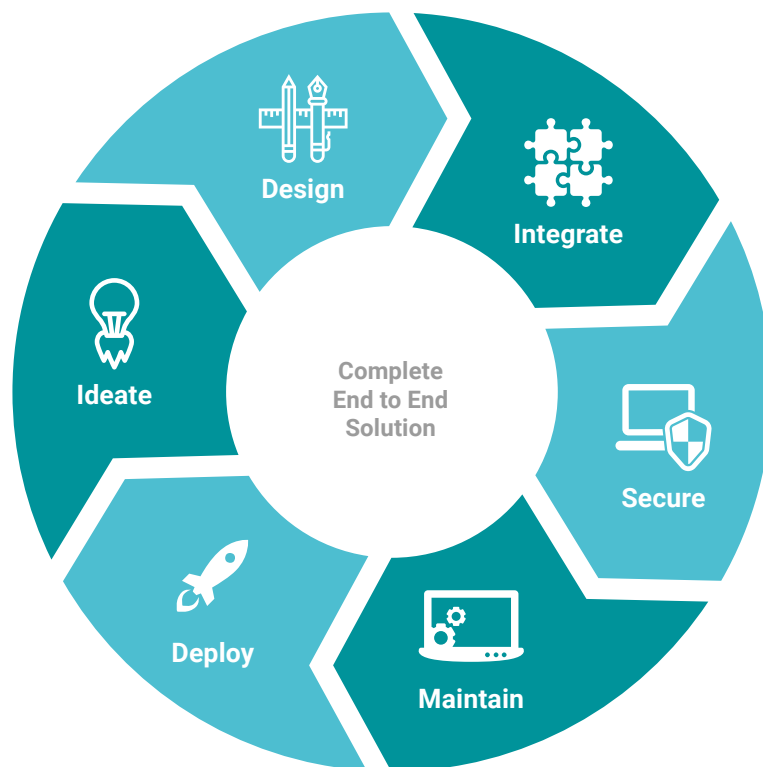
We recommend, while building a healthcare application, it would be a good strategy to implement predictive analytics using AI and machine learning algorithms.

We suggest using predictive models from AI and Machine learning as a strategy in building healthcare applications for better patient centric care. This data-driven approach help in discovering valuable knowledge from large databases of EHR, for financial transactions and to optimize operations, also allow us to make better scientific, clinical and healthcare policies. We need to encourage collaboration between surgeons, clinicians, database specialists, statisticians and scientists in order to build simplified and optimal user-friendly applications .

About Egghead Creative

Egghead Creative is a personalized technology consulting firm specialized in building Comprehensive technology solutions for the ever-changing needs of the modern industry.

Helping clients in every step of their journey right from discovering the idea, crafting it into a product, launching it and helping with sustainability of the application, thus disrupting innovation across every function, every industry, and every need. Our long term support and services helps products grow in a sustainable and stable environment.



For additional information about how we can assist you in building or improving your product needs.

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