Transforming Healthcare Through Artificial Intelligence Systems
About This Report

This industry report was created by Frost & Sullivan, in coordination for the forthcoming Artificial Intelligence in Health & Life Sciences Conference hosted by Kisaco Research, taking place in London, October 4, 2016.

Join us at the Artificial Intelligence for Health & Life Sciences Conference where we will be bringing together leaders from a multitude of disciplines to showcase new technological advances and translational case studies, to highlight not only the potential applications for artificial intelligence in health and life sciences, but also the barriers to its adoption and practical implementation. http://ai-healthandlifesciences.com/

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Artificial Intelligence Ecosystem Segmentation

Artificial Intelligence Toolkit

- Algorithms
- Computer Vision
- Machine Learning
- Image Recognition
- Speech Recognition
- Cognitive Computing
- Semantic Web
- Natural Language Processing

Artificial Neural Networks
- Mimics the structure and functioning of the human brain, to create intelligent behaviour
- Benefits: Pattern recognition, learning and generalization
- Uses: knowledge discovery and mining in medical imaging, as biological models and in cancer predictions

Fuzzy Logic
- Applies approximate reasoning in incomplete or fuzzy data
- Benefits: evaluates conditions, and processes decisions
- Used in ‘Clinaid’ system for diagnostic and treatment recommendations, used in wearables

Expert Systems
- Simulates thought process of a human expert for decision making
- Benefits: Through intelligent integration into hospitals, these systems improves quality of care delivery, reduces costs and diminishes recurrence of medical errors

Source: Frost & Sullivan
Artificial Intelligence Market for Healthcare Applications, World, 2014 and 2021

<table>
<thead>
<tr>
<th>Total AI in HC Market ($ Million)</th>
<th>2014</th>
<th>2021</th>
<th>CAGR (2014-2021)</th>
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<tbody>
<tr>
<td></td>
<td>633.8</td>
<td>6,662.2</td>
<td>40%</td>
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Key Findings:
- Excellent treatment and patient outcomes in various studies using AI as a decision support tool coupled with drastic reduction in diagnostic and treatment costs have been the principal drivers for this market.
- Relatively new market with huge growth potential due to easier integration within HC space.
- Future shift to fee-for-value model for healthcare positively impacting this market.

Note: All Figures are rounded. The base year is 2015. Source: Frost & Sullivan
Transforming Healthcare Through AI
Artificial Intelligence the Key to Actionable Big Data in Healthcare

Data Collection

Artificial intelligence systems enable the conversion of information into insights. These tools can draw correlations and connections between seemingly unrelated data sets.

Analysis

Neural Networks  Fuzzy Logic  Expert Systems

Information is analyzed in a manner similar to human brain function towards pattern recognition and learning. Reasoning is applied to ‘fuzzy’ or incomplete information, and expert systems provide recommendations for decision support.

Comprehension

Information Accessibility  Automated Support  Decision Support

Outputs are curated and adapted to a variety of use case scenarios supporting:
- Automated tasks
- Real time decision support
- Long term planning

Capture  Storage  Security

Most data today in healthcare is unstructured and difficult to share. Outputs and insights can only be as valuable as the information being integrated.
AI Systems Critical to Deployment of Internet of Medical Things

The Internet of Medical Things (IoMT) entails any ecosystem of connected medical technologies supporting targeted health and well-being services.

Applications are often developed in coordination with multiple stakeholders who specialize in specific aspects of solution development and deployment.

Solutions may be tailored to one use case, or bridge across various layers of the care continuum.
Distinguishing Consumer vs Medical Apps & Wearables

**Consumer Health Applications**
- Intended for maintaining or encouraging a general state of wellness or healthy activity.
- Considerably large market with huge number of players.
- Less regulated market, thus promoting easier entry, although very competitive.
- Due to a large variety of solutions, it is very tough to make consumers stick to a particular device.
- Newer tech with consumer-centric and secure interfaces expected to easily overtake existing players in the ecosystem.

**Medical or Clinical Use Applications**
- Useful for a medical professional to diagnosis or influence course of care decisions
- The market is new, slow moving with limited number of players
- Considerable regulations and stringent norms; difficult to enter
- Once entered with apps providing accurate medical information, secure user interfaces and private health data securities, players can gain significant market share in less period of time
- Fees can be paid by insurers and thus expected to be more regularly used by users

Source: Frost & Sullivan
Care Anywhere, Anytime, Any Place Concept Highlights
Core Opportunities for Development of AI Solutions

INSTANT HEALTHCARE
Virtual office visits reduce wait times

CONTINUOUS HEALTHCARE
Information is transmitted and shared in real time between individuals and caregivers

ERROR FREE HEALTHCARE
Sensors, real-time analytics improve diagnoses, reduce procedural errors, and errors in medication administration

MY HEALTHCARE
Care will increasingly be customized to fine tune the approach to the individual and their family

COST EFFECTIVE HEALTHCARE
The most innovative companies improve quality while collapsing extraneous outdated processes and costs

Source: Frost & Sullivan
Personalizing Healthcare Through Big Data & A.I.

Today in healthcare, individuals are often segmented into broad demographic categorizations.

This one size fits all approach leads to initiatives that have low compliance, and often fail to achieve desired milestones.

By creating a more comprehensive view of the individual, healthcare stakeholders are discovering new ways to engage consumers and truly impact healthy outcomes.
Innovating Business Models in Healthcare with AI
Business Model Evolution in Healthcare Emphasizes Actionable Information

Value for Customer

Medical Platforms
- Wearables/Biosensors
- Big Data & Health Analytics
- IoMT

Medical Solutions
- Artificial Intelligence
- Augmented Reality
- Robotics

Historic/Evidence Based Care
- Product-as-a-Service
- Data-as-a-Service
- Platform-as-a-Service
- Managed Services

Real-time Outcome based Care
- Insight-as-a-Service
- Automation-as-a-Service
- Robotics-as-a-Service

Predictive & Preventive Care
- Differentiation via intelligent solutions for evidence/outcome based health benefits to demonstrate value to end-users

Last Decade
- Differentiation solely through product innovation
- Medical Products

Current Decade
- Differentiation by providing services to key stakeholders such as Physicians, Patients and Payers
- Medical Products

Next Decade
- Sell Parts/Hardware
- Consumables/Upgrades
- Repair/Maintenance Support
- Leasing and Buying Support
- Wearables/Biosensors
- Medical Products

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AI in Clinical Applications

- Analysis of Patient's Electronic Health Records
- Population Health Management
- Predictive Care Guidance
- Effectiveness of Care Metrics
- Physician and Hospital Error Reduction
- Medical Image Processing
- Oncology Diagnostic Assistance

Source: Frost & Sullivan
AI for the Consumer

- Personalized Activity Coaching
- Diet Guidance
- Cost Comparison
- Virtual Personal Assistants
- Predictive Modelling
- Wearables Integration
- Social Networking

Source: Frost & Sullivan
Conclusion
Keys for Success in Executing Your Big Data/A.I. Strategy

**Identify the Right Partner:** More than a land grab for customers, the more critical battle for market participants is to identify and establish partnerships with the right stakeholders.

**Underserved Customers:** There are a number of underserved customer segments who are in need of solutions, but see very few services being designed to meet their specific needs.

**Simplicity:** Many available solutions suffer from over-engineering. An overwhelming number of features, and advanced functionalities lead to user confusion and can delay or restrict usage.

**Solution Flexibility:** As new entrants continue to join the market place, solutions that have the ability to adapt to various use cases and can function as either a platform or plug & play mitigate risk.

**Tangible Impact:** Entrants witnessing the highest rates of adoption have targeted applications where ROI is easy to recognize, metric, and translate to savings.