Artificial Intelligence: A Solution for Interoperability

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cloud and healthcare data
Conflict of Interest

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Salary:
Royalty:
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Contracted Research:
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Other: None
Agenda

- Primer on Healthcare Data and Artificial Intelligence
- Interoperability and Challenges
- Convergence of AI and Interoperability
Learning Objectives

• To understand the current state-of-the-art of artificial intelligence (AI) and its limitations

• To appreciate the challenges of interoperability

• To delineate how AI and other technologies can solve the aforementioned challenges of interoperability
Healthcare and Data Conundrum
Healthcare and Data Conundrum

About 80% of patient information is unstructured, and in turn, unmineable.

Advancements in voice recognition and clinical language understanding are enabling the healthcare enterprise to capture information at the point of care, convert patient data into actionable information, and leverage that information for clinical, business, and patient good.

www.nuance.com/for-healthcare
Healthcare and Knowledge

Explicit knowledge:
- Data, information
- Documents
- Records
- Files

5%

Tacit knowledge:
- Experience
- Thinking
- Competence
- Commitment
- Deed

95%
Artificial Intelligence in Medicine
Artificial Intelligence in Medicine

“Artificial intelligence is the science of making machines do things that would require intelligence if done by man.”
Artificial Intelligence in Medicine
Artificial Intelligence in Medicine

- Automatic speech recognition (ASR)
- Named entity recognition (NER)
- Part-of-speech tagging (POS)
- Syntactic parsing
- Coreference resolution
- Machine translation
- Text-to-speech (TTS)

NLP
- Relation extraction
- Paraphrase & natural language inference
- Sentiment analysis
- Summarization

NLU
- Dialogue agents
- Question answering (QA)

Text categorization
Artificial Intelligence in Medicine
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Complex Conditions

Knowledge Hidden in Data

Evidence Based

Intelligence Based

Time

Knowledge

YOU ARE HERE

Evidence Based

Intelligence Based

Complex Conditions
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New Approach
Create a suite of machine learning techniques that produce more explainable models, while maintaining a high level of learning performance.

Learning Techniques (today)
- Deep Learning
- Graphical Models
- Ensemble Methods
- Random Forests
- Decision Trees

Explainability (notional)
- Prediction Accuracy
- Explainability

Deep Explanation
Modified deep learning techniques to learn explainable features

Interpretable Models
Techniques to learn more structured, interpretable, causal models
Interoperability
Joint Multinational Readiness Center

Technical
Procedural
Human
Interoperability
Interoperability

Interoperability

- Standard bodies created **data exchange framework** (HL-7, C-CDAs, and FHIR).
- HITECH and meaningful use by government with **wide EHR adoption** (~90%).
- Exchange of records via private and public **HIEs**.
- **Security measures** being developed.
- **Cloud platforms** available via IT industry.
Interoperability
ABCDEFG and Interoperability
ABCDEFG and Interoperability
ABCDEFG and Interoperability

**Patient Generated Data**
- Stores different types of health data (e.g., images, genomics, and lab reports).
- Consists structured and unstructured data.
- Information is encrypted and digitally signed.

**Clinical Data and Health Records**
- Consists a complete indexed history, patient’s unique identifier, and an encrypted link to health record.
- Each record is time stamped.
- All patient records (historical) are together and stay with the patient.
- Patient has control over the permissions on whom to share with.

**Data lakes**
- Indexing
- Encryption & Digital Sign
- Decryption & Authenticate Digital Sign

**Blockchain**
- Blockchain network consensus enables disintermediation to automate claim adjudication and payment processing with predefined smart contracts.

**Providers**
- Providers use health application to access health data.
- Patients use mobile devices to assign access permission to data and to provide public key.

**Payers**
- Health Analytics & IoMT
- Pharma/Research
- Distributed patient consent for research/clinical trials enables data sharing, audit trials, and clinical safety analyses.

Source: www.healthit.gov; Frost & Sullivan
ABCDEFG and Interoperability
ABCD EFG and Interoperability
ABCDEF and Interoperability

Embedded-type AI Interacts with environment and people in real world

e-Al: embedded Artificial Intelligence

Web & Social Media Data
Machine-to-Machine Data
Big Transaction Data
Biometric Data
Human-Generated Data
ABCDE FG and Interoperability
ABCDEF G and Interoperability
Interoperability
Universal EHR
AI and Interoperability

- **Artificial Intelligence** (AI) is progressing rapidly but challenges remain especially with bias and explainability.
- Much can be learned from **universal EHR** as well as other domains with good interoperability.
- An **exponential convergence** of AI, Blockchain, Cloud, Data Structure, eAI, FHIR, and 5G are key parts to eventual interoperability in healthcare.
AI and Interoperability

We can only see a short distance ahead, but we can see plenty there that needs to be done.
Artificial Intelligence in Medicine: Essential Principles and Current Applications

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www.AI-Med.io
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Questions

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• Remind attendees to complete online session evaluation