AI IN HEALTHCARE

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Outline

Introduction

Application areas
- Diagnostics
- Genomics
- Psychology
- Medical research

Challenges

Prospects

Discussion
Introduction

Why is healthcare today in need of improvement?

- Deficit of personnel
- Larger populations and longer life spans
- Low supply and high costs of one-to-one care
- Quality of treatment.
Introduction

Why do we want to use AI to improve healthcare?

• Efficient diagnostics
• Low cost
• Availability
• Increase understanding
In which areas can AI be used to improve healthcare?

- Diagnostics
- Genomics
- Mental health
- Medical research
- ...
Applications - Diagnostics

- Large amounts of data in the form of patient records, clinical notes and reports as well as journals
- Many "simple" repetitive tasks such as examining x-ray images
- Expensive and unnecessary tests can be avoided with better structuring and availability of data
Applications - Diagnostics

IBM Watson:

- AI-powered computer system, specialized in oncology
- Able to analyze vast amounts of structured and unstructured data in clinical records
- Compares analyzed data to patients records which enables it to provide diagnosis and potential treatment plans
Applications - Diagnostics

Usage of IBM Watson:

- Patient originally diagnosed with a rare form of leukemia
- Slow progress of recovery leading doctors to suspect a misdiagnosis
- A better diagnosis requires a heavy study of mutations within the patients genome
Applications - Diagnostics

IBM Watson - Results:

• Was able to re-diagnose the patient and supply a better treatment plan
• Only took 10 minutes
Applications - Diagnostics

IBM Medical Sieve:

- Algorithm specialized in analyzing images such as X-ray or CT-scans.
- A radiologist has to look at up to 200 images / day ⇒ causes eye fatigue and often diagnostic errors
- Introducing Medical Sieve ⇒ quickly analyses and classifies images.
- Most complicated and unclear cases are left to the radiologists.
Applications - Diagnostics

Cognitive Computing Application: “Medical Sieve”
*Image anomaly detection and identification*

- Quickly filters irrelevant images
- Highlights disease-depicting regions
- Multi-modal decision support
Applications - Diagnostics

- Enlitic - Specializes in optimizing diagnostics through deep learning
- 50% more accurate than an expert panel of radiologists
- Real-time clinical support
- Also offers patient triage
Applications - Genomics

Genomics: the study of the genome
For example, the human genome:

- 20 000 genes
- $3 \cdot 10^9$ base pairs of nucleobases (A,C,G,T,U)
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⇒ Forms large complex systems
⇒ Machine learning excellent!
Key challenge - predicting disease risks from the genome

- Traditionally - black box model
- Supervised machine learning problem
Applications - Genomics

- Doesn’t account for the complexity of the genome
- Black-box approach gives little information on where treatment should be focused
Applications - Genomics

Solution: modularize the problem by introducing cell variables, quantities that are relevant to the function of the cell

- Concentrations of proteins
- RNA and protein folding
- ...
Used recently to discover which *de novo* mutations give rise to autism spectrum disorders.
Applications - AI in Mental care

• Many people suffer from mental illnesses.
• Better understanding of the human psyche.
• Cost reductions.
• Better access to medical records, therapy...
Applications - $\chi^2 AI$, ”Tess”

- Depression and anxiety, a growing problem in both developed and development countries.
- Going to a psychologist is expensive, people avoid seeking help.
- Solution: $\chi^2 AI$, ”Tess”
Applications - $\chi^2 AI$, ”Tess”

How does ”Tess” work?

• Emotions is the core of Tess.
• 24/7 communication to the patient
• Forms a bond with the patient based on emotions.
• Perfect complement or substitute to a psychologist.
Applications: Example of psychological coaching-

Χ²AI, ”Tess”
Applications - Medical research

- Expensive
- Time consuming

Solution:
- Atomwise - Startup company specialized in new forms of medicine development
- Does this using deep learning
- Powered by IBM
Challenges

- Data quality
- Lack of widespread and detailed documentation standards
- Implementing new procedures are expensive and time consuming
- Regulation
Prospects

- Expected increase in computer power
- Availability of cheap and powerful computing components
- Improvements in natural language processing
- Already implemented as a supporting tool in medicine
Future Prospects
• Michiel Rauws, Eugene Bann, 2014. \( \chi^2 \text{AI} \). https://x2.ai/assets/X2AI_Executive_Summary.pdf


• https://medium.com/the-mission/deep-learning-in-healthcare-challenges-and-opportunities-d2eee7e2545#.1g7mnzsxw

• http://venturebeat.com/2015/10/27/deep-learning-startup-enlitic.raises-10m-from-radiology-company-capitol-...
1. Will it be possible to replace all healthcare professionals in with AI in the future or do humans provide something that machines cannot?

2. How can the public perception of AI be improved so that people, for example, accept a diagnosis from a machine?

3. If, for example, you had diabetes and there was an implant with an AI that automatically managed your insulin levels, would you accept that sort of assistance?

4. In what other areas in medicine and healthcare can AI be used? Which would be the most helpful?