

Deep medicine

Leveraging AI for Health in a relevant & impactful way for Africa

Dr. Quentin Awori, MD, MSc Public Health

Senior Researcher Scientist

Kenya Medical Research Institute (KEMRI)



Plan

Birds eye view of AI and relevant topics

How does Health use AI

KEMRI & AI

Challenges implementing AI in Healthcare in Africa

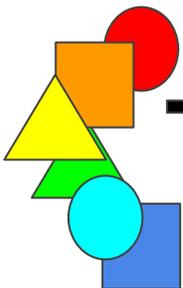
Approaching Research and Innovation in AI in Health in Africa

Q/A

Bird's eye view

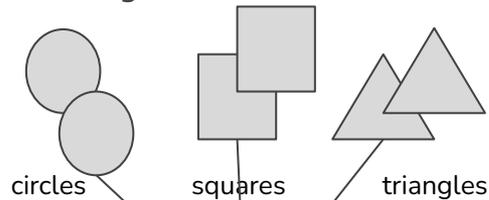
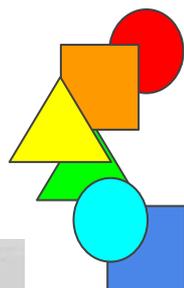
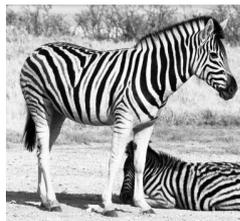
Fundamental difference between deep learning and traditional coding

```
If shape is round:  
    shape = circle  
Else if number_of_sides = 3:  
    shape = triangle  
Else if number_of_sides = 4:  
    shape = square
```



Computer program

Answers



Neural network

Comes up with its
own rules

Answers





Topics in Deep learning

Topics in Deep learning

Computer vision

Image classification

Object detection

Image segmentation

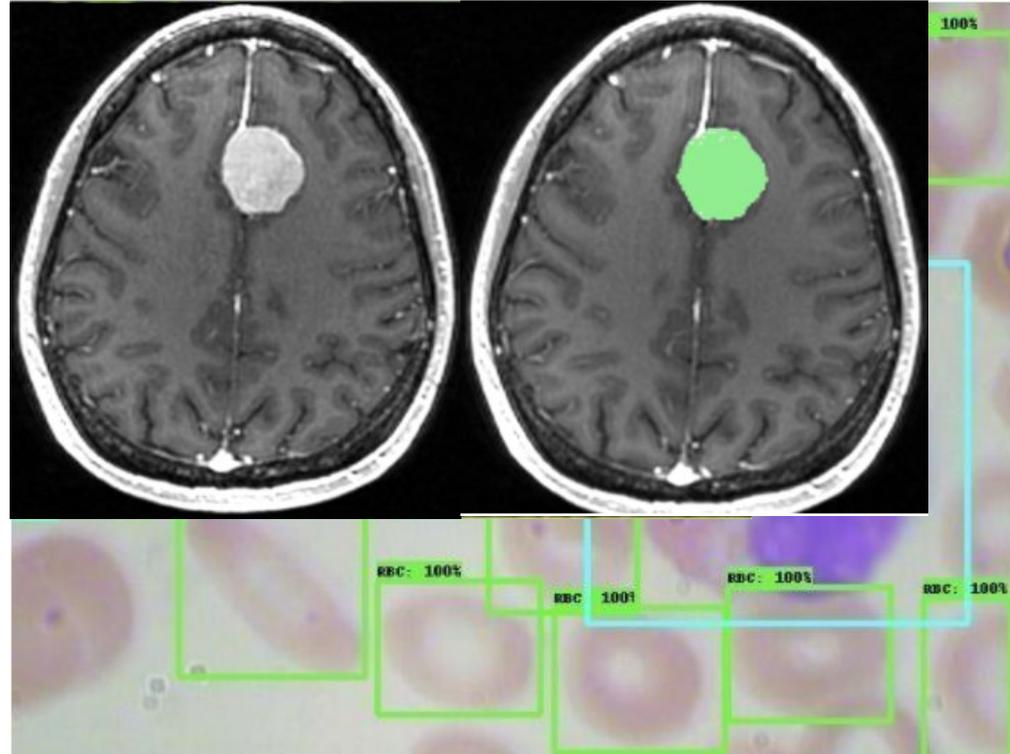
Natural language processing

Named Entity Recognition

Sentiment analysis

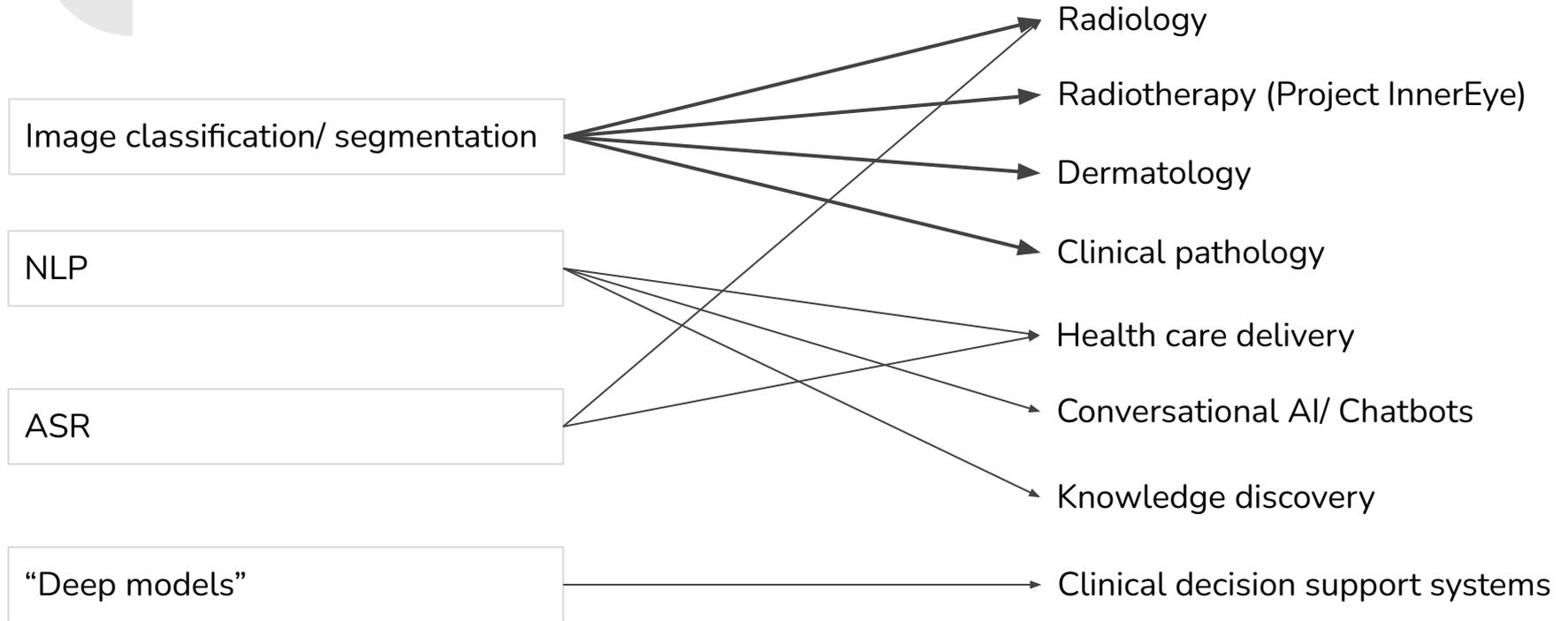
Intent classification

Automatic Speech Recognition





How does Health use AI





How does Health use AI

Named entity recognition

James is a 50 year old male. He is a known diabetic and has been on management for the last 5 years. Today, he reports blurring of vision and inability to drive at night, of gradual onset for the past 5 months

- Identity of patient
- Age of patient
- Gender
- Medical condition
- Presenting complaints



How does Health use AI

Intent classification

DR: What happens after you wake up?

PT: I get up to turn off the alarm and my heart rate jumps up.

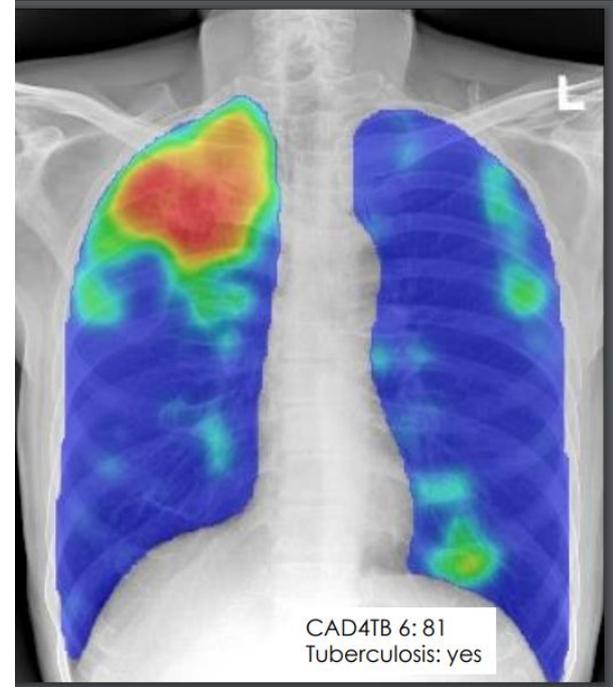
DR: You feel your heart racing?

PT: Yeah, then it goes back to normal in a few seconds.

DR: Okay.

- Palpitations (increased heart beat)

How does Health use AI





AI at KEMRI

Fetal age estimation via handheld ultrasound devices when used by nurse midwives.

Medical text prediction, to ease the clinical note taking of tablets

Using ML to predict which genes in mosquitoes make them resistant to insecticides



No history of cough, **running nose**

predicted text suggestion





Challenges in Health AI in Africa

Largely not unique to

- Implementing AI in health
- Implementing AI in Africa



Challenges in Health AI in Africa

Data

- Training any deep learning model needs data, a lot of data
- Varying proportions (at least some) of the data need to be labelled/annotated
- The quality of labelling is quite important and needs doctors/medical expertise
- More than any other field, getting data to train is difficult in health due to the need to maintain patient privacy/confidentiality
- A lot of the 'rich' data is still handwritten



Challenges in Health AI in Africa

Bias

- This is the GIGO problem of AI
- The accuracy of a neural network when making predictions depends on the how similar that new data is to the data it was trained on
- Most AI applications, in Africa are (still) being trained with data sourced from outside the continent - this may introduce inherent inaccuracies when making predictions when deployed in Africa

However in health !!!

- In some cases, where African physiology does not differ much from “the rest”, this may not be a big issue.



Challenges in Health AI in Africa

Calibration drift

- Not unique to health but more pronounced in it
- A consequence of deploying models clinical environments where differences arise between the data on which a model was trained on and data to which that model is applied to.
- More a problem in health due to the prolonged development to production cycles.



Challenges in Health AI in Africa

Cost of development, deployment, adoption, maintenance

- Cost of getting & labelling the correct data +
- Hardware and computing costs (models are getting bigger and bigger)
- System maintenance and upgrading



Challenges in Health AI in Africa

Inadequate infrastructure

- Varying levels of internet connectivity across the continent
- Many SOTA deep learning models ARE HUGE and can only work in the cloud
- Deploying these in environments with unreliable connectivity will be a challenges

Take home

- How a rough idea of your deployment environment, before you decide what model to use



Challenges in Health AI in Africa

Neural networks can be wrong !

- This needs to be understood and communicated early, even though they will be right most of the time
- Esp in health care, they should not be introduced as infallibly correct



Approaching Research and Innovation

in Health AI in Africa

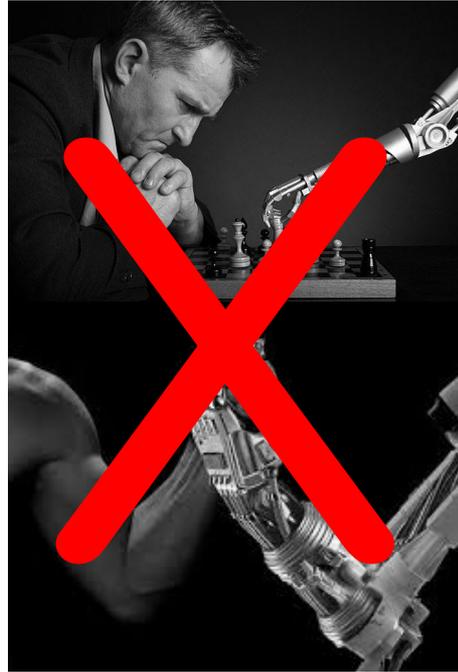
People should stop training radiologist now! It is just completely obvious that within 5 years, deep learning is going to do a lot better than radiologist - Geoffrey Hinton 2016



Approaching Research and Innovation in Health AI in Africa

AI in health should never be an arm
wrestling contest with health
professionals

It should really be about giving them
SUPERPOWERS





Approaching Research and Innovation

in Health AI in Africa

...to every (computer science) student who is joining my (health AI) team, I ask them to first close their laptops and go shadow the doctors in the hospital ... then afterwards come back and we talk about what problems we can help to solve..having a shared understanding of the problem.

Fei Fei Li, Prof Stanford 2021



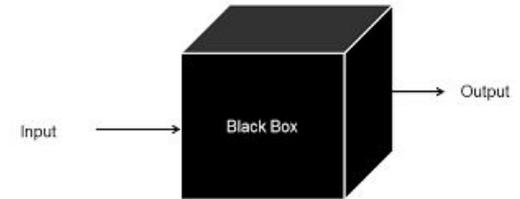
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in Health AI in Africa

Deep learning has a “black box” problem

This is more a problem in health AI where some explanation as to how a prediction made by a neural network is needed

!! At the end of the day the HCP is accountable for the decision, not the neural network !!





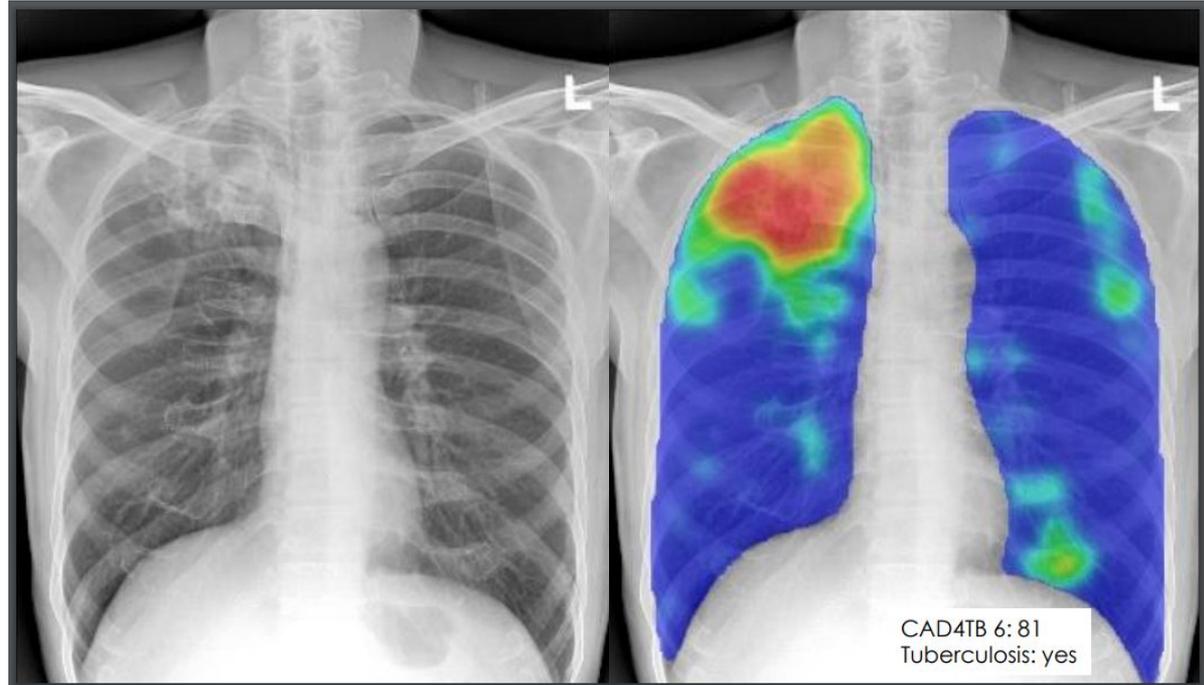
Approaching Research and Innovation

in Health AI in Africa

Explainability in AI esp. health

XAI is an attempt to show how a neural network arrive at a decision

- It facilitates two things,
- reveals an intuitions as to how the neural networks is working,
 - helps the HCP to know when to trust it and when not to





Q & A