USE OF ARTIFICIAL INTELLIGENCE IN HEALTH CARE

0-10 years

NHS Digital & AI Investment Programme
£10bn by 28/29

Diagnostics

Public Health Screening

Neurological Health

New Drug Discovery

Personalized Treatment

Medical Administration

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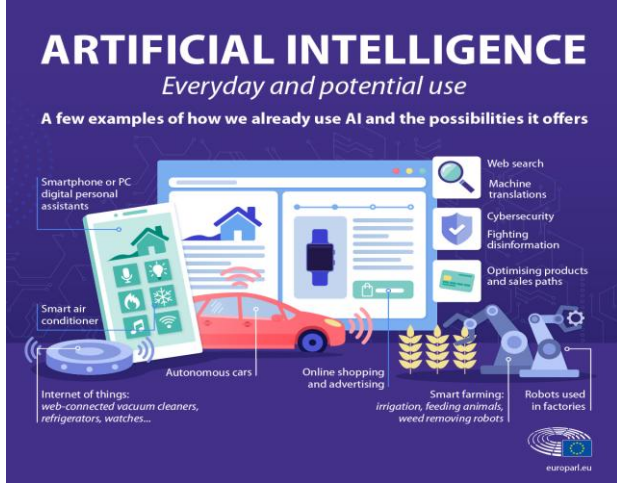
WHAT IS AI?



Machines with human-like intelligence

Learn and problem solve

Faster than humans

Trained on massive data

Work well in complex situations

Organizations spent $235 billion on AI in 2024

Expected to spend $630 billion per year by 2028

Across all market sectors *Health, Education, Transport, Industry…*

AI HEARING ENHANCEMENT

Available

AI actively monitors the local sound environment

AI automatically adjusts the hearing aid settings to match the user profile to the environment

Focuses on live conversations

Reduces the background noise

Allows for a more natural and personalized listening experience

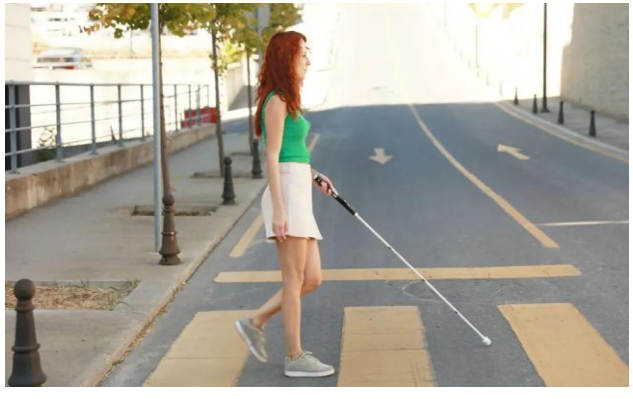
Private sector

AI FOR THE VISUALLY IMPAIRED

Available

Seeing AI

(1) iPhone application provides a voice description of an object
Can be trained to recognize people's faces



(2) AI-powered cane describes obstacles
AI navigates the user to their destination

(3) AI spectacles provide a verbal description of a scene/object

AUGMENTED EXPERIENCE FOR HANDYCAPPED

In development

Sight, sound, smart wheelchairs

Any digital information

Increased independence

Improved communications

Remote assistance

Greater social inclusion

AI CANCER HEALTH CHECK

Available

Blood tests that use AI to spot signs of cancer within 45 minutes

AI trained on common cancers

Early detection of ovarian cancer before it spreads

Precise cancer location using AI nanotubes which collect in cancers & emit fluorescent light

National database of 120 diseases detectable using AI blood test

>90% accurate

TYPE 2 DIABETES

Two NHS hospital trusts are using AI technology to spot Type 2 Diabetes

Up to 10 years ahead of symptoms

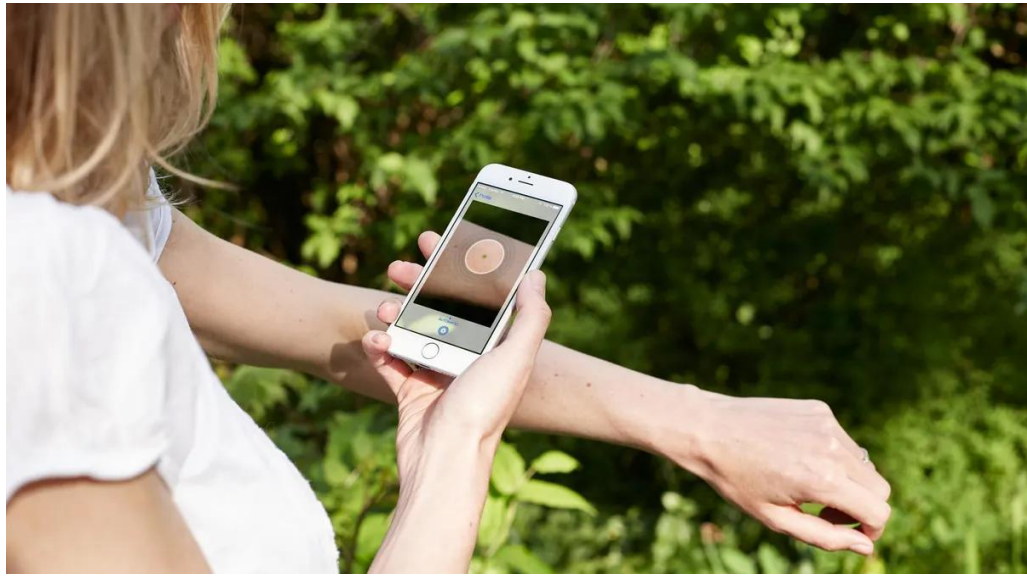
Imperial College and Chelsea and Westminster hospital NHS foundation trusts are training the AI system

Checks patient ECG heart traces for subtle early warning signs

Clinical trials are planned for 2025

Early work suggests >70% accuracy

SPOT SKIN CANCER USING AN iPhone



Specialist apps use an iPhone's camera to capture images of moles

AI analyse images & provide cancer risk assessments

Apps like *SkinVision* claims 99.9% accuracy

Encourage users to seek professional medical advice

Images may be shared with dermatologists for remote consultations

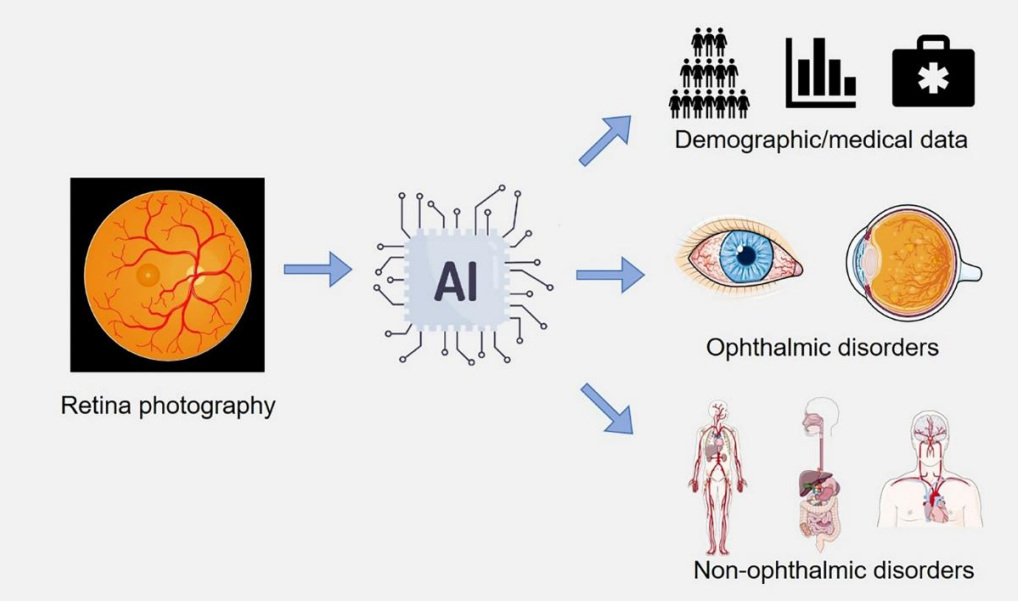
London hospital uses AI to prioritise NHS cancer diagnosis & treatment

95% patients are cleared quickly reducing waiting times

AI DIAGNOSIS OF EYE CONDITIONS

AI trained to recognise common eye conditions

Detect Age-related Macular Degeneration (AMD) & Glaucoma



Increasingly used by high street opticians

AI IN DENTISTRY

Diagnostics

Treatment Planning

Image Enhancement

Surgical Guidance

Administrative Tasks

ENHANCED MEDICAL DIAGNOSIS

Human diagnosis
Medical symptoms
SLOW,
EXPENSIVE,
EXPERTS NEEDED

AI DIAGNOSIS IS
CHEAPER, FASTER
& 99% ACCURATE

AI diagnosis
(1) Train the AI machine
on 100,000s patients

(4) Human Specialists
focus on none routine cases

(2) Machine builds an
internal model relating
medical symptoms &
disease

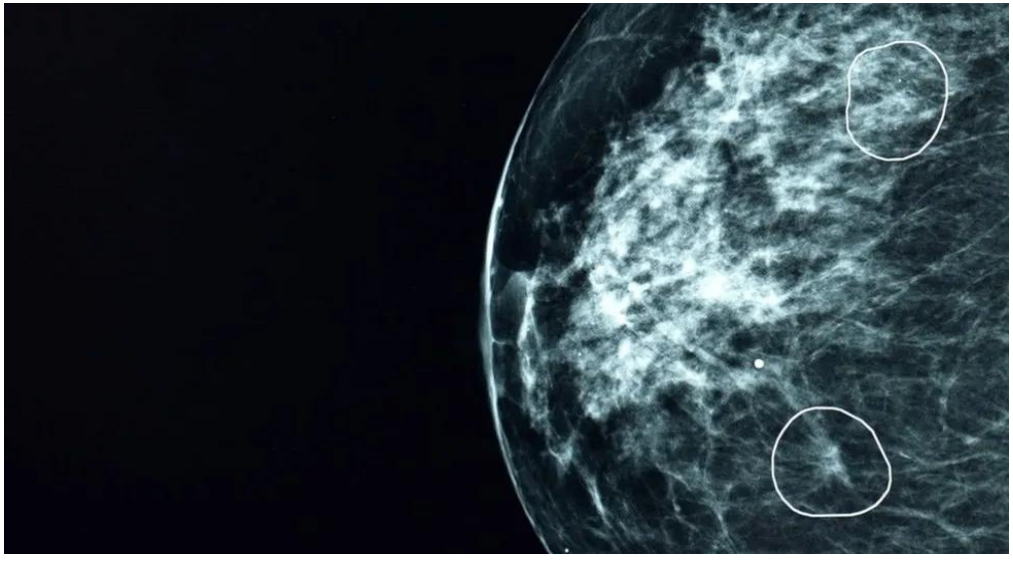
(3) AI EXPERT MACHINE
Routine diagnosis of
common diseases in minutes

AI CANCER DIAGNOSIS

Screen testing of 10,000 women by NHS

AI trained tool was piloted alongside NHS clinicians and analysed the mammograms of over 10,000 women in 2022

AI identified all cancer cases + 11 additional cases missed by doctors



AI spots very small cancers in early stages

Further 700,000 women are being recruited for a trail in 2025

TUMOUR REMOVAL SURGERY

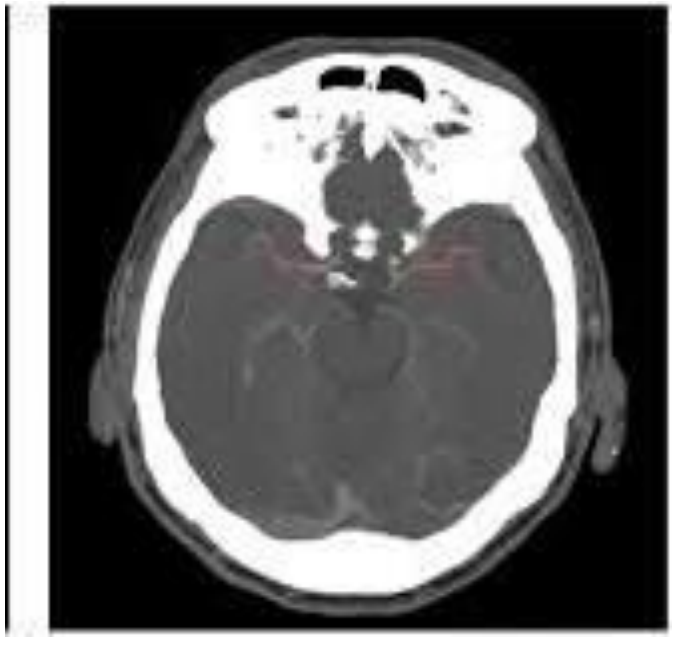
AI imaging technology presents the surgeon with an augmented view

Highlights small tumours & blood vessels allowing removal of more of the tumour

The AI system learns from 1000's brain videos in <1 year

AI powered simulations used to help train surgeons

AI STROKE ANALYSIS & TREATMENT



100,000 people have strokes each year in UK
Early treatment reduces stroke damage clots/swelling

Early Detection and Diagnosis

Remote monitoring of home test results for stroke signs
AI hospital systems analyse CT & MRI scans

Performance

Time between stroke symptoms & treatment reduced
by >60 minutes

Statistics

x3 number of stroke patients recovering with no/slight disability
AI flags the likelihood of complications/recurrence

Rehabilitation and Recovery

AI-powered VR platforms aid recovery
Monitor patient response & adjust exercises

REMOTE MONITORING OF PATIENTS

AI can analyse data from wearable devices to monitor patients' health remotely.

Identify potential problems

Managing chronic conditions like heart failure, diabetes & pulmonary disease

Ensure a smooth transition for patients after hospitalization

Empower patients to take a more active role in their health management

MASS AI HEALTH SCREENING

Trials

Healthcare costs reduced by early interventions

A healthcare system that creates health rather than a medicine dispenser for sick people

New category of medical device to collect people's medical information cheaply and conveniently

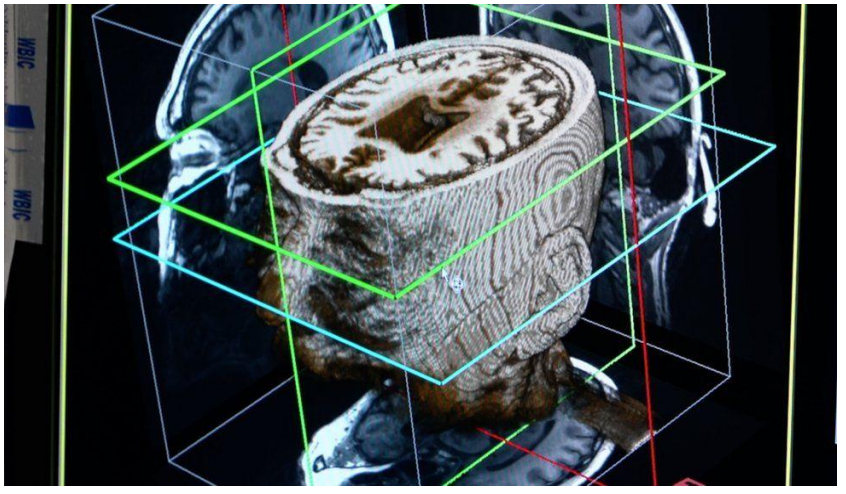
Wearables, home diagnostics

Home based cancer detection in early stages of R&D

Data processed by AI and delivered to a GP who makes a health assessment

Delivers results back to the patient within hours

DEMENTIA DIAGNOSIS



Nearly 10 million new cases occur globally each year

AI is trained on brain scans from 10,000s dementia patients

Identifies 'invisible' patterns in the scans

AI enables early diagnosis of dementia

8 years before symptoms appear with 80% accuracy

AI detects Parkinson's, MS and other neural conditions

AI will soon recognise dementia in measurements of memory, speech, movement

PARKINSONS DISEASE & AI

AI improves the diagnosis & treatment of Parkinson's

Manage symptoms of Parkinson's

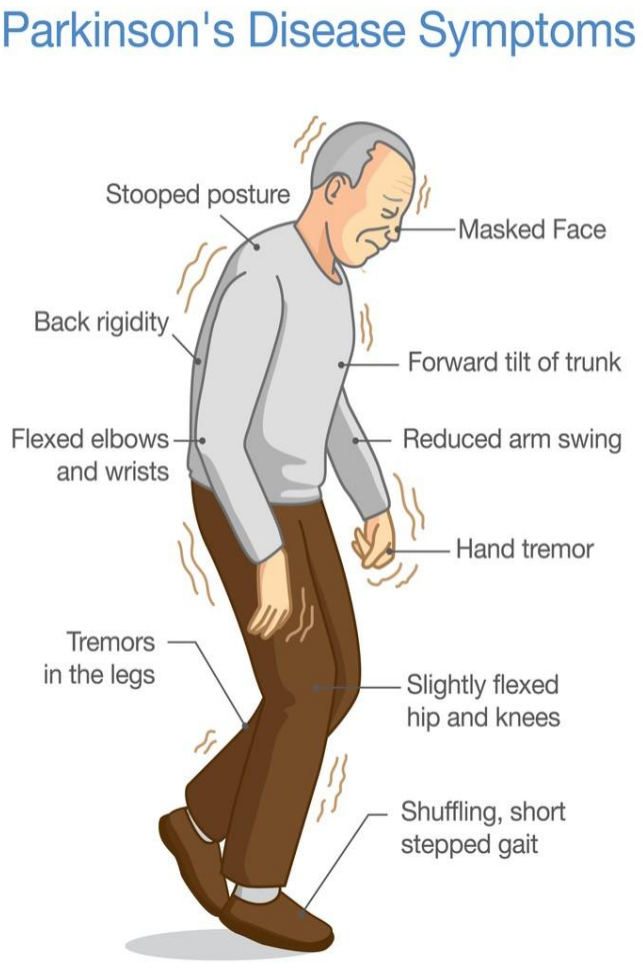
Implanted AI devices in the brain & chest

Deep Brain Stimulation (DBS)

Electric pulses from the device cancel the affect of misfiring neurons in the brain

Adjusts the stimulation levels in real-time

AI adapts to the patient to maximise benefit



LIVING WITH DEMENTIA

AI-based tools offer to help to people living with dementia

Voice activated diary, music player, digital photo screen

AI conversation

AI suggest activities

AI HOME ASSISTANT

In Development

Improved Elder Care

Virtual assistant or home robot

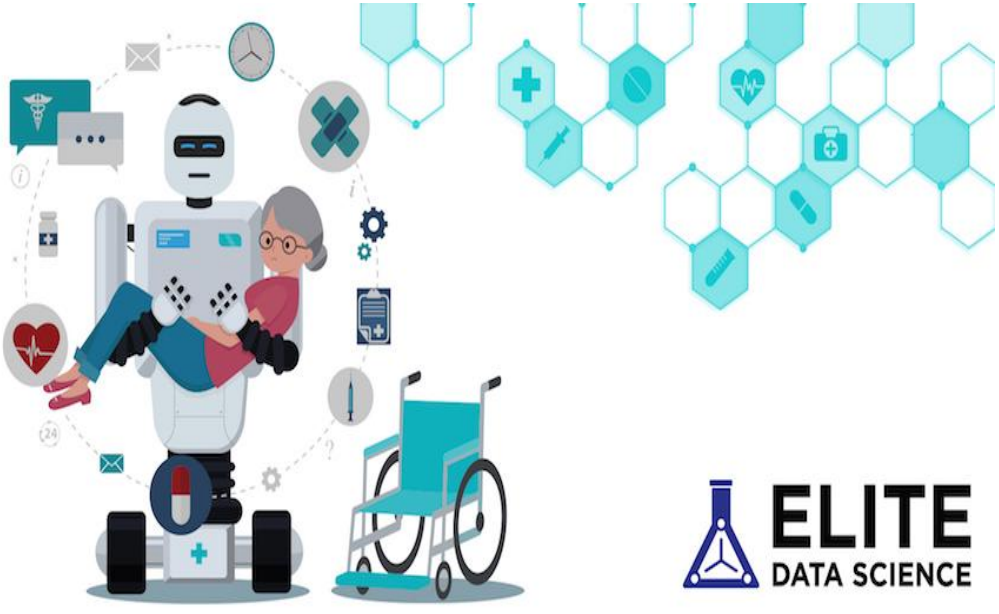
Help seniors with every day tasks

Keep them independent

Monitor alcohol/food consumption, restlessness, urinary frequency, chair & bed comfort, sleeping & mobility

Provides social interaction

Notify relatives or medical services



ELITE DATA SCIENCE

NEW DRUG DEVELOPMENT

AI is accelerating the discovery of new drugs

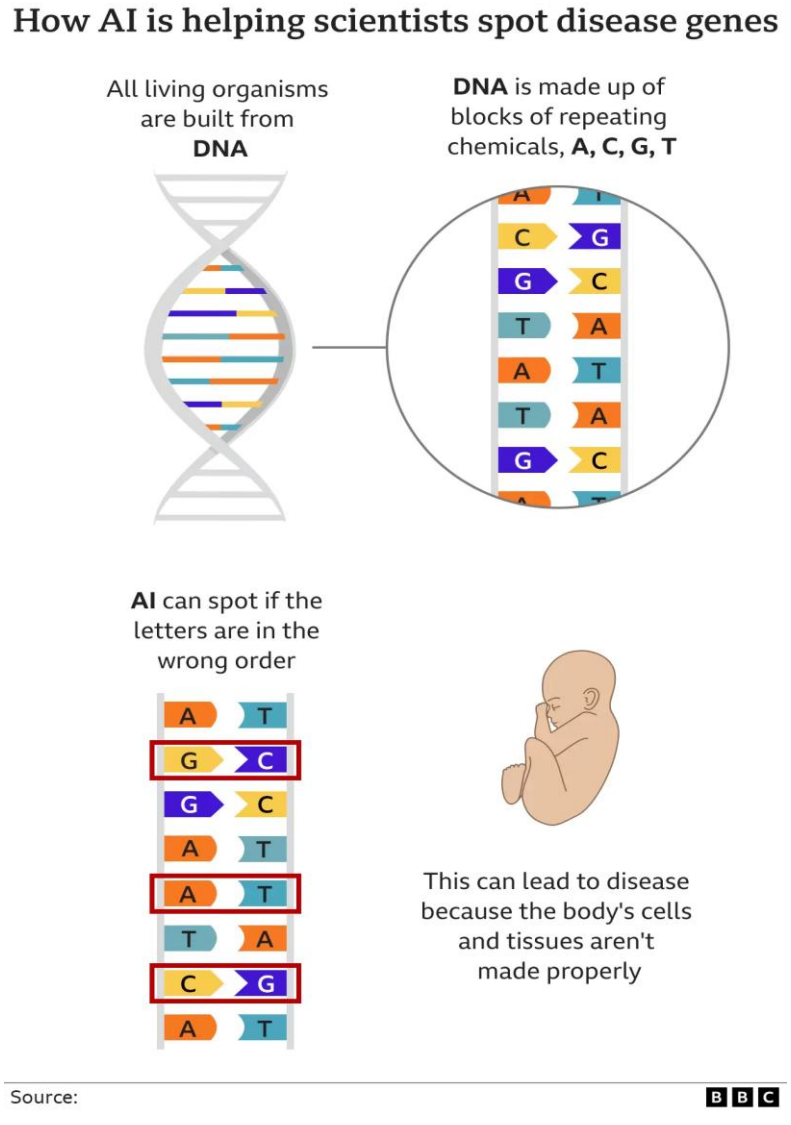
AI analysis of vast datasets of existing drugs, molecular structures, and biological information

Helps researchers to identify new drug candidates

Reduces drug development times

Uses genetic information

Customised drugs from individual DNA

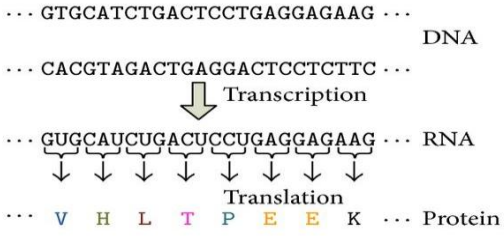


PROTEIN STRUCTURES

Understanding protein structures to help understand & treat diseases

3. Analyse protein sequence using AI

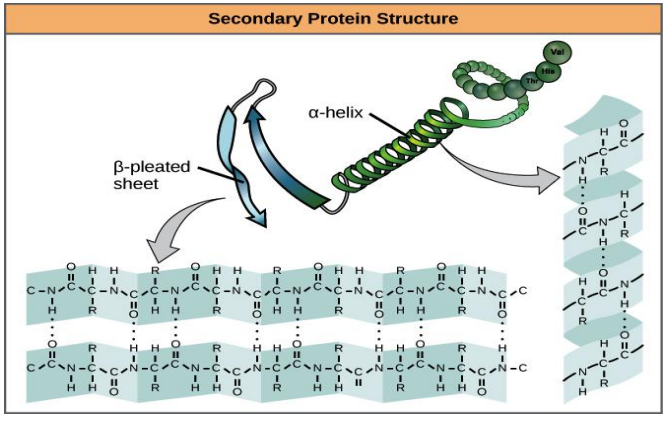
2. Sequence DNA of proteins with unknown structure



1. Train the NN to recognise 170,000 known protein sequences & structures

Deep Mind
Alpha Fold Neural Network

4. Predict Protein structure to >90% accuracy



200 million protein structures discovered by AI

x1000 improvement in 10 years

MY DIGITAL TWIN

In development

A medical digital twin (MDT)

A virtual model of a patient's organs generated by AI

Use data from the patient's medical records, diagnostic tests & wearable devices

Simulate the effects of different treatments and interventions

Personalised treatment plans for each patient

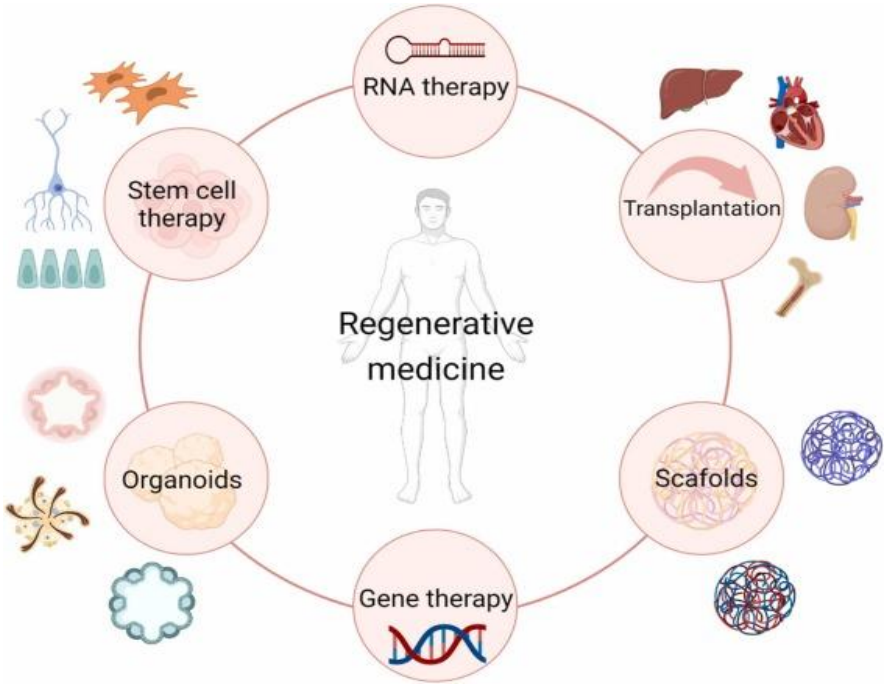
REGENERATIVE MEDICINE

Make me young again!

Repair damaged/diseased tissues & organs

Engineer patient stem cells for specific organs

Inject into the body to repair damaged cells



Role of AI:

Identify usable stem cells from person

Re-engineer the stem cells for any organ

Make the regenerative process efficient

AI BRAIN IMPLANTS

Development

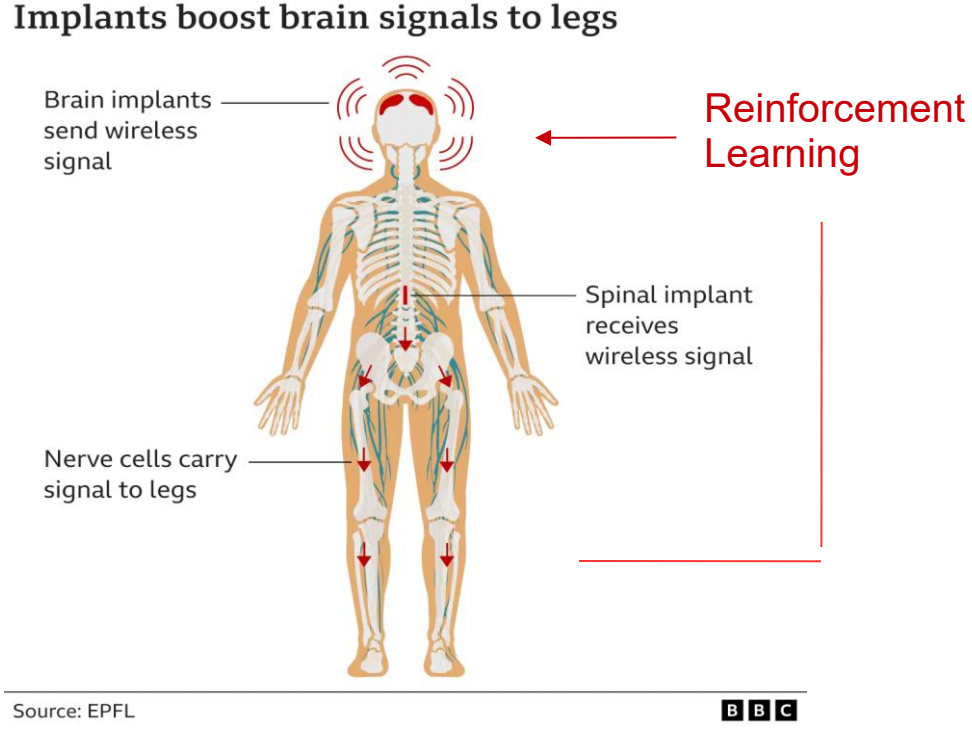
Brain implants enable direct communication between the brain & an external devices
Translates thoughts into actions

Spinal Injuries
AI brain implant wirelessly transmit 'action signals' to implants in legs and feet

AI makes adjustments to improve walking over time

Neuralink patient

Control of prosthetic limbs
Artificial hands



Reinforcement Learning

AI MIND READING

Research activity

Communicate with patients who have lost the ability to move or speak

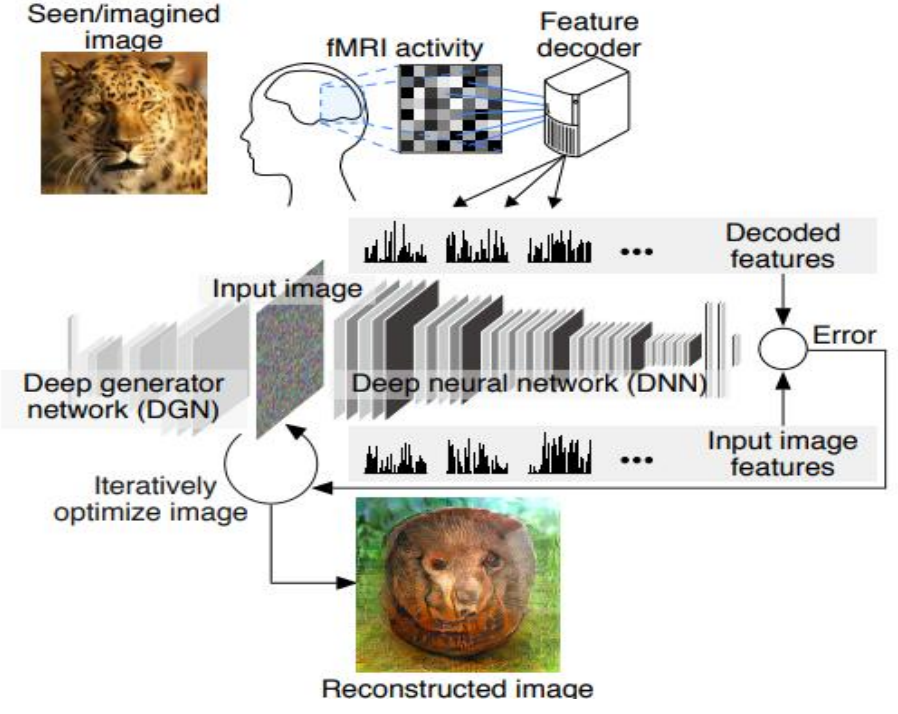
Show the human subject many images/sounds

Functional MRI generates data patterns specific to each image/sound

AI system learns to associates data patterns with specific images/sounds

AI can then 'read' the images in the patients mind via an fMRI headset

Ethical implications?



AI MEDICAL ADMINISTRATION

Automating administration

Make the GP more efficient

GP spends 20% time on admin tasks

Train AI to do administration

Interview preparation

Present patient data, medical history, symptoms & test results

Make transcripts of consultations & updates patient records

Draft referral letters

EMERGENCY CALL HANDLING

AI emergency co-worker

Real time analysis of 999 calls

Suggest questions

Automated Risk Assessment

Early Detection of Critical Conditions

Prioritisation

HEALTHCARE RESEARCH

OpenSAFELY

OpenSAFELY AI is an NHS program for large-scale analysis of electronic health records

Began during COVID 10 accessing about 58 million health records

Access to GP records of the entire population of England since March 2020

Helps identify trends, evaluate treatments, and improve the delivery of healthcare services

About 50 projects running

COVID19 Research, Mental Health Research, Drug Safety Studies

Does not identify individual patients

HEALTHCARE IN DEVELOPING COUNTRIES

AI assistance to healthcare in developing countries

AI-powered diagnostic tools

Makes expertise available locally

Train local medics

Ongoing collaboration between governments, NGOs, researchers, and technology companies

AI & SPACE MEDICINE

AI improve health and well-being of astronauts during space flight

Local AI expert assistance

Monitoring of vital signs

Early detection of potential health issues

Personalised medicine & health planning

Medical procedures implemented by AI robots

ANIMAL THERAPY

Conversation with an animal

Train an AI to translate animal sounds into human speech

AI analyses animal sounds in different circumstances

Associates animal sounds with meaning

Generate synthetic speech from animal sounds

Bi-directional conversation possible

Conversation with many species

DIGITAL GHOST

Bring back a relative

Continue relationship with deceased person
HereAfter AI, Deepbrain AI, StoryFile

Create a digital persona of the deceased person on an AI machine

Capture the dead persons personality, communication style, memories, voice & personality

Interact in real time with deceased person using an electronic device

Legal and regulatory framework needed

CHALLENGES & ETHICS

Data Privacy and Security

Bias and Fairness

AI algorithms can reflect biases in training data

Transparency - how AI algorithms make decisions?

Ensure equal access to AI-powered healthcare solutions.

HEALTHCARE IN 10+ YEARS

Personalized Medicine

Mass health screening

Wearable and Implantable Technology

Surgical robots

Regenerative Medicine

Digital twin for treatment planning

Early mental health diagnosis & treatment

Improved administration

AI library - https://u3acommunities.org/interest-groups/computing/ai-for-everyone/