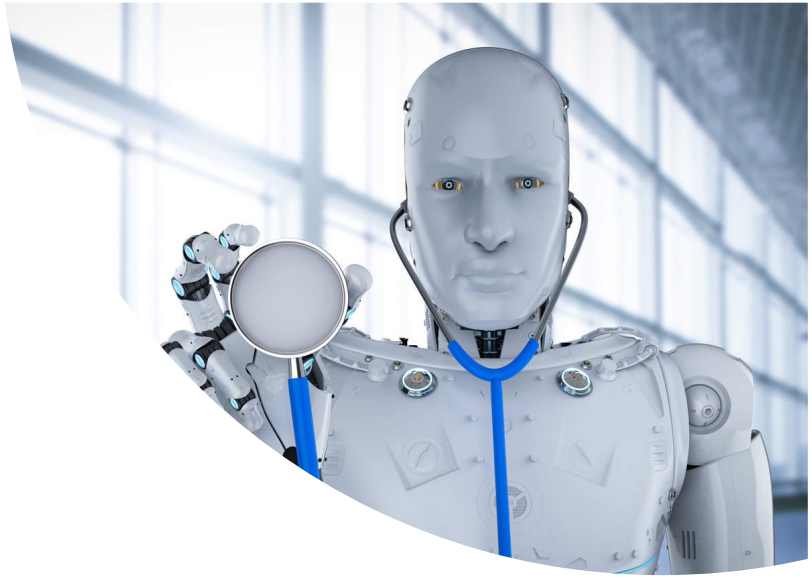
AI in Medical Decision-making



INM708

Explainable Artificial Intelligence

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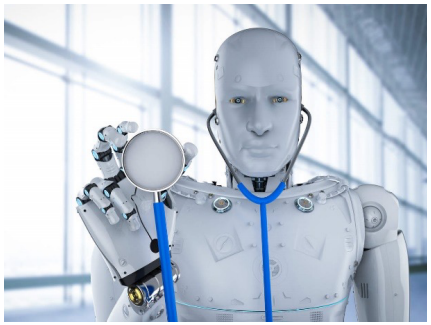
AI in Healthcare



AI has had a great impact and influence on healthcare sector (Tsang et al., 2017).

- <u>AI technology in healthcare:</u>
    1. Qure.ai - Head CT scan tools: qER/qQuant (Qure.ai, 2018)
    2. IBM Watson (Tsang et al. 2017)
    3. Siemens Healthineers: AI-Rad Companion Chest CT
    4. Emerald: for Covid
    5. eCart (electronic Cardiac Arrest Triage): offers an early warning system and patient risk of deterioration. (www.agilemd.com, n.d.)
- <u>Known failures:</u>
    1. IBM Watson Oncology: cancelled after $62 million and unsafe treatment recommendations (Strickland, 2019)

Computed Tomography - CT

Description: Medical device that uses X-rays, and equipment to produce cross-sectional images of the body.

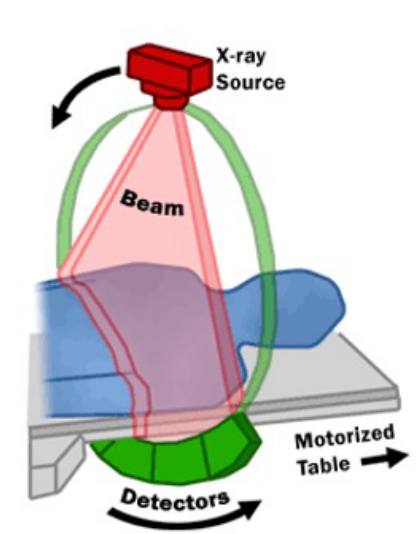


Image sourced from FDA website (Health, 2019)

Uses:

- Diagnose disease, trauma or abnormality
- Plan and guide interventional or therapeutic procedures
- Monitor the effectiveness of therapy (e.g., cancer treatment)

Risks and Benefits:

When used appropriately, the benefits exceed the risks

- This may eliminate the need for exploratory surgery
- Risks from exposure to ionizing radiation and possible reactions to the intravenous contrast agent or dye
- Exposure to ionizing radiation may cause a small increase in a person's lifetime risk of developing cancer

CT enhanced with AI - software as a medical device (SaMD)

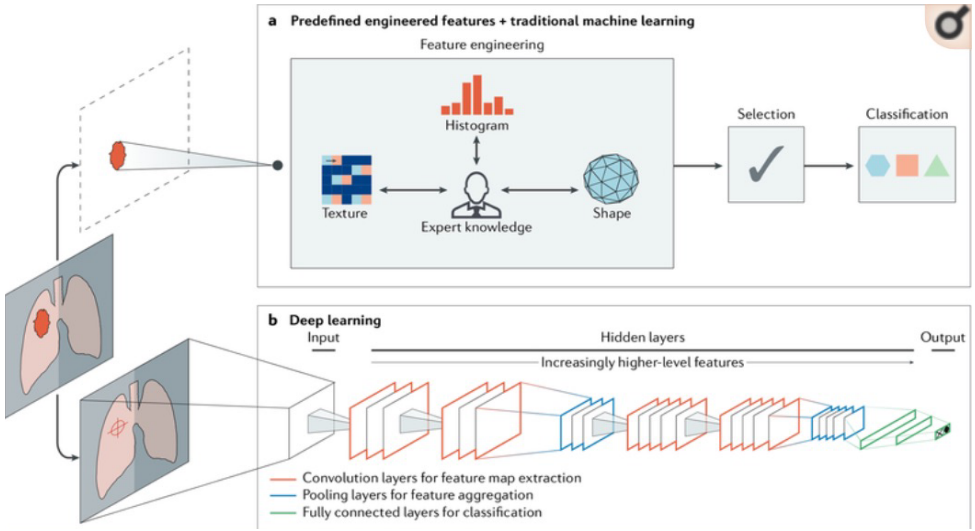
- **Benefits over conventional methods:**

✓ Better efficiency

✓ Improved image quality and speed

✓ Reduced errors i.e. better accuracy

✓ Reduces radiation exposure



"AI is expected to reduce medical malpractice liability by improving diagnosis and treatment and reducing medical error (Allen, 2019)"

Robot Taxonomy – (Steinert, 2014)

• Acting "Through Robots - Robots as instruments

- Artifacts, a means to an end, are to alter situations according to one's will. The ethical agent is the human.

- Robots as used as mediators between a human being and the world. Mediation is never neutral but is transformative in nature.

• Don't Hurt My Robot! – Robots as recipients of ethical behaviour

- The more 'intelligent' a robot acts, the more people are inclined to attribute liveliness to it. Emotional bonds between humans and their machines are likely to strengthen, especially if robots start to behave like human beings.

Robot Taxonomy – (Steinert, 2014)

• Acting Robot – Robots as Moral Agents

- These robots are of special interest to ethicists and philosophers and are envisioned as both active and passive moral agents, referred to as decision makers. Systems that independently sell and buy stocks, and aeroplane pilots are examples of this type of robot, where risk versus benefit must be evaluated.

• Robots and People - Robots as an influence in society

- Robots that can have an impact on society and might contribute to the restructuring or even erosion of norms, standards and customs.

Robot Taxonomy – (Steinert, 2014)

Robots and Ethics – The Meta-perspective

- The influence of robotics on the discipline of ethics.

- Workings of a technology used as a metaphor or a model for understanding some human features in different aspects (e.g. cultural, social, individual).

Ethical and Legal Agency I -
First sight of potential ethical issues

- **Ethical agency**: the responsibility of considering/governing moral values
- **Legal Agency**: being legally accountable for someone's actions
- **AI medical devices**: an assistive tool to the radiologist and not a replacement.
- **Ethical concerns**:
    a. Autonomy and moral agency
    b. Unfairness/bias
    c. The challenge to existing role
    d. Automation Bias
    e. Privacy, protection and Safety

Ethical and Legal Agency II – Five Ethical rules for robotics (EPSR, 2020)

1. **Robots should not be designed as weapons**, except for national security reasons.
2. **Humans, not robots, are responsible agents**. Robots should be designed and operated to comply with existing laws, fundamental rights, and freedoms, including privacy.
3. **Robots are products**. They should be designed using processes which assure their safety and security.
4. **Robots are** manufactured **artefacts**. They should not be designed to exploit vulnerable users in a deceptive way; instead, their machine nature should be transparent.
5. The **person** with legal responsibility for a robot should be **attributed**.

Ethical and Legal Agency III – Case of Study

A patient was misdiagnosed with a malignant tumour by an autonomous AI CT device. The radiologist did not verify the out. Invasive surgery was undertaken for the diagnosis.

- The radiologist is the moral and legal agent who distinguishes right and wrong actions.
- AI manufacturer – legal subjects/persona
- Hospital – legal subject/persona
- AI considered as a medical aid – Acting 'Through' Robot (Steinert, 2014)
- Diagnosis undertaken by AI – AI used as a "Moral Agent" (Steinert, 2014)
- Patient unaware of AI Diagnosis
- Patient – invasive surgery, seeking civil legal action
- Evil, unethical AI? (Beltramini,2017)

Who is responsible for the diagnosis? Who is accountable for the misdiagnosis? (Neri, 2020)

Ethical and Legal Agency - Future

- Only if **personhood** is granted to AI, then the CT scan can be accountable for the diagnosis. There is no guideline to determine whether AI should or should not be granted legal personhood (Dremliuga et al., 2019).
- ***Legal personality of AI is not only a scientific but also one of the highest political issues***. The European Union (e-persona) and the USA are leading discussions about the legal status of AI (Delvaux, 2017; Dremliuga et al., 2019).
- AI could act as a legal person or agent in business relations with other legal persons. However, society must recognise every legal person as such.
- Laws will need to be updated, and regulations need to be in place.

AI Rights

Rights are the ethical or moral entitlement to execute an action or own something.

At present, only humans, not AI, have the authority to procure rights.

Case Study – Patient Misdiagnosis

Human Rights:

- The rights of the doctor were affected by the introduction of an AI device.
- The patient's inalienable right to life and freedom from discrimination were endangered.

AI Rights:

- AI: has no agency, but is still entitled to make the decision of the patient's right to life.
- Empowering AI with certain rights may relieve the clinician of additional responsibilities and burdens, while also ensuring that its rights are not exploited.

AI Rights - Should AI be given any rights?

Granting legal status to AI will automatically entitle them to certain rights.

Giving sentient AI its rights could be harmful to humans as it can overpower humans' rights and co-existence.

Joanna Bryson argued that creating AI that requires rights is avoidable and unethical, both as a burden to the AI agents and to human society.

Granting legal personhood to AI can help to improve economic efficiency or risk allocation

Possible solution:

Giving them rights equivalent to companies and not humans.

Human-centric and safe by design AI

One robot has been granted "citizenship" in Saudi Arabia: AI has become too important to be ignored by the law. (Panch, Mattie and Celi, 2019)

AI Liability I

Believes – AI is more accurate and efficient than radiologists

Cause – Wrongful diagnosis - AI??, Effect – unnecessary invasive surgery

- AI has neither moral nor ethical agency.
- AI was tested on a limited dataset.
- Radiologist: forced to align her criteria to AI's.
- Manufacturer: bounded in a contract with the hospital.
- Clinicians and AI are the hospital's assets.
- Medical maltreatment, negligence, vicarious or strict-product liability?
- Accountable (liable) - Hospital, radiologist or manufacturer/developer (product)?

***** By placing full responsibility on the AI providers, hospitals and clinicians could transfer any form of malpractice onto the AI provider ****

AI liability II

- **Medical malpractice —If malpractice is claimed, the patient** must prove that harm was a consequence of the malpractice.
- **Radiologist negligence** —The *patient must prove* the radiologist's behaviour was *negligent*. This will be difficult to prove if AI is involved.

  -The radiologist used technology that developers are unable to comprehend and explain.

  -The risk was unforeseen, and there is no evidence to claim that the radiologist's care was not standard.

AI liability III

- **Hospital vicarious liability -** the *patient must prove* that the *hospital* was *negligent* of their assets.
  - The radiologist aligned her criteria to AI's diagnosis.
  - The hospital owns the CT scan, while the radiologist is the user who is in charge of the system.
  - The harm was not caused by misuse of the device, so there is no owner's liability. The hospital cannot be liable for defective products, but if the selection of the product was negligent, then the hospital remains accountable.

AI liability IV

- Strict product liability (AI)

  A promise of better delivery than the clinician? But in which circumstances is this statement true? What does it mean to be more accurate than a clinician?

  - Is AI a product or a service?
  - A causal link between the damage and the defect is enough
  - *The patient/hospital needs* to prove that the harm was due to the defective technology (Directive 85/374/EEC, 1985).
  - The developer/manufacturer can argue that the device comprises software, firmware, hardware and data, that failure was not anticipated and that she cannot identify any source of error.

Liability – Responsible party

"Whatever principle is adopted, it will make it more difficult for the victim to identify the responsible party and to furnish proof that the requirements of liability were in fact satisfied by that party " (Wagner, 2018)

AI Control - I

Controls

- Device safe, fair, explainable and interpretable by design
- Cross-functional teams during the design
- Identification of limitations
- AI in-built self-debugging, correction and warning function features
- Directives, standards, risk management, laws and regulatory guidance
- Results reproducibility
- Testing, validation, version control
- Periodic review, audits, self-inspection and certifications

AI Liability and Control

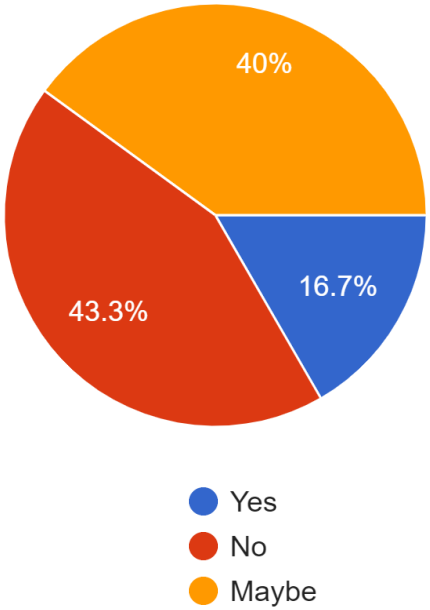
- Liability distribution matrix based on the learning abilities of the Robot (Zornoza *et al.*, 2017)
- Mandatory liability insurance to those who put robots into the stream of commerce or otherwise set them free' would be required to provide for an insurance cover up to a certain minimum threshold *Robot Liability (How Does it Feel to be Hit by an ePerson?*, 2018)
- Licence to operate – user/ producer/AI

Future

- Integrating robots into legal systems can discourage humans from violent behaviour towards AI machines.

Survey Analysis

- 60 participants were surveyed about their trust in AI over physicians.
- 43.3% of the participants trust Doctors over AI technology: AI is not yet trusted.
- 40% might be able to trust AI under certain conditions.
- Minority of participants 16.7% do trust AI: acceptance of AI has started?



Concerns for mistrust:

- Lack of human touch/emotional needs, and human intelligence.
- Accuracy, data privacy and bias of the AI system.
- Transparency of the algorithm and use of data.
- Accountability and legal responsibility in case of misconduct.

Evidence:

- Regulations by human bodies
- Certificate of acceptance by professionals
- Assisted by humans , and the final decision lies in the hands of doctors.

Conclusions and Future work

- The analysis of the ethical agency, rights, liability and control is interrelated.
- Entitlement of rights – execute actions involving legal and moral responsibility.
- Artificial intelligence seems too human to be ignored: regulation, laws, and AI liability can be factors impacting the usage and growth of AI systems for healthcare.
- Instilling trust in the public will make the AI system widely acceptable.
- There is an urgent need for new and clear regulations for the implementation of AI in healthcare.
- Introduce a “kill switch” or “danger warning” in case the AI system is uncertain about its prediction or its prediction's scope of damage (for any area).
- Introduce frameworks to reduce the human bias enshrined in AI.

AI as an assistant or a Doctor as an assistant?

Conclusions and future work

- There is scope for improvement of AI applications, which is limited by certain factors including the law of identification, informed consent for data sharing, and protecting confidentiality, yet maintaining data fidelity.
- Making AI sustainable is another concern that needs to be addressed.
- The potential of AI in healthcare is well described, but humans have two options:
  - Downgrade its use in clinical practice, maintaining the current rules and regulations.
  - Resolve issues of ethical and legal responsibility, data ownership and trust by demanding new legal norms.
- Without Human-centric AI, AI rights and legal guidelines, opportunities for AI in healthcare will remain just opportunities. (Panch, Mattie and Celi, 2019)

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