

**Socio-economic
Rationale of
Implementing Robot
Technologies in
Healthcare**

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Healthcare in Europe: current socio-economic challenges



Ageing population and increased life expectancy



Health staff shortage



Differentiating points of care



Waste of resources and overprescribed pharma



Rise in lifestyle diseases



Shifting viral disease patterns



Long diagnosis timelines



Distributive inequality

A brand-new “technology stack”



High Performance Computing (Edge, Fog, Quantum)



Nanotech and IoT: towards a trillion connected devices in 2035



5G/6G connectivity



“Cyborgization”: implants/smart pills, sensors, exoskeletons



Secure forms of data storage and exchange (Cloud and DLTs)



Breakthroughs in machine learning and Natural language processing

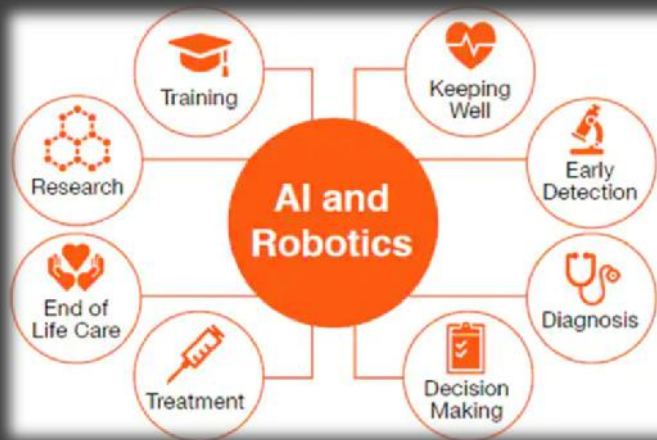


New services, including companion robots and telepresence surrogates



Personalised health and nutrition services

An enormous promise



Real-time prevention and more accurate monitoring



Greater Efficiency in healthcare delivery and reduced risk of over-prescription of pharmaceuticals



Greater effectiveness through data-driven “mass customization” of therapies and drugs



Real-time, real-life monitoring of impacts during the delivery phase

Risks



Healthcare “for all” or “for some”?



Pressure on the welfare system



Body hacking and mind manipulation



Massive privacy intrusions



Loss of agency and self-determination



“Junk AI” problems

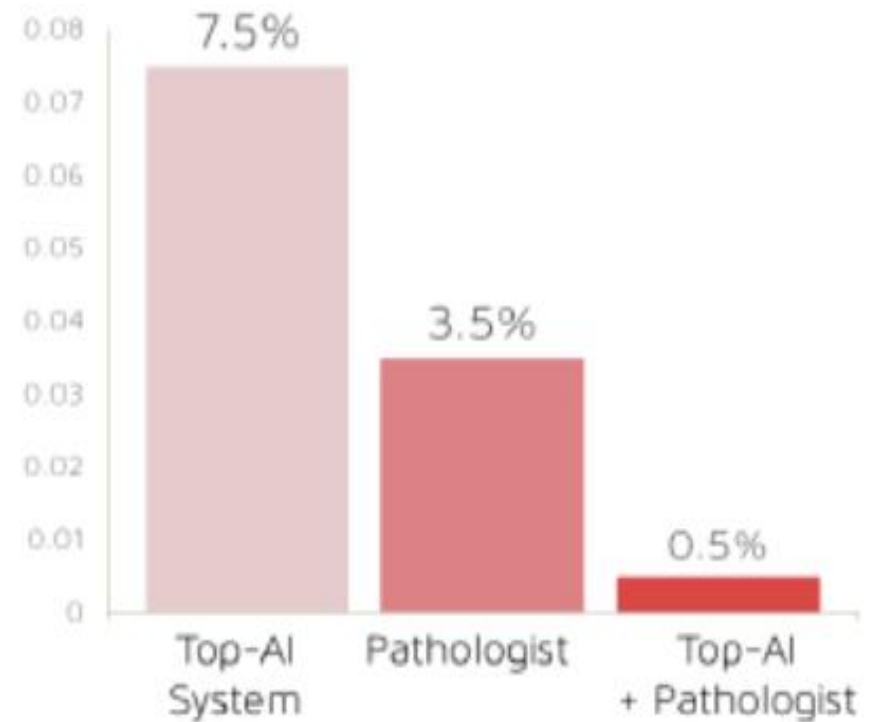
Ethical aspects

- Bias and Discrimination
- Efficiency v. Fairness
- Accuracy v. privacy
- The “junk AI” problem
- Inclusiveness
- Loss of identity, agency and self-determination
- Liability and “Human in the loop”
- Explainability



	Strengths	Limitations
Humans	Judgment is excellent	Prone to fatigue and interaction
	Excellent hand-eye coordination	Tremor limits fine motion
	Dexterity is excellent	Outside natural scale it has limited ability and dexterity
	Having capability of integration of multiple information sources	Not possible to see by tissue
	Trained by easily	Bulky end effectors, hence accuracy decreases
	Able and versatile to improvise	Geometrically less accurate
		Sterility is not easy
		Quickly infected and not protest against radiation
Robots	Higher geometric accuracy	Poor decision
	Untiring and stable	Adoption is not fast
	Fight against radiation	Limited dexterity
	Having many degree of freedom in motion analysis	Problems in hand-eye coordination
	Able to integrate multiple sources of numerical and sensor data	Not up to mark haptic sense
		Problem occurs when complexity

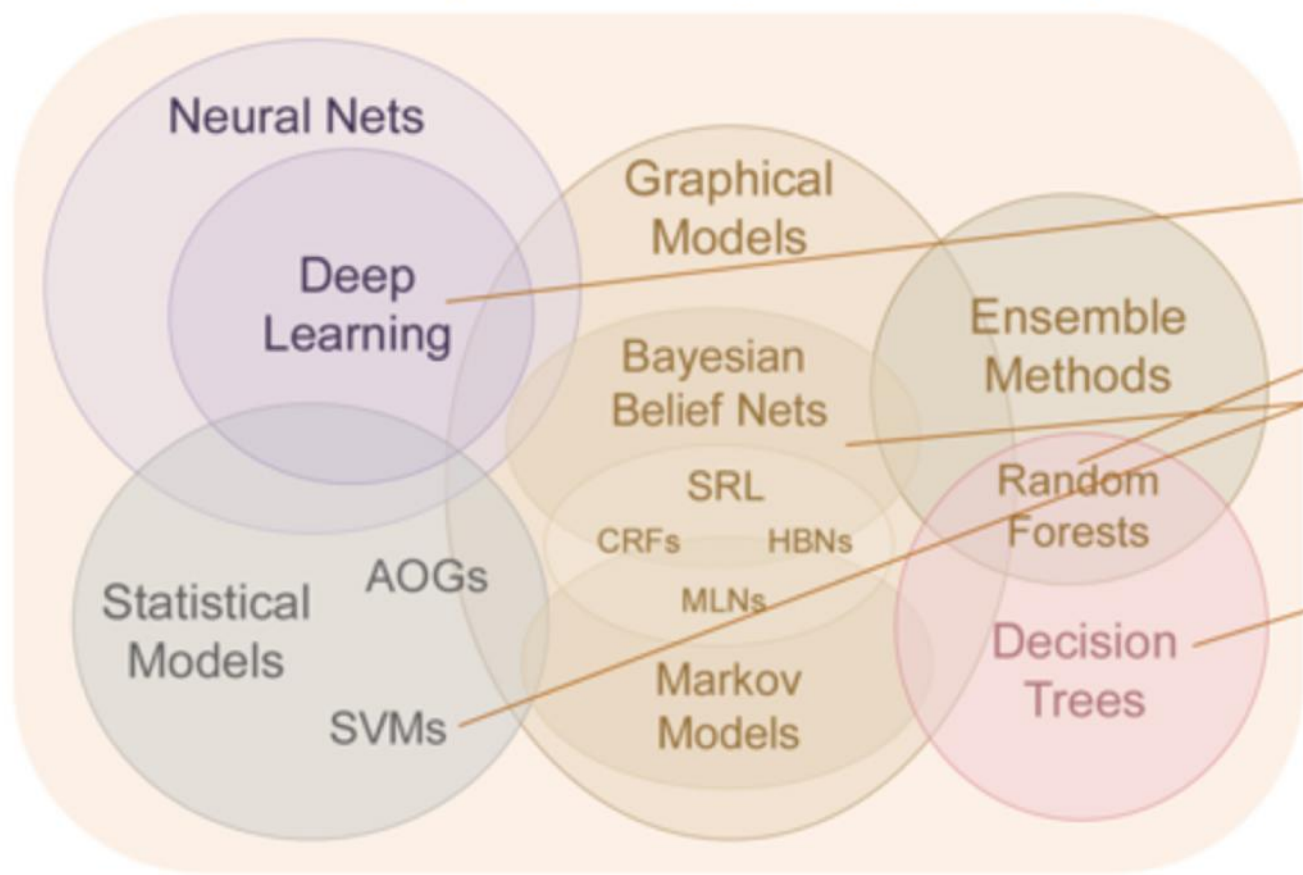
Source: Patel. et al. (2017)



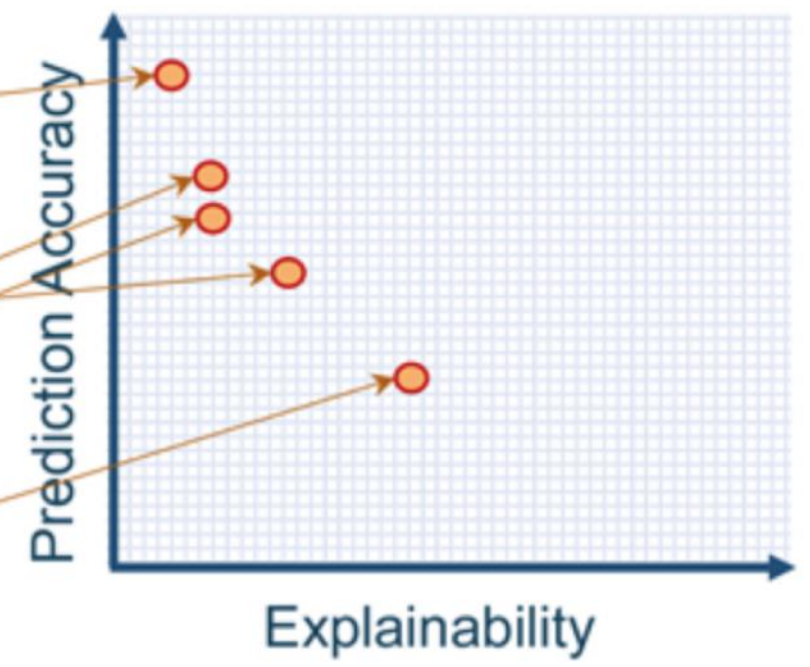
AI significantly reduces pathologist error rate in the identification of metastatic breast cancer from sentinel lymph node biopsies.

Source: U.S. White House (2016)

Learning Techniques (today)



Explainability (notional)



Concluding remarks

- **Strong socio-economic rationale, but need to take into account ethics, law and social acceptability**
- **Europe as leader in “embodied AI”?**
 - **Need for dedicated public funding and ensure strong funding for healthcare robotics in Horizon Europe**
 - **Promote human-centric AI + complementary skills**
- **Can Europe develop a “third way” in human-machine cooperation in healthcare?**

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