Impacts of digital technology on wider society

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Ethical: considerations about right and wrong, morality and power.

Privacy: what impact does the technology have on the right to privacy?

Environmental: the effect technology has on the world around us.

Legal: laws that have grown around technology.

Legislation relevant to Computer Science:

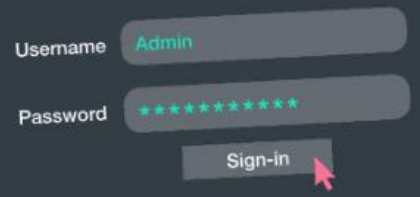
Law / Licence Type	What It Covers	Key Points
Data Protection Act 2018	Personal data and how it is used	- Data must be kept safe and accurate- Collected for specific, lawful purposes- People can access, correct, or delete their data- Organisations must report serious data breaches
Computer Misuse Act 1990	Protects computers and networks from misuse	- Illegal to access systems without permission (hacking)- Illegal to access a system to commit further crimes- Illegal to change or damage data (viruses)- Illegal to make or share hacking tools
Copyright, Designs and Patents Act 1988	Protects creative and original work	- Prevents copying without permission- Applies to music, films, software, images, writing, etc.- Illegal downloading/sharing breaks copyright- Creators automatically own their work
Open-source Software Licence	Software with editable, shareable code	- Source code available- Users can modify and share- Usually free but still licensed
Proprietary Software Licence	Software with restricted use	- Source code hidden- Users can only use the software, not edit or share it- Usually paid for

The Computer Misuse Act

The Computer Misuse Act 1990 was brought in as a response to numerous breaches of digital systems in the 80s. At the time, these security breaches were not against the law. Subsequent amendments have also been made to keep our law up-to-date with the available technology. There are three main offences:

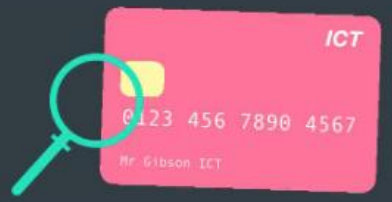
1. Unauthorised access to computer material

The offence makes it illegal to gain access to a computer system without permission. This can include using someones username and password without permission, using brute force attacks to guess passwords, and gaining physical access to a computer system.



2. Unauthorised access with the intent to commit further offences

In addition to the first offence, this offence deals with actions that may be undertaken once someone has access to a computer system. It makes it illegal to use a computer to commit: fraud, identify theft, and blackmail.



3. Unauthorised modification of computer material

This offence makes it illegal to make modification to any content on a computer without permission. This includes installing malware or making any modification to files, settings, or software on a computer system regardless of intent.

Punishment

Committing any of the three offences can lead to imprisonment and / or an unlimited fine.

Offence 1	Offence 2 & 3
12 months imprisonment Unlimited fine	5 years imprisonment Unlimited fine

GDPR & Data Protection Principles

When companies and organisations hold your personal data, they are bound by law to protect it and treat it with respect. The Data Protection Act 2018 is the UK's implementation of GDPR and outlines what companies can and cannot do with personal data. Below are the 7 key principles:

Lawfulness, fairness and transparency

Data must be used in a way that's fair, legal, and not misleading. The company must be clear and honest about what the data is being used for

Purpose limitation

Companies must be clear about how they will process data before it is collected. If there is a new purpose for processing the data, they must ask permission.

Data minimisation

Data must be relevant to what it is needed for. Companies should not hold more data than needed for the intended purpose.

Accuracy

Data should not be incorrect or misleading. Companies should keep data up-to-date and correct it if they find it to be incorrect.

Storage limitation

Data must not be kept longer than necessary. Companies should review the data they hold and either erase it, or anonymise it when it's no longer needed.

Integrity and confidentiality

Data held by companies must be protected sufficiently so it is not lost or stolen. This could be digital measures against hackers or physical measures such as locking doors.

Accountability

Companies must be responsible for how they use personal data. It is up to the companies to show they are complying with the law.

What if there's a data breach?

If there is a serious breach it must be reported to the Information Commisioner's Office. Breach of the Data Protection Act can lead to heavy fines - £17m or 4% of global revenue (whichever is greatest).

Intellectual Property

Intellectual Property law protects companies and individuals who create, invent, and design original works, and prevents others from using them without permission. Those who don't get permission may be liable and could face legal repercussions. Copyright protects a wide range of different creative works.

What is copyright?

Copyright gives legal protection to the creators of original works and prevents other from using them without permission. Protected work is often accompanied by a © symbol, however it's not required. If you come across any creative work you should assume it is protected by copyright

Copyright is automatic and doesn't have to be applied for, but you have to be able to prove you own the work. In most cases, it lasts for 70 years after the creator has died.

What is covered by copyright?

Copyright covers a range of different creative works including:

Literary: books, magazines, song lyrics, computer programs
Dramatic: plays, musicals, pantomimes, choreography
Audiovisual: tv programs, live action films, animation, videogames
Sound: music, audiobooks, audio samples, spoken words
Artistic: paintings, photos, maps, drawings, sculptures, patterns

Using copyright material

If you want to use copyrighted work, you must ask permission of the owner. If they give you their permission, they may ask you to give acknowledgment, or pay a fee in order to use their work.

There are special circumstances in which you can use copyrighted material without permission, including: in criticism, parody, teaching, and reporting current events.

What's not covered by copyright...

Inventions

When someone invents something new and wants to protect it, they can apply for a patent. It is a long and expensive process. Once granted, a patent can protect an invention for up to 20 years. After that time, anyone may copy or reproduce the invention.

Company Identity

Designs, names, and slogans which help people identify a company, product or service can be protected by Trademarks. Applying for a trademark is not free and usually takes up to 4 months to be approved. They last 10 years and can be renewed.

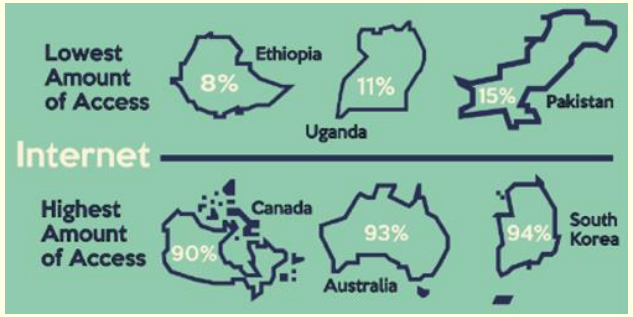
Digital Divide

The gap between those who have access to the latest technology and those who do not is called the 'digital divide'.

Money - people need money to access the internet and buy the latest devices, such as computers, smartphones and tablets.

IT literacy and accessibility - knowing how to use technology empowers people to make the most of it. People who don't know how to use computers and the internet do not have the opportunities that IT-literate people do.

Location - access to network coverage and high-speed broadband can vary greatly depending on where you live. Most large towns and cities have good network coverage and access, but rural areas can have limited or no coverage. Without these connections, the internet can be slow or non-existent.



Internet access - the internet provides many opportunities for people who want to access online shopping, banking and job adverts. Students with internet access at home can research or revise with online help. Many universities and schools offer courses online. Social networking helps people make connections and stay in touch.

Environmental Issues

Extracting raw materials depletes scare natural resources and extraction causes pollution and is a humanitarian issue.

The mineral-rich "Democratic Republic" of Congo has been bought and sold to Apple, Microsoft, Samsung, and privileged technology consumers, for example cobalt used in lithium-based rechargeable batteries.

Precious metals in phones are often sourced from mines in conflict-zones where children and adults are working in inhumane conditions.

"Children as young as 7 work 12 or more hours a day separating the precious metal from rocks with mallets and chisels for as little as $2 a day. Children as young as 2 transport, wash, and crush minerals to earn half a dollar a day. Men work with no protective gear and are often crushed in collapsing mines. Women, who carry heavy loads of the mineral to lakes to be washed and sorted, complain of aching bodies and respiratory problems. All of them are at risk of fatal lung disease from breathing the cobalt dust." (**Amnesty International)**

While most technology companies have pledged to try to buy as much non-conflict tin, tungsten, tantalum and gold as is available, there are simply not enough of these minerals available in non-conflict zones to meet our ever-growing demand for the latest and greatest.

E-waste

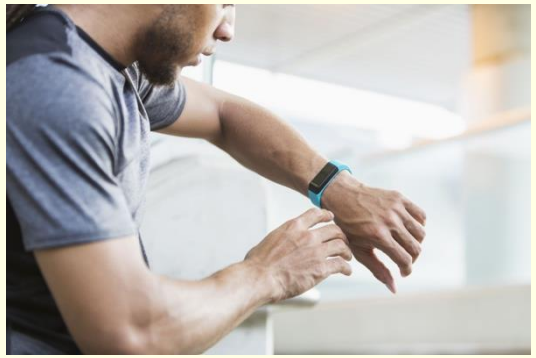
- People dispose of their devices in landfill even if they are in good working order

- Smartphones are portable so can be easily broken, not built to last, and often cheaper to replace than repair, new releases on a regular basis and people often want to buy newest tech. Peer pressure to upgrade

- Some raw materials are difficult to recycle and end up in land fill and can be toxic.
- Some equipment is also sent abroad to be disposed of leads to excessive landfill (in this country and/or abroad, e.g., Africa and Asia)
- Toxic waste released into land, ground water, air (in this country and/or abroad, e.g. Africa and Asia)

People can take devices to local collection facilities to be correctly disposed of and recycled. Old devices can be reused and refurnished.

Technology can be energy inefficient and energy consumption is increased by over charging devices, leaving them on standby, use of air conditioning to keep servers cool. Requires designing tech that is more energy efficient



Case Study: Wearable fitness tracker

Wearable technologies relate to the increased use of technology that we carry attached to us. For example, fitness trackers, google glass, smartwatches, wearable cameras and even devices used for health.

A fitness company have developed a wearable wristband that collects data while you exercise, including heart and location. The wristband uploaded data wirelessly over the internet to the company's servers. The user can access their data by signing into their online account.

Discuss the **benefits** and potential **ethical, environmental** and **legal issues** related to using a wearable fitness tracker [8]

Benefits	Ethical	Environmental	Legal Issues
Monitor fitness levels Track location with GPS Hands-free and portable When these devices are in use, the data is not only stored on the device but will also use cloud services. People are likely to want to ensure that any data saved by these devices is kept secure and the software that allows wearable technology to share data usually uses encryption to provide privacy.	Risk of hacking • Hackers could access the company's servers and steal the data • hackers could intercept the wireless signal to steal a person's data • If someone obtained a user's location data, they could use it to track them and possibly commit crimes against them Privacy • Unethical use of your health data by 3rd parties – insurance companies	Increased production of electronic components, E-waste and increased energy usage.	Data Protection – company has not kept data secure Computer Misuse Act – criminal charges against the hacker

Case Study: What are the impacts of mobile technology on wider society. Discuss the technology, ethical, cultural and environmental issues.

Stakeholders

End user – health, financial, hacking & security issues.
Manufacturers - can benefit by selling more phones and increasing profits
Shops/networks help increase sales and upgrades.
Advertisers – using social media to sell more products

Technology

Mobile technology refers to devices that are portable; it encompasses everything from mobile phones to portable games consoles and laptops.

Mobile technology allows us to **communicate** much more easily, as most devices are internet-connected and can be used in very **remote locations** compared to traditional desktop computers.

Mobile phones allow quick access to the **vast information network** that is the internet, from any location that has a signal

Ethical issues

Puts social pressure on parents to pay for their children to have digital tech and upgrade.
Spending too much time on devices - contributes to ill health and addiction.

Digital Divide: Might not have the money, live in rural areas and have poor network coverage, little knowledge of how the technology works.

Accessing fake news, privacy and security issues.

Cultural Issues

Mobile technology has changed the way we interact with each other, and some people are now more likely to connect through their phones than in person.

With the help of social media, interactions can flourish across great distances and time zones.

Diverse and important news can also be spread.

Environmental Issues

E-waste People dispose of their devices in landfill even if they are in good working order

Smartphones are portable so can be easily broken, not built to last, and often cheaper to replace than repair, new releases on a regular basis and people often want to buy newest tech. Peer pressure to upgrade.

Extracting raw materials depletes scare natural resources and extraction causes pollution and humanitarian issue

Case study Social Media

Many people today use social media to comminate with their friends. Discuss the impact of social media to communicate and share information.

In your answer you might consider: technology, ethical issues, privacy issues and cultural issues.

Technology	**Ethical issues**	**Privacy**	**Cultural issues**
The need to be able to contact anyone at any time on social media may increase the demand for smartphones and other mobile/ wearable devices Software has adapted to suit social media needs. Many apps include 'share over social media' options. New social media apps and websites have been created in hope of giving users and advertisers a new social media experience (snapchat/ TikTok)	Social media increase the potential for cyberbullying and trolling, which could course distress among its users. Social media increase the potential for stalking and spying on others The significant time spent on social media means face-to-face interaction can be ignored. Contributes to ill health and addiction – spending too much time on social media. Fake news and offensive content.	Social media encourages users to expand their online network of friends so that the social media company can gain new users and therefore more advertising revenue. The use of this data in targeted advertising and companies try influence people to use new products via social media Problem of confidential data stored on the devices - need to check privacy settings and users must agree to privacy agreements. Risk of hacking and phishing scams.	Social media allows people with a range of different identities, opinion, and backgrounds to communicate and share information with others. This allows people who don't normally get a voice to be heard and allow other social media users to be exposed to a diverse range of views and experiences. Social media allows people with specific interests to more easily support causes they care about and meet like-minded people. Social media encourages users to post views and selfies which contributes to a culture which might be becoming more self-centred and vain.

Case study: Smart Payments

Smartphones can now be used instead of notes, coins or bank cards when making purchases in a shop

Discuss the impact of the increasing use of smartphones as a replacement to traditional forms of payment.

In your answer you might consider: stakeholders, technology, ethical and environmental issues.

Stakeholders	Technology	Ethical	Environmental
Manufacturers of notes and cions with lose out as less needed Shopkeepers will have to invest in new tech Users will always have a way of paying even if they forget their wallet	Mobile phones need to be designed with the appropriate hardware and software to make use of payment systems. Mobile phones need to have high quality security software to prevent theft and fraud Mobile phones need to have a long battery life Mobile phone developers need to work with shops and banks to make sure they have the tech to accept payments from mobile phones.	Transactions are easier on digital payment systems and the money is never visible. This may encourage people to spend more money. Digital payment may encourage more widespread hacking and computer misuse	There is no need to dispose of old notes and coins, although e-waste caused by broken mobile devices arguable caused greater environmental damage. Will not longer need to produce physical coins and notes

Case study: Amazon Robots. What the ethical issues of **Amazon using robots?**

Stakeholders	Technology	Ethical Issues
Company can cut costs by getting the same products made without having to pay any wages Workers could become unemployed, as robots take over their jobs. Consumers could be able to buy the same products for less, as the costs involved in making could be lower	The hardware and software of robots may not be sophisticated enough to fully replicate the work of human employees The increased use of robots in the workplace could help improve them as problems can be identified and fixed Successful use of robots could lead to their application in other areas of work.	Leave hundreds of people without jobs in order to pursue profit Lack of awareness and rules around the use of robots in the workplace By allowing robots to do routine jobs, workers are free to do more interesting and fulfilling work New jobs are created to program, maintain and manufacture the robots Robots can perform hazardous tasks, meaning there could be fewer injuries in the workplace.

Case Study: Smart Devices

Discuss the benefits and risks of AI assistants, for example: Google assistants and Alexa. In your answer, you should consider any ethical, legal and privacy issues. [6]

Benefits:	**Risks:**
Very useful and convenient technology, helpful reminders, helping find information, manage smart home, shopping lists etc Use the internet to allow instant communication Accessible as requires voice recognition – useful for visually impaired and mobility issues.	**Ethical** Record people without their knowledge, which could be seen as an **invasion of privacy** Hackers may be able to exploit the technology Expensive and not available to certain members of society and contribute to the digital divide **Laws** Data Protection and Computer Misuse Act

Case study: GPS

Satellite navigation systems are used by many car and lorry driver to enable them to plan and follow a route to their destination.

Discuss the impact of the increasing use of satellite navigation systems to plan journeys.
In your answer you might consider: stakeholders, technology, ethics issues and environmental issues. [8]

Stakeholders	Technology	Ethical	Environmental Issues
Drivers will receive benefits from better, faster and shorter routes Some residents on some route will see an increase in traffic as that are used/ recommended by Satellite navigation systems Traditional printed map manufacturers may face loss of demand Satellite navigation systems manufacturers will enjoy increased sales.	Widespread use of Satellite navigation systems will encourage the development of improvements, better options to customise routes, easier user interfaces, full speech recognition and wireless charging. Standalone Satellite navigation devices could become obsolete as more people use GPS and mapping applications on smartphones.	Potential for increased risk of accidents as devices are a distraction from driving, although better then printed maps. Speed camera detection could encourage reckless driving	Widespread use of Satellite navigation systems could result in shorter journey times, which means less overall fuel use and less pollution. Satellite navigation devices require disposal when they break and are less easy to recycle than. Paper maps. Satellite navigation devices require electricity, which may come from non-renewable sources which cause pollution.

Learning Aims

- Define artificial intelligence and machine learning
- Explore examples of where they are being applied
- Teach a machine how to recognise different types of images

What do you think is AI?

- AI = Computers doing tasks that usually need human intelligence.
- Machine Learning = Computers learning from data.
- LLM = A program trained on lots of text to talk like a human.

Everyday Examples of AI

- **TikTok / YouTube / Netflix recommendations** – suggest videos you might like.
- **Face recognition** – unlocking phones or tagging people in photos.
- **ChatGPT / virtual assistants** – chatting, answering questions, writing text.
- **Siri / Alexa / Google Assistant** – voice-activated helpers.
- **Google Translate** – turns one language into another instantly.
- **Spam filters in email** – stop unwanted junk emails.
- **Maps & Sat Nav (Google Maps, Waze)** – find the fastest route.

Shopping websites (Amazon, eBay) – recommend products.

Self-driving cars – use AI to see and make driving decisions.

Games – computer opponents that "learn" or adapt.

Photo filters / Snapchat lenses – detect faces and add effects.

Medical AI – reading scans or helping doctors spot problems.

Security cameras – spotting movement or recognising number plates.

Banking apps – detect fraud or unusual transactions.

Smart home devices – adjust heating, lights, or energy use.

AI Today

- **Talk & Write** – AI can chat, answer questions, write stories, essays, or code.
- **Understand Speech** – It can recognise voices and even speak back in natural-sounding voices.
- **Create Media** – AI can make pictures, videos, and music from text instructions.
- **Help with Learning** – It can explain homework, give practice questions, or tutor step-by-step.
- **Spot Patterns** – AI can analyse data, find trends, or detect problems (like in medicine or fraud).
- **Everyday Uses** – Chatbots, translation apps, recommendations (YouTube, Netflix), and virtual assistants (Siri, Alexa).

Important:
AI is very powerful, but it can still make **mistakes**, copy **human bias**, and it **doesn't "think" like a human**.

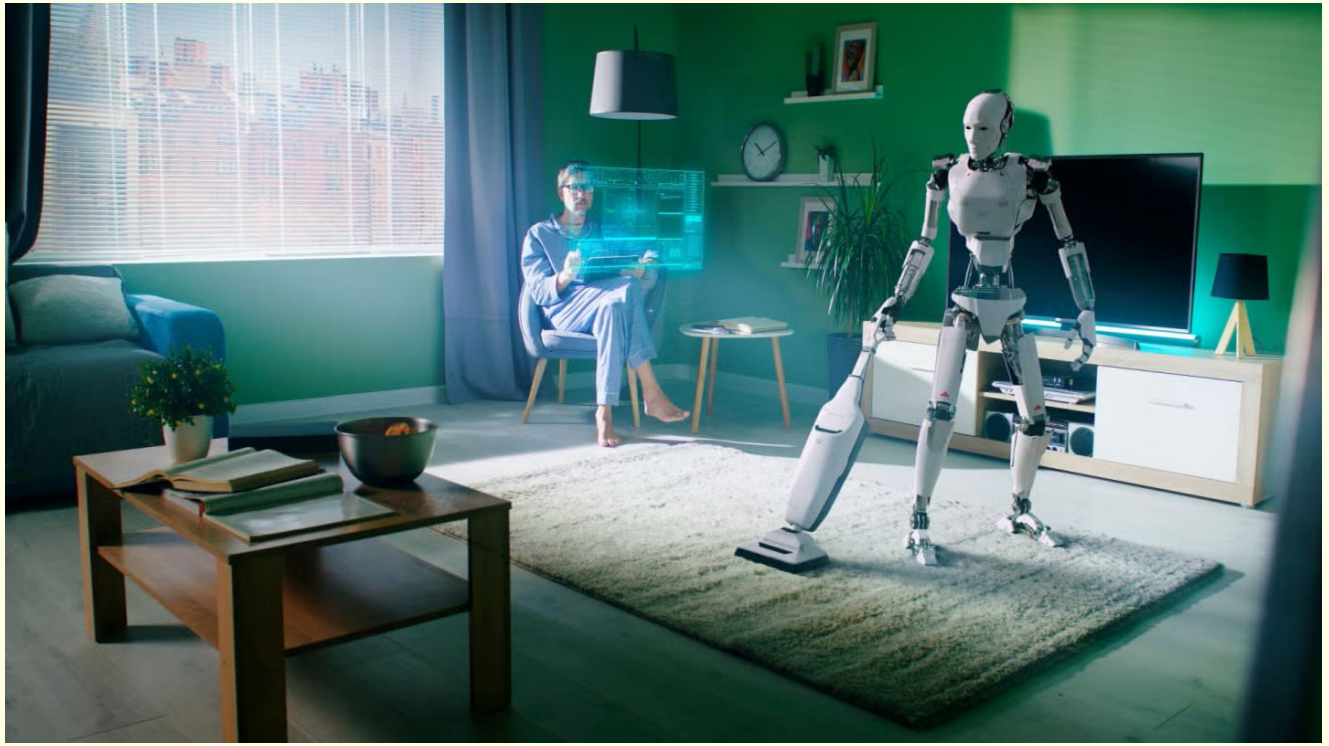
Key terms

Artificial intelligence	When a computer system is designed to perform tasks that normally need human intelligence (e.g. recognising images, answering questions, playing chess).
Machine Learning	A type of AI where computers "learn" from data and improve their performance without being directly programmed step by step.
Large Language Model (LLM)	An AI trained on huge amounts of text to understand and generate language (e.g. ChatGPT).
Generative AI	AI that can *create* new content (text, images, music, video) rather than just analysing data.
Natural Language Processing (NLP)	How computers understand and use human language (spoken or written).
Deep Learning	A form of machine learning that uses very large neural networks with many layers to recognise patterns (e.g. in speech, images).
Bias (in AI)	When an AI system gives unfair results because the data it learned from wasn't balanced or fair.

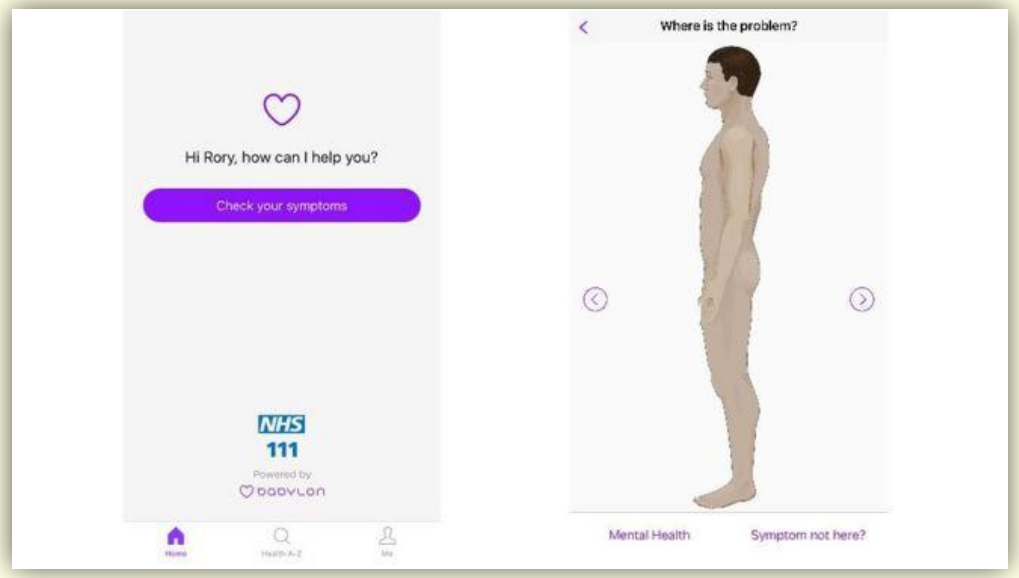
Future AI

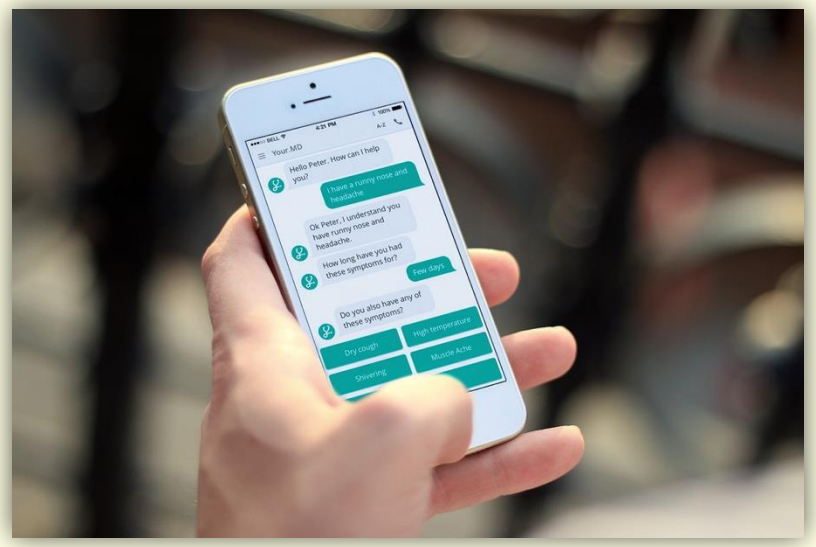
- Future AI won't be "human"
- It won't truly think or feel.
- But it will get more powerful, useful, and everywhere in our daily lives.

Robots in action – AI in machines will help in homes, hospitals, and workplaces.



In the news…The chatbot will see you now: AI may play doctor in the future of healthcare





"Our scientists have little doubt that our AI will soon diagnose and predict personal health better than doctors,"

To build this perfect doctor it is using machine learning.

http://www.bbc.co.uk/news/technology-39695768

Machine Learning