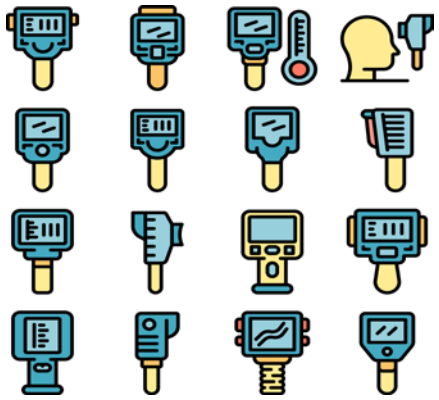
What if AI could improve thermal imaging, to help fight coronavirus?

Thermal imaging cameras have been widely installed in recent months in office buildings, hospitals, shopping malls, schools and airports as a means of detecting people with fever-like symptoms. Given their capacity to perform temperature checks from a distance, they have been seen as an effective means to limit the spread of the highly contagious Covid-19 virus. Looking beyond manual temperature checking, this note provides an overview of the use of thermal-imaging empowered with artificial intelligence (AI) capabilities, its suitability in the context of the current pandemic and the core technical advantages and limitations of this technology. The main legal responses and ethical concerns related to the use of AI in the context of thermal imaging at entry points, to identify and triage people who may have elevated temperatures, are also examined.

Infrared thermal-imaging cameras can measure radiated energy emitted from the human skin in a contactless, safe and fast manner. Adding machine-learning capabilities allows them to survey large groups of people at points of entry in an inexpensive, non-invasive way and to process their temperatures in seconds in the context of the current pandemic. Within this context, AI-enhanced thermal imaging cameras are currently being used in sensitive locations around the world to spot those who may have a symptom of the virus. Is general fever measurement through thermal cameras an effective means to tackle Covid-19? Are these cameras designed or sufficiently operationally mature to operate as medical devices or diagnostic tests? Should we consider the possible legal and ethical implications related to the use of these cameras, especially when paired with facial recognition software and movement-predictive algorithms? Are employees and passengers aware of their data protection rights, including their right to rectification as well as their right to benefit from a second measurement?



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Potential impacts and developments

AI-based thermal-imaging technology allows for fast and scalable screening of employees and travellers, from a distance, while they are moving, and without asking individuals to queue for individual checks. It can identify potential Covid-19 carriers by automating and streamlining the monitoring of an individual's temperature, simplifying and standardising record-keeping, and by reducing the need for invasive or potentially error-prone manual tracking procedures.

The integration of optimised algorithms for fever detection and facial-detection algorithms, as well as mask wearing detection functions, in thermal cameras allows them to recognise human faces obscured by masks and glasses and distinguish faces from nearby objects in real time by excluding other heat sources. Through the use of machine-learning algorithms, automated recalibration procedures and AI-powered statistical analytics, thermal imaging can achieve high measurement speed and accurate temperature screening of up to 95 %. The incorporation of advanced AI image-processing and video-analytics algorithms not only allows the detection of elevated skin temperature in high-traffic public places through quick multiple target screening but also facilitates the emission of automatic alerts to security personnel. The integration of accurate mask-on face-recognition functionalities in thermal-imaging cameras is currently being tested in the United States of America, Israel, China and several Latin American countries.

Some authorities are now able to identify patients with an elevated temperature, revisit their location history through automated analyses of closed-circuit television (CCTV) footage, and provide audio and visual notification of temperature-screening passes and failures. London Heathrow Airport has used the technology to carry out

Author: Mihalis Kritikos, Scientific Foresight Unit (STOA)

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large-scale passenger temperature checks, whereas Los Angeles International Airport has begun piloting thermal-imaging cameras that can detect fever in travellers. The installation of these cameras in entry points could reduce bottlenecks and delays, screen dozens or hundreds of people without the latter violating social distancing requirements, but also requiring less manpower for temperature checks.

At the same time however, the European Union Aviation Safety Agency, the European Centre for Disease Prevention and Control and the World Health Organization (WHO) have concluded that thermal screening of passengers is a 'high-cost, low-efficiency measure'. There is little evidence of its effectiveness and accuracy in detecting and mitigating Covid-19 cases, given that temperature is a bad proxy for having the disease. In addition, these measuring devices are sometimes not very accurate when used in high-traffic areas, where several individuals are moving in different directions at once, while being presented to the camera from different distances and at different angles.

Moreover, scanning may not detect people with early-stage illness, asymptomatic illness, those with symptoms that do not include fever, or those who take medicines to reduce their temperature. The UK Medicines and Healthcare products Regulatory Agency has noted that thermal cameras are not a reliable way to detect if people have the virus whereas the US Food and Drug Administration has concluded that, despite their multiple advantages, are not effective at determining if someone definitively has Covid-19.

Anticipatory policy-making

In view of the absence of a common international standard for health-screening at airports and workplace locations, the use of thermal-screening cameras triggers questions about their compliance with ISO 13154, which sets the standard for deployment and implementation, and operational guidelines for identifying febrile humans using a screening thermograph, as well as with IEC 80601-2-59:2017 requirements for the basic safety and essential performance of screening thermographs for human febrile temperature screening.

Do temperature checks using AI-assisted thermal cameras constitute processing of personal data wholly or partly by automated means within the meaning of Article 2(5) of the General Data Protection Regulation (GDPR)? Is the use of cameras to perform mass checks justified under the duty of care of the employer towards employees and proportionate under data protection and human rights laws? Is temperature-related data going to be analysed along with other biometric identifiers?

Many European Data Protection Authorities (DPAs), including in Belgium, France, Czechia, the Netherlands and Poland, have made a series of recommendations that range from absolute prohibition of their use for triaging people, to allowing thermal scanning under specific conditions. Such conditions include an analysis of the data life cycle and the verification that there is no recording of thermal images in accordance with the orientations on body temperature checks in the context of the Covid-19 crisis that were recently issued by the European Data Protection Supervisor. An assessment of this kind should take account of the necessity, proportionality and effectiveness of this technological solution and provide for meaningful human involvement.

Beyond privacy concerns, the gradual installation of AI-enhanced thermal-imaging cameras enabled by facial recognition technology as a fever-detection tool in public spaces raises questions about their effects on the civil liberties of travellers and employees alike including questions of surveillance creep, namely the collection of biometric data beyond the current emergency context. The gradual introduction of this technology in airports and office buildings to proactively detect an elevated temperature also raises questions about what happens when people are detected as having fever, especially in cases of false positives:

Can they be banned from the airport or their workplace? Are robust safeguards in place to verify the technical accuracy of these public health measures, including meaningful human overview and control of the system? Are ethically and legally sound standardised technical protocols in place that could prescribe additional tests and temperature checks, data verification, and robust data protection safeguards?

In view of the novelty and possible limitations of the technological solutions being proposed, it would seem reasonable that any remote temperature-screening finding should be accompanied by secondary temperature screening, temperature checks by a healthcare professional and health questionnaires, and should be directed by public health guidance. They should be viewed as only one layer of protection in the context of the wider ecosystem of public-health emergency responses to the current pandemic.