# **Infectious Disease Tech: Overview**



### **Sighting Covid-19: AI camera surveillance and smart wearables target the pandemic**

An infectious disease is any disease caused by a pathogen, such as a virus, bacteria, a parasite, or a fungus. Currently, the world is battling the Covid-19 pandemic, which has caused more than 7 million cases of infection and close to 200,000 deaths in the US alone as of September 2020. Notable infectious disease epidemics in the recent past before Covid-19 include SARS (2003) and Ebola (2013–2016), although they were less severe.‘Infectious disease technology’ refers to 1) camera-based detection tools that use thermal imaging and facial recognition, 2) surveillance gadgets (smart wearables), and 3) software platforms that convert data from hardware (described in points one and two above) to identify individuals (i.e. to trace contacts and share system-generated insights in real-time). The software tools often include the latest artificial intelligence (AI) and machine learning capabilities that allow end-to-end, seamless, actionable insights.(Note: This report does not cover clinical/medicinal diagnostics methods, such as PCR testing, as they are unlikely to be used outside of the healthcare industry).

These detection tools are now being promoted to the masses in response to the Covid-19 pandemic, including for implementation in office spaces. The smart wearables segment has an innovative set of products (smart badges, bands) for containing Covid-19. Players often provide the hardware and software parts in combination, although several operate as pure-play software providers. (e.g., Landing.ai). Development and integration of AI and machine learning act as main enabling factors

AI and machine learning have been used in the surveillance industry for most of the past decade. Interest was reignited recently by the Covid-19 pandemic, for which faster and accurate disease detection tools are needed. For instance, unlike traditional thermal cameras, thermal fever cameras with built-in AI and machine learning can screen people for body temperature more accurately (roughly ±0.3°?/roughly ±0.6° F), identify potential risk and threat targets, and send that data to stakeholders in real time.AI and machine learning have been enabled largely by other technological advancements such as the following:

**Advanced chips for parallel computation:** Until early this decade, computers that ran AI software could only run one process at a time. This changed with the creation of a chip called the ‘graphic processing unit’ (GPU) which would later be included in PC motherboards. Made for visual processing, it can recalculate millions of pixels multiple times in a second. In 2009, the chip was used for running neural networks parallelly, aiding AI development, as hundreds of millions of connections could be made between different data structures (nodes). Neural networks are the backbone of any AI technology platform. Those running on GPUs are routinely used by cloud-enabled companies to develop AI software for various applications. This has caused an increase in the production of GPUs, resulting in lower chip prices. Examples of key GPU chips include Alphabet’s tensor processing unit (TPU), Qualcomm’s neural processing unit (NPU), Nvidia’s deep learning chip, and IBM’s TrueNorth neuromorphic computing platform, used in the development of AI in thermal scanners, among other machines.

**Big data:** The concept of AI and deep learning centers on datasets used for categorizing variables. Data collection plays a vital role in the development (and in teaching) of AI in databases, web cookies, online footprints, storage, and search results. For instance, AI software in a thermal scanner might find changes in a scanned individual's behavior, or any behavior that raises suspicion (e.g., excessive sweating, etc.), based on its learning from datasets available on the world wide web.

**Improved algorithms:** AI and machine learning make use of algorithms—relationship combinations stacked in layers. Algorithms have improved dramatically over the years as data scientists used complex mathematical inputs that helped learning accumulate faster, proceeding up the stack of layers. Deep learning and AI algorithms have developed even more rapidly when integrated with GPUs or AI software chips.Nevertheless, the development of chips, big data, and algorithms have also improved over the past decade as long-term evolution (LTE) technology evolved from 3G to 5G, enabling faster data processing.

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## **Driving Factors**

### **1. Covid-19 Boosts Demand for Detection and Surveillance Equipment**

The pandemic is increasing new demand for virus detection equipment in places with high human traffic (e.g., offices, malls, supermarkets, and transportation hubs). Infection detection and social distancing tools are the only options for monitoring Covid-19 and limiting its spread while research into vaccinations and cures continues. A vaccine is expected to be released for commercial use in H2 2021. Meanwhile, several federal and state laws in the US oblige companies to implement social distancing and infection detection tools. For instance, Ohio issued firm guidelines for companies to monitor each employee's temperature daily before the start of each workday and to implement strict social distancing. Delaware and Michigan are also among states that issued guidelines for offices and shops opening for business.The following are new products being created for social distancing as they emerge in response to the pandemic:

* **Access-control systems and contactless sensors:**Many offices are expected to redesign their spaces focusing on 1) temperature monitoring at entry points and 2) contactless sensors for otherwise frequently touched objects like power switches and door handles.
* **Social distancing tools:**The use of smart bands and tags are estimated to increase as offices and workspaces enforce social distancing. Several companies have already announced commercial sales in the US. For instance, Chicago startup Proxfinity is promoting a Covid-19 tracking product that can warn employees to maintain social distance. Another, ESRI, added Covid-19-specific features to its indoor mapping products to triangulate people’s locations and map them in real time. The companies initially targeted institutions like hospitals and airports, but now also sell the tools to firms that want to reopen their offices.
* **Contact-tracing apps:**Contact-tracing apps were not commercially available during the Ebola and SARS outbreaks because those viruses do not spread via human-to-human or surface contact, unlike Covid-19. In the US, so far, a few big organizations have publicly committed to using the tools. In the meantime, tech firms are viewing this new market segment as an opportunity and are repurposing existing technology to focus on tracking Covid-19. For instance, PwC is reported to already be working on a contact-tracing app and mentioned that nearly a quarter of CFOs surveyed plan to evaluate the technology as part of their office reopening strategy. Meanwhile, both Apple and Google announced they are looking to build contact-tracing apps for iOS and Android, respectively.

### **2. Long-term need for detection tools as complexity and fatality of infectious diseases increase**

The need for infection detection tools has grown because of the Covid-19 pandemic. Spreading both from human-to-human contact and without contact, the disease poses a formidable challenge for efficient detection and surveillance tools. The way that coronaviruses and other new viruses spread in crowds means these tools are needed at sites with significant human movement, such as office spaces, malls, and railway stations.Despite a historical surge in demand for tools that detect infection during viral outbreaks (e.g., Ebola, SARS, influenza), in the long term, reports suggest that the frequency of outbreaks would still increase. According to WHO reports, infectious diseases kill over 17 million people every year, with 30 new diseases identified over the past 20 years. By 2050, deaths related to infectious diseases should be the most frequent cause of death, among other medical complications (e.g., heart disease). This should drive demand for surveillance tools and platforms. Many research papers suggest that epidemics might occur more often because zoonotic diseases (those that spread from animals to humans via contact or meat consumption) are increasing, along with the general growth in populations globally.

## **Risks to Growth**

### **1. Discovery of a vaccine for Covid-19 might slow demand for surveillance tools**

The Covid-19 pandemic has raised demand for scanning machines that detect viruses and elevated temperatures. However, vaccine development has advanced more quickly than anticipated. In November, 2020, pharmaceutical giant Pfizer announced that its vaccine had an effective rate of 95% in preventing infections in Phase 3 trial participants. Pfizer estimates that it could produce up to 50 million vaccine doses in 2020 and up to 1.3 billion doses in 2021. Also in November 2020, the biotech firm Moderna announced that its vaccination is showing a 94.5% effective rate. The company projects production capacity of roughly 20 million doses in 2020 and around 1 billion doses in 2021.If a vaccine arrives sooner, the industry for imaging technology for scanning and detecting virus symptoms would decline. The WHO expects future outbreaks of coronavirus, or other viruses, from time to time, so there might yet be demand for high-tech infectious disease scanners.

### **2. Privacy concerns and the risk of cyber attacks**

As surveillance equipment can now share real-time data, private information such as people’s locations is shareable to stakeholders, possibly without users’ full knowledge. Added to that, if contact-tracing is installed in mobile phones as an application, user information could be put at further risk. Furthermore, companies providing AI software for surveillance equipment and running real-time data flows are at heightened risk of cyberattacks because of their increased connectivity and system digitization. Although digitalization is now mainstream, cyber risks remain due to the sophistication and complexity of cyberattack methods.

### **3. Delays in the availability of 5G could slow AI performance**

The performance of technologies such as AI and machine learning depends heavily on the next LTE platform known as 5G. The optimal performance of AI and machine learning tech (which requires real-time data sharing and algorithm mapping) in infectious disease detection tools will depend on 5G connectivity in the US. The deployment of 5G globally and in the US, however, could be delayed. The Covid-19 pandemic has already caused its postponement in China and halted 5G ecosystem device production there. The US ban on Huawei, which competitively manufactures 5G equipment, could cause even longer delays in the US.

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