

Flipping human motion detection on its head

Automatic object detection is growing ever more sophisticated, yet the accurate detection of humans still poses unique challenges. Omron's Gabriele Fulco explores what it is that makes humans so difficult to reliably detect, and how successfully navigating these obstacles could usher in a new era of productivity.



Efforts to mimic human vision to identify objects are nothing new. The first digital image processing technologies were first developed in the 1960s, and have been constantly refined and improved ever since. Recent advances in AI have served to intensify these efforts further. Achieving a computer-based vision system that can not just match but exceed the accuracy and understanding of human vision combined with a human brain has been notoriously difficult. Unlocking this technology could potentially herald a revolution in human progress, revolutionising everything from agriculture to medical science, as well as industrial operations.

The human body is the product of hundreds of thousands of years of evolution, and as such is incredibly sophisticated. Computers have long been able to detect and understand 2D pictures, but dynamic three-dimensional environments are a step far beyond this. Indeed, human vision is not just about simply perceiving the world around us; it is also about understanding it. Our brains are able to constantly provide the vital contextual information to allow us to make sense of our surroundings in real-time. Computers have traditionally been unable to match this level of



sophistication, that is until recently.

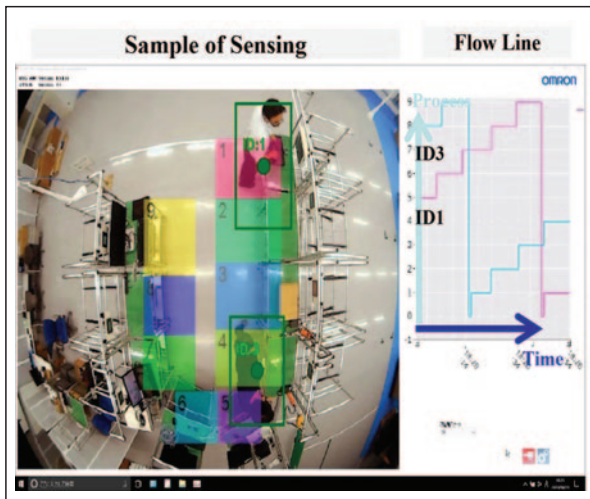
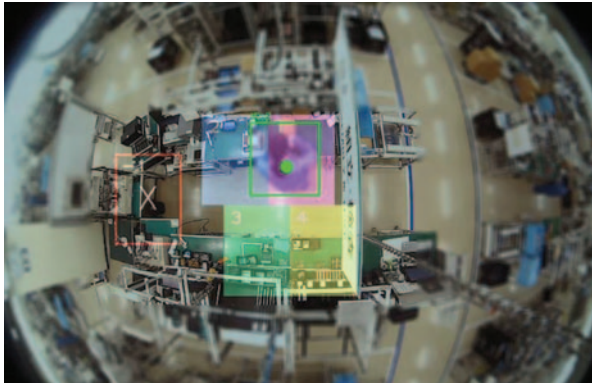
Training a machine to not only perceive but understand the world around it presents complex technological and computational challenges. Detecting humans adds yet another layer of complexity. Indeed, the uniqueness and diversity of humans themselves make them one of the most challenging subjects to reliably detect without training any system extensively on specific individuals.

Even a change of clothing or hairstyle

can present problems. When you add in additional factors such as the wider environment with which humans are interacting, combined with the unpredictability of human behaviour, the technical challenges quickly mount up. Any viable solution also has to be cost-effective and economical in size in order to be practical in everyday environments.

Solving these problems is not easy. In fast-moving industrial settings for instance, several humans may all be working at speed, carrying out various different duties within the same space. Attempting to track their movement from a side-on or even an isometric view has traditionally proven an imperfect solution, as this requires the system to have an understanding of the depth of vision. In a single-camera configuration, one person can also very easily obscure another from view and create blind spots.

In addition, one of the major challenges in the development of vision sensing technologies is not so much in the capture of images, but in processing them. For a machine to understand human movement in real-time requires a large amount of computational power to ensure high speed and accuracy. Since no two environments are the same, developing a system that can not only understand the nuances of human



movement, but also adapt to different scenes and lighting levels, has traditionally been a barrier to such technologies becoming viable on a wide scale.

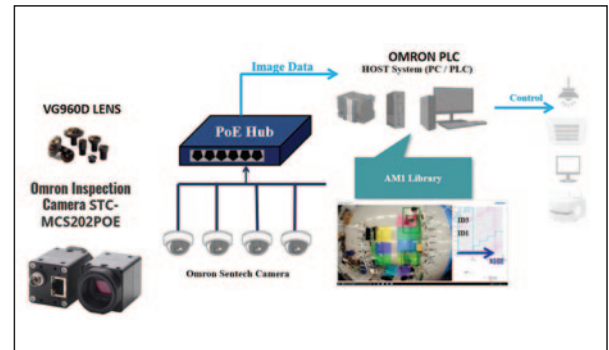
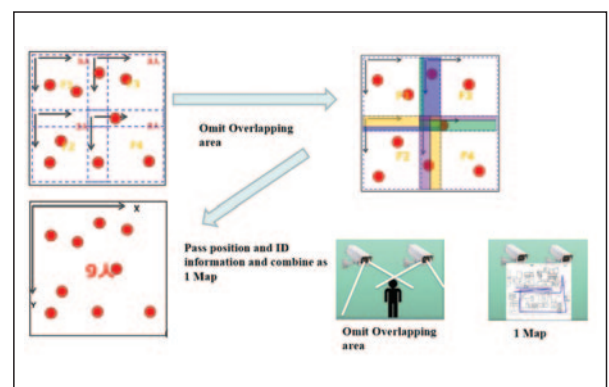
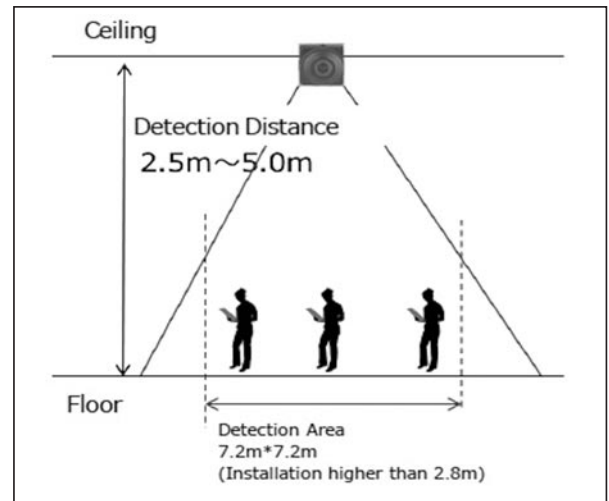
Omron's AM1 human detection system tackles these challenges quite literally from a different perspective. Designed for optimising human productivity in industrial settings, it utilises a single top-down camera, combined with sophisticated software optimised specifically to detect and interpret human movement. In doing so, it can provide a more accurate picture of where in a given space human workers are located, while also reducing the likelihood of overlapping and blind spots. The AM1 software has been trained to understand typical patterns of human movement, and can track up to 10 individuals within a 7m x 7m area with an accuracy exceeding 95 percent.

Having this capability allows organisations to track where and how workers are moving, or how long they're staying at a particular station for. This information can in turn be used to detect bottlenecks, and ensure that space utilisation and workflows are as efficient as possible. In practice this could mean removing obstacles, or shortening routes that are most frequently used, or reducing the likelihood of workers having to cross each other's path. By identifying and understanding the problems earlier,

solutions can be found more quickly, underpinned by a data-driven approach.

AM1's accuracy is achieved through the system's 10fps frame rate. Image data from the camera (or multiple cameras) is fed into a processing hub via Ethernet, which is powered by an Intel OpenVINO™ accelerator. This is the crucial innovation that allows the system to turn raw data into useful information quickly. Once processed, the information is then conveyed for human operators to a standard PC or PLC. Omron's vast library of data, accumulated through years of developing vision solutions, means that the system does not need to be trained on particular individuals, and can detect any human body type. As such, no specific programming skills are required for users.

Aside from optimising productivity, other potential uses for this technology could



involve occupancy detection to determine the appropriate HVAC conditions, or intrusion detection during non-work hours. There are also potential use cases in shared residences for optimising the layout and environment of communal areas.

While the accurate detection of humans across all environments continues to present challenges, systems like Omron's AM1 are proving that human motion detection has finally reached maturity as a viable technological solution. In the future these systems hold immense promise for revolutionising productivity, as well as other aspects of society.

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