AURORA-AI

The benefits of infrared in face recognition

Overcoming the limitations of image capture in natural light

Aurora-AI is a pioneer in the use of infrared images for face recognition, with numerous successful deployments processing millions of transactions each year.

Read on to find out why we added this approach to the more traditional one where visible light is used.

FACE RECOGNITION FUNDAMENTALS

All face recognition systems must follow a prescribed path to implement the solution

Step 1

Images must be captured, usually in real time

Step 2

An assessment must be made to determine if the image contains a face at all

Step 3

The face must be cropped from the image and a template created to represent the features

Step 4

The template is compared to other templates to determine matches

The key step in this process is Step 3, as the quality of the image capture will directly impact the performance of the matching. If the image quality is poor, then matching becomes more difficult. Note that “quality” in this argument relates to the information that has been captured in the image of the face, i.e. the level of blur and the exposure and contrast of the facial features. The pose of the person can also impact performance, but this is not considered explicitly here.

Suffice to say, face recognition works best if the whole face is visible in the image with the person looking directly at the camera – although tolerance to these changes has improved dramatically in recent years, performance degrades with changes to the head angle.

Capturing high quality images

Strong backlighting leading to washed out, low detail face image

In visible light photography, extreme light levels make it difficult to capture high quality images.

Systems have to employ bright lighting to overcome variance in illumination across the face. But this can't always compensate, especially with high levels of sunlight, and, even where it can, the user experience isn't a good one. An example of the issue is shown for a modern camera (Logitech Brio) to the left.

It is important to note that the ability to capture high quality images is not part of the public tests on the quality of face recognition. NIST and Labelled Faces in the Wild offer independent testing frameworks of step 4 only. The performance statistics reported in these tests will not be replicated in real systems unless images of suitable quality can be captured.

Infrared Images

The issues with changes in visible light have a much smaller impact if illumination is controlled in other parts of the spectrum. Near infrared was chosen by Aurora-AI to develop face recognition that will operate consistently in all conditions. We developed a camera that uses a flash to eliminate motion blur and provide even illumination across the face – as shown in the images above.

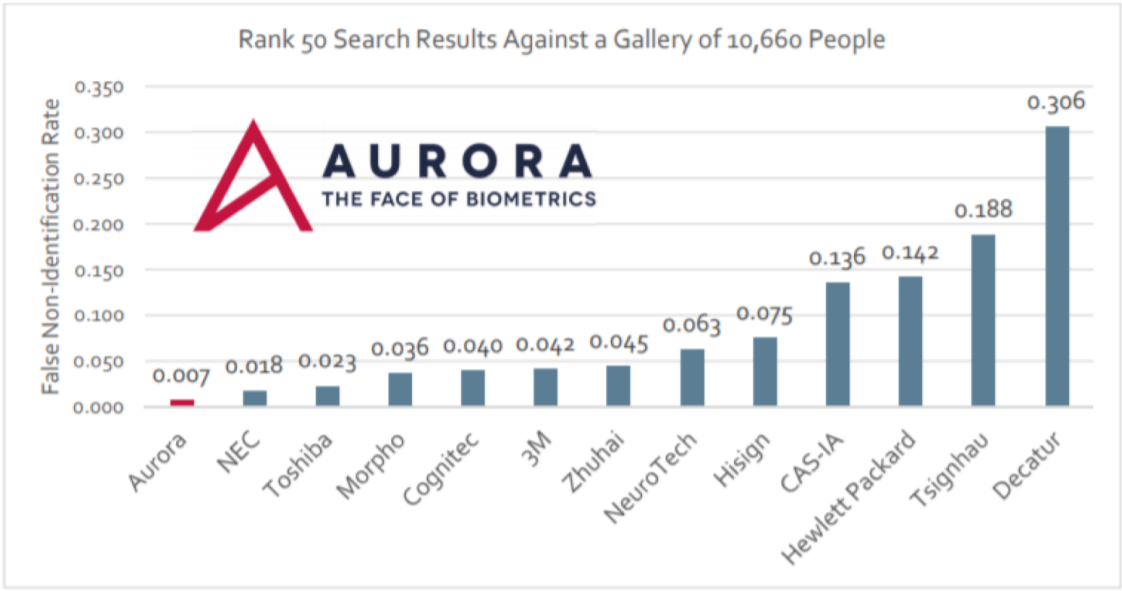
The grey scale representation of the IR image shows how the shadow that appears in the visible light image is removed. Even illumination will be achieved independent of the lighting and the quality of the image is just the same if taken at night. The use of the IR cameras solves the image capture challenge. Furthermore, it does it without bright lighting – the IR illumination is bright but can't be seen – so any of the issues with poor user experience are also removed.

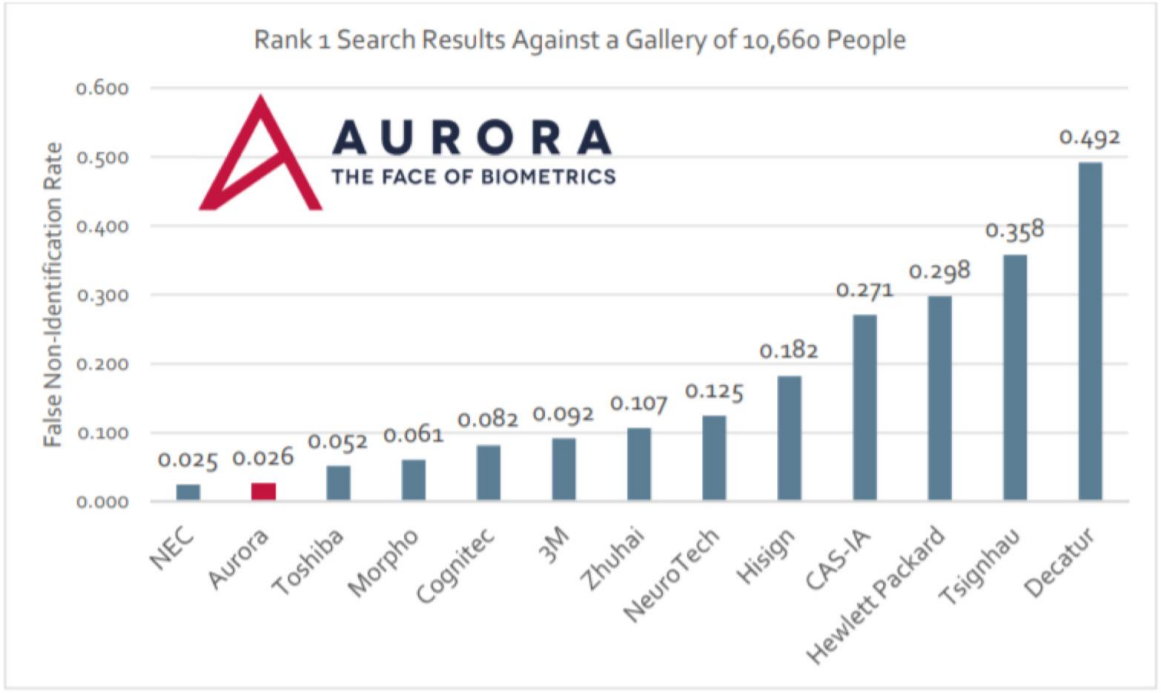
IR face matching performance

One of the other challenges we faced was providing a benchmark on the quality of matching IR images to enable comparison with the visible light algorithms submitted to the public tests. These tests don't offer databases with IR images so we had to replicate the approach so we could determine how well we compared to others in the matching step (number 4). A team from the University of Nottingham Computer Vision Lab, led by Dr Michel Valstar carried out the evaluation as an independent 3rd party to verify our approach as consistent with the NIST Face Recognition Vendor Test (FRVT). The results are overleaf….

These results demonstrate that the matching algorithms are competitive with the major players in face recognition.

Note: All vendors have improved on these results subsequently, in the case of Aurora-AI we have since removed 92% of the outstanding error rates in our IR face matching engines shown in the above charts.





Conclusions

The IR cameras that Aurora-AI sells as part of its face recognition solution ensure that high quality images are captured at all times. We can say with confidence that the laboratory performance of our matching engines will be retained in live deployments. Those operating in visible spectrum will work well but only when the image capture works well. Extremes of lighting from the sun will degrade that performance, potentially to the point where the system stops working all together.

It is perhaps interesting to note that Microsoft has recently decided to implement IR face recognition as part of their Windows Hello service and Apple implemented Face ID using a variant of the approach but still using IR. They understand the issues with consistent lighting and have adopted a similar approach to ensure that identifications are made to a high standard.

Visible light face recognition still has its place. In areas where lighting levels are consistent then it will perform well. Aurora has extended its capability to enable deployment in those more challenging environments with the targeted use of IR which solves the image capture problem and enables high quality results in all circumstances.

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For more information about using infrared in facial recognition:

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