Thesis Project Portfolio

Radiance

(Technical Report)

Ethical Concerns Surrounding the Widespread Deployment of Thermal Imaging Technology in Surveillance

(STS Research Paper)

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Minsol Kim

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Department of Electrical and Computer Engineering

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Executive Summary

The introduction of new technologies is often surrounded by excitement, but how do we, as a society, manage the corresponding potential misuse that inherently accompanies innovation? Radiance was a project undertaken to develop an autonomous security system that relies on multispectral imaging to track potential intruders found in its field of view. This idea sparked from the many shortcomings of traditional modern surveillance including unreliability in adverse weather/lighting conditions and the heavy reliance on human operators for intruder detection. The standard concerns of data misuse and unethical data collection were especially relevant to thermal cameras due to their ability to capture sensitive, biometric data. After the completion of Radiance, an effort was made to explore the implications of new surveillance technologies and analyze past examples to mitigate these risks.

Traditional security and surveillance solutions available to the general public are fairly limited in their capabilities. They often struggle to reliable detect intruders in rain or snow. Furthermore, once the sun goes down, even if cameras correctly capture a threat, users are typically left with low-resolution, grayscale footage that doesn't provide much information. Radiance was developed as a solution to these issues. By taking advantage of multispectral imaging, the final product was a significantly more robust surveillance system that worked flawlessly in all lighting and testable weather conditions. The final product was equipped with a thermal camera, powerful searchlight, and by running a custom developed real-time tracking algorithm, was able to efficiently distinguish potential points of interest from random spots of heat.

The device was able to reliably and accurately track people in its field of view. The spotlight stayed focused on the torso of targets that were walking, sprinting, and even dancing. The integrated light allowed users to quickly locate and identify the detected target, and the device's

ability to pick out and save potentially important clips of video made reviewing footage extremely easy and efficient.

After the completion of Radiance, the potential risks that accompany widespread implementation of thermal imaging technology were analyzed. This was done by exploring the current state of cutting-edge thermal imaging research, reviewing similarly sensitive technologies from the past that were successfully deployed on a wide scale, and considering studies on the public opinion of these potentially sensitive surveillance technologies. By appropriately understanding the potential risks surrounding this relatively new technology, we believed that it would help mitigate these risks by informing design and deployment decisions.

Thermal imaging has been improving at a rapid pace, and while not able to directly identify individuals off of just their heat signatures, researchers have had success gathering potentially sensitive information just from thermal footage. Researchers also had significant success tracking vehicles through both urban and rural environments, reinforcing the idea that the implementation of thermal imaging could further enhance preexisting surveillance technologies such as facial recognition. By studying past instances of similar technologies, it became apparent that the public is often more worried about the management and intended use of technologies rather than raw capability. By educating the public, establishing a precedent of transparency, and implementing appropriate security regulations on data storage and collection, many of the mistakes of the past could be avoided.