Concealed Weapon Detection Using Infrared Image Processing and Machine Learning

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The American people and worldwide citizens face the daily consistent threat of those with concealed weapons. Each day, human lives are lost due to concealed weapons. Recent and memorable examples include the Las Vegas and Sandy Hook shootings. Additionally, police officers use firearms every day and face potential for miscommunication, and attacks by groups like ISIS have created uncertainty and a threat to public safety. This study worked to develop a solution through the combination of infrared/thermal imaging, and a neural network. Infrared radiation takes a large scale of the electromagnetic scale; it represents the difference in the absorption, reflection, and transmission of energy at different levels through a wavelength. This difference in wavelength levels presents an efficient method for concealed weapon detection on any human figure when the level difference displayed in the output data is extreme. Further, this study included using a neural network structured around detecting concealed weapons. After meeting prerequisites, the neural network trained using over 1,200 infrared images of a concealed handgun. This process produced a set of weights for the neural network, enabling recognition of the taught handgun from any new image or video. When processing new data with a threshold of 50% or greater probability, the network successfully produced an output log identifying the weapon with complete accuracy. Additionally, such a network with more infrared training data and weapons classifications would have the potential for greater utility, and application expanding to include an array of many gun models. Furthermore, concealed weapon detection in front of establishments would prevent potential tragedies with the control of external stimulus such as a door.

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