Autonomous COVID-19 Screening Using Deep Learning and Low-cost Thermal Imaging

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The COVID-19 Pandemic is our biggest challenge with already over 100 million infections and 2.4 million deaths globally. Employers are following CDC guidelines by creating mask mandates, requiring social distancing, and checking temperature at entrance. The objective of this study was to identify the best algorithms and hardware solutions to build a low-cost automated COVID-19 screening system for small businesses that detects masks using artificial intelligence and measures forehead temperature using a thermal sensor. I evaluated two different neural networks, the SSD Mobilenet V1 and the Faster RCNN Inception, within Tensorflow, an open source artificial intelligence platform. On the hardware side, I calibrated 3 low-cost thermal sensors, MLX 90614, AMG8833 and FLIR Lepton 3.5 in a cardboard-blackbox to identify the best sensor for autonomous temperature detection, and tested how it measured my forehead temperature compared with a handheld thermometer. The Faster RCNN Inception model was better for my prototype, as it operated within a second, with 100% recall and 98% precision. The MLX90614 and AMG8833 sensors were unable to detect remote temperature accurately. The FLIR Lepton 3.5 generated a high resolution thermograph, with maximum temperature measured within the forehead region having a 100% recall, without any false negatives (no fevers were left undetected). With these results I was able to generate a prototype that is now being used in the Lansdale Public Library. This experiment showed how a low-cost prototype can be successfully used to assist small businesses in following CDC guidelines for safe and socially-distanced COVID-screening.