Using Machine Vision to augment safety in Makerspaces

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Abstract:

In makerspaces, it can be difficult for staff to keep watch of all users to ensure safety and proper usage of machinery. SMART³ Makerspaces has been working on a project to attempt to predict the misuses of a band saw without human assistance. Android phones were utilized to record video of a slightly angled overhead view of the cutting bed of a band saw in order to detect unintended, hazardous, or otherwise unsafe use. To generate training and test data, the team recorded multiple cuts and labeled 'safe' and 'unsafe' frames and then compressed and filtered these frames to be conducive for training on limited hardware. This process was built with the pipe and filter architectural process in mind to allow for reuse of each individual part. To detect the misuse, the team built a convolutional neural network (CNN) as a classifier. After training the CNN, it had achieved an ~90% accuracy rating over the training and test sets when detecting whether the current frame was a safe or unsafe position while using the bandsaw. Building off of this, the team plans to improve the detection algorithm and integrate the detection into the live workspace of the makerspace staff. The model can be simplified and improved with the introduction of different computer vision algorithms, likely making the process more efficient. While doing so, the team plans to build a live notification system such that the staff on duty can be alerted when a user is misusing a machine. Eventually, both the complete notification and data collection of maker space near-misses could be utilized by staff and trainers to improve the overall safety training curriculum.