

## Analysis

### Objective 1

The criteria for objective 1 were met by the model. Based on the data in Figure 5, the model had an average inference time of 1.748 seconds. This value must be considered in terms of the physical environment where syringes are manufactured. Given that the average conveyor belt moves at 7 feet per second (National Safety Council, 2016), a syringe will travel around 12 feet before defect results are produced. For a camera with a field of view of 10 feet that is mounted above the conveyor belt, for example, syringe processing will finish when the syringe is just 2 feet ahead of the camera's position. Therefore, a camera that is elevated a few feet off the ground can determine if a syringe is safe or faulty when the syringe is just a few feet ahead of it. Immediately after detection, the syringe can be disposed of or kept for shipping. This value will change slightly as the conveyor belt speed may change. However, the change can be accommodated as long as the camera's mounting height can be modified slightly.

### Objective 2

The objective was met for most scenarios. As shown by the confusion matrix in Figure 3, torn plungers, good plungers, and bent needles were detected accurately with a recall of 92% or above for these classes. The strong recall score for these classes demonstrates that the model performs well on detecting defective syringes, particularly because of its high rate of correctly finding bent and torn syringes. However, the model accurately finds good needles at a rate of only 80%. In the context of the problem, the issue is not that severe; the model is incorrectly detecting non-defective syringes as defective, which is not as problematic as if the model was detecting defected syringes as non-defected. Nonetheless, the best approach for

the problem would be to add more training data related to needles. With more data, the model would have a better understanding of variations in needles and be able to classify these objects more accurately.