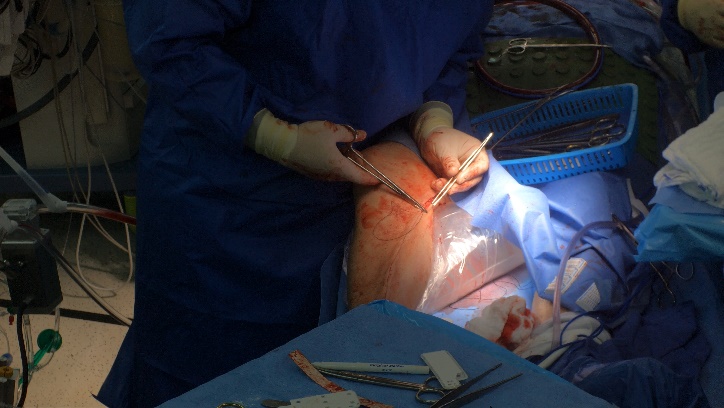
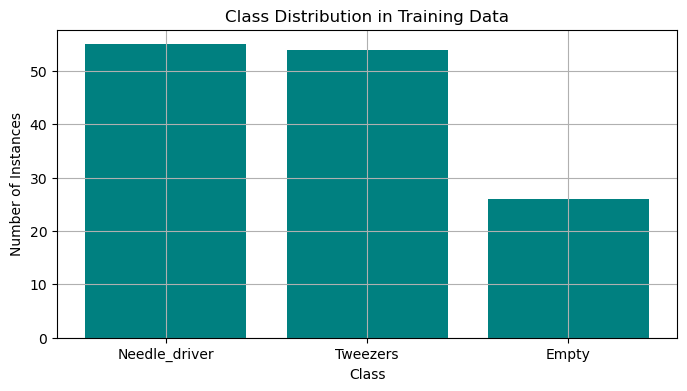
**Computer Vision, Surgical Applications 0970222 -HW1 Report**

1. **Exploratory Data Analysis**
   1. **Image Visualization (with/without label)**  
       ****To understand the data visually, We also labeled images from the training set and overlaid the bounding box to understand the labels better:A person in surgical gown performing surgery

      AI-generated content may be incorrect.A person with surgical scissors on their arm

      AI-generated content may be incorrect.
   2. **Insights from looking at the data:**After viewing several labeled images from the training set, we made the following observations:
      * Most images are close-up views of leg suturing.
      * Handsand tools are sometimes occluded or cut off, making detection harder.
      * Lighting varies — some images are bright, while others have shadows or glare.
      * Tools are often overlapping or in realistic positions, as in actual surgeries.

These observations suggest that, although the dataset is small, it captures realistic surgical variability—including occlusions, lighting differences, and visual clutter—which makes detection more challenging but also can helps the model generalize better to unseen surgical scenarios, such as the OOD (out-of-distribution) video.

* 1. **Data Distribution analysis  
     Training Data:** **Total labeled images:** 61, **Total bounding boxes:** 135

**Average boxes per image:** 2.21  
**Most frequent class:** Needle\_driver, **Least frequent class:** Empty  
**Validation Data:**  
A graph with a number of blue squares

AI-generated content may be incorrect.  
**Total labeled images:** 10, **Total bounding boxes:** 22

**Average boxes per image:** 2.20

**Most frequent class:** Needle\_driver, **Least frequent class**: Empty

1. **Experiments**
2. **Discussion and Conclusions**