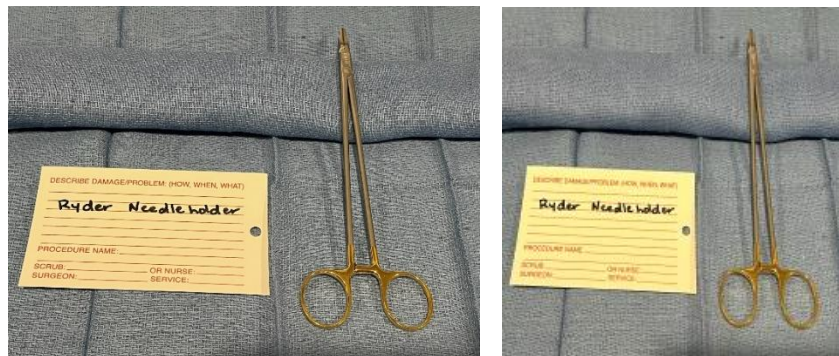# Results and Performance

1. **preprocessing.py** - Preprocessing Raw Surgical Images
   a. RAW => Processed Image Example (Ryder Needle Holder):

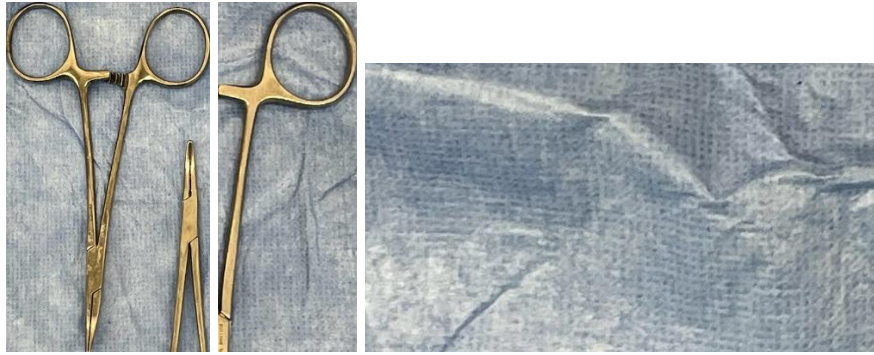   b. RAW => Processed Image Example (Ryder Needle Holder):

   c. Test Image Example (Ryder Needle Holder):

2. sam2_mask_generator.py - Mask Generation with SAM2 + CLIP

3. **sam2_surgical_mask.py** – Precise Surgical Instrument Mask Generation
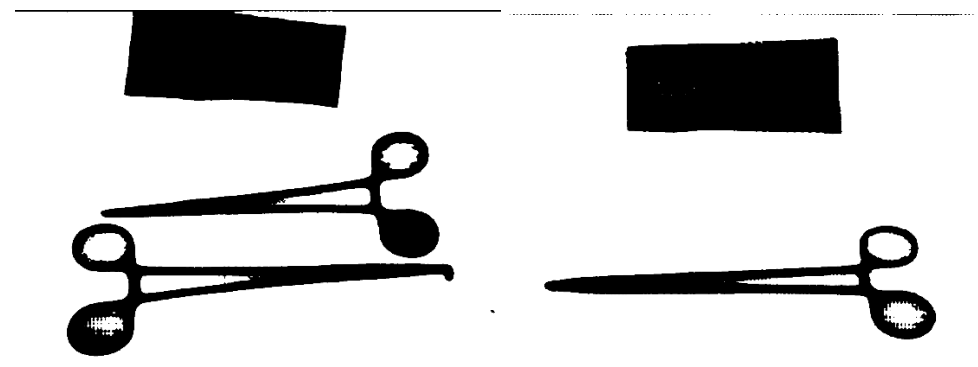   a. Keeping the Instrument's Color
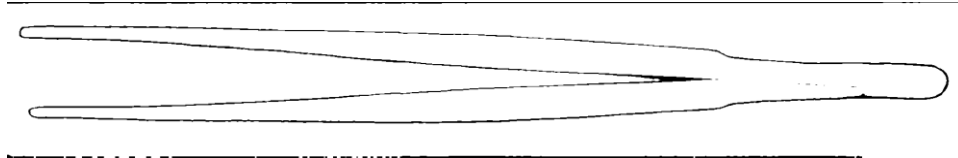

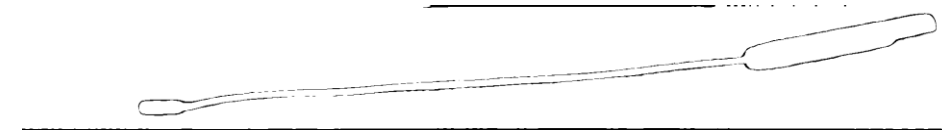   b. Keeping the Background's Color

   c. Black and White

4. generate_masks_with_sam.py – Binary Segmentation Masks
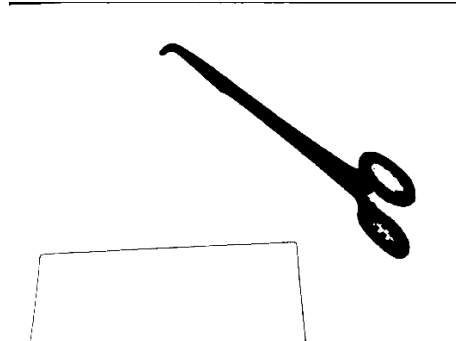
    a. debakey_forceps_1.png

    b. 1_4mm_dilators_1.png

    c. right_angle_clamp_10.png
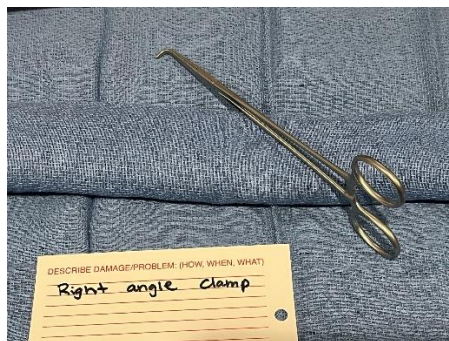
d. angled_bulldog_clamp_large_1.png
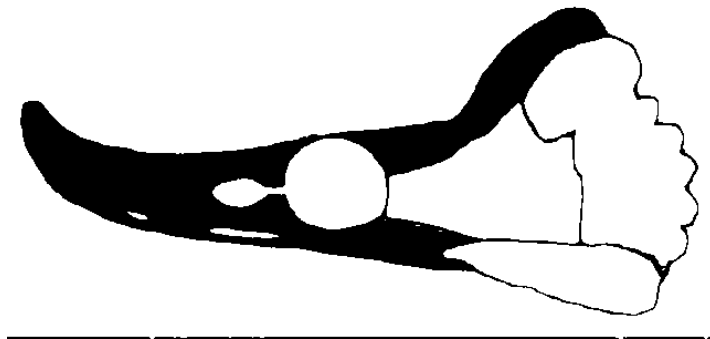
5. **Model YOLO LoRA** – YOLOv8 Custom Training Pipeline

Confusion Matrix

F1-Confidence Curve

Precision-Confidence Curve

- 1-4mm Dilators
- Angled Bulldog Clamp (Large)
- Angled Bulldog Clamp (Medium)
- Crile Wood Needleholder (Straight)
- Curved Crile Clamp (Kelly Clamp)
- Curved Mayo Scissors
- Curved Metzenbaum Scissors
- Curved Mosquito (Jacobson)
- DeBakey Forceps
- Jacobson Locking Straight Needleholder (Straight Castroviejo)
- Right Angle Clamp
- Ryder Needle Holder
- Short Gerald Forceps Without Teeth
- Straight Mayo Scissors (Suture Scissors)
- all classes 1.00 at 0.969

Precision-Confidence Curve | Precision-Recall Curve

- 1-4mm Dilators 0.995
- Angled Bulldog Clamp (Large) 0.995
- Angled Bulldog Clamp (Medium) 0.995
- Crile Wood Needleholder (Straight) 0.233
- Curved Crile Clamp (Kelly Clamp) 0.572
- Curved Mayo Scissors 0.812
- Curved Metzenbaum Scissors 0.525
- Curved Mosquito (Jacobson) 0.923
- DeBakey Forceps 0.781
- Jacobson Locking Straight Needleholder (Straight Castroviejo) 0.995
- Right Angle Clamp 0.304
- Ryder Needle Holder 0.601
- Short Gerald Forceps Without Teeth 0.982
- Straight Mayo Scissors (Suture Scissors) 0.238
- all classes 0.711 mAP@0.5