



TECHNICAL REPORT

TASK FOR RESEARCH ASSISTANT ROLE

Image Processing Task

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NAAMII Selection Team

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Task 1.1: Bone Separation (Femur & Tibia)

What Was Done

Automatically identified femur and tibia bones in CT scans.

How It Was Done

- Applied Hounsfield Unit thresholding (390-5000 range)
- Performed slice-wise morphological closing to disconnect fibula
- Selected two largest 3D connected components

Table 1: Key Parameters

Parameter	Value	Why Used?
HU Range	390-5000	Bone tissue identification
Closing Kernel	3×3 (4-connectivity)	Fibula and Paletta separation
3D Processing	26-connectivity	Anatomical preservation

Task 1.2: 2mm Expansion

What Was Done

Expanded bone masks by 2mm.

How It Was Done

- Calculated Euclidean distance from bone surfaces
- Applied 2mm threshold in millimeter space
- Performed 3D closing to smooth margins

Task 1.3: Randomized Segmentation

What Was Done

Generated randomized contours between original and expanded masks.

How It Was Done

- Created distance-based random thresholds
- Combined masks using logical operations
- Preserved original anatomical boundaries

Table 2: Key Parameters

Parameter	Value
Randomization Range	0-2mm
Reproducibility	Seeds 42, 123

Task 1.4: Guide Points

What Was Done

Identified medial/lateral landmarks on tibia.

How It Was Done

1. Slice Selection:

- Located most inferior axial slice with tibia presence

2. Landmark Detection:

- Identified minimum/maximum X coordinates
- Selected corresponding Y coordinates

3. Coordinate Conversion:

- Applied affine transformation from NIfTI header
- Output world coordinates in LPS system

Table 3: Key Parameters

Parameter	Value
Coordinate System	LPS
Output Precision	2 decimal places
Validation	Neighboring slice check

Core Libraries Used

- **NiBabel**: NIfTI file I/O operations
- **SciPy**: 3D image processing and morphology
- **NumPy**: Array manipulation and masking
- **scikit-image**: Distance transform calculations
- **Matplotlib**: Visualization and debugging