Overview of task.

This project focuses on bone segmentation in 3D CT images volume. Your task is to process a specific bone region as outlined in the task description and ultimately identify a key anatomical landmark. We have provided a CT scan (data) of the knee region (refer to Figure 1).

You are required to upload your work to a GitHub repository and share the link with us. Submissions in PDF format will not be accepted. Please ensure the repository includes:

- The complete codebase, organized in a modular format.
- A results folder containing:
    - Output images
    - A text file with relevant details
- A well-written README file
- GitHub commit history
- Any other necessary files to support reproducibility and understanding

Please note that we will evaluate not only the final solution but also the overall quality of your work, including code structure, readability, and good software development practices. Be sure to follow proper coding standards and documentation guidelines throughout your implementation.
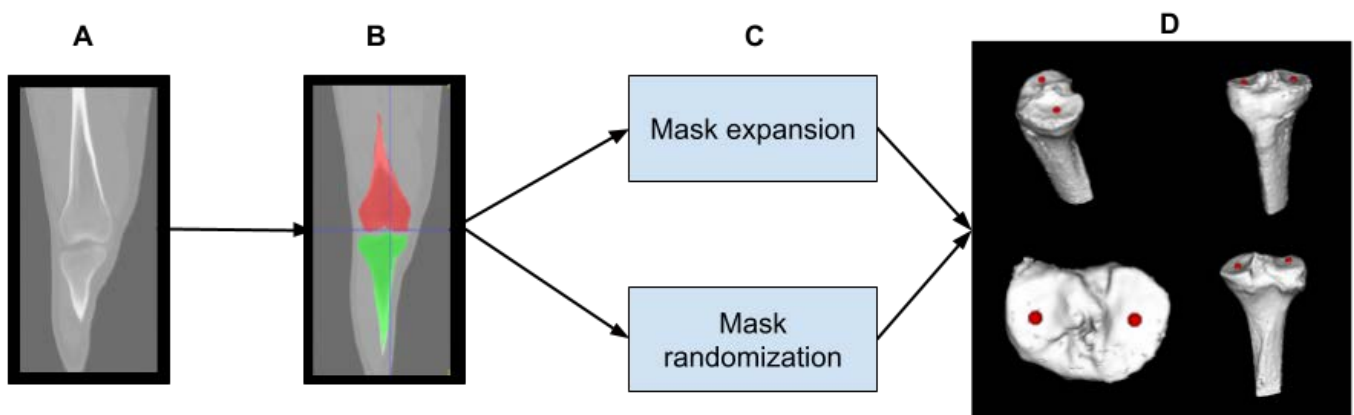

Figure 1: Workflow diagram for the task.

Links

Data link:
https://drive.google.com/file/d/1NR7OEboARP_fpseIZOY0Wy8Ir1NEYfL5/view?usp=drive_link

Submission Form: https://forms.gle/NyUZrbRFshFvYd4y7

Task 1.1 – Bone Segmentation

Your first task is to segment the femur and tibia regions from the provided CT image, as illustrated in Figure 1.B and save as nii.gz format. Apply only image processing techniques.

Task 1.2 – Contour Expansion

The second task requires you to expand the segmented mask by 2 mm uniformly outward. 2mm should be parameter.

Task 1.3 – Randomized Contour Adjustment

The third task involves randomizing the expanded segmented mask such that:

- The new mask lies between the original segmentation mask and the 2 mm expanded mask.
- The randomized mask must not exceed the 2 mm expansion limit.
- The contour must not shrink below the original segmentation contour.
- 2 mm and random value should be parameter.

Task 1.4 – Landmark Detection on Tibia

The final task focuses on the tibia. You are required to:

- You are required to save the following segmentation masks in .nii.gz file:
    - Original Mask
    - 2 mm Expanded Mask
    - 4 mm Expanded Mask
    - Randomized Mask 1
    - Randomized Mask 2
- Identify the medial and lateral lowest points on the tibial surface, as demonstrated in Figure 1.D for all the above 5 masks. Please note that Figure 1.D is provided for illustration purposes only. You are not required to generate this image as part of your submission. Our team has tools for this visualization.
- Submit the coordinates of these points for evaluation we will compare your results with the ground truth.