University of Peradeniya

AI Based Image Interpretation for Dental Procedure

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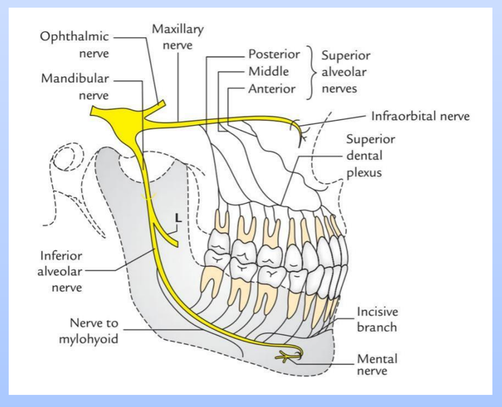
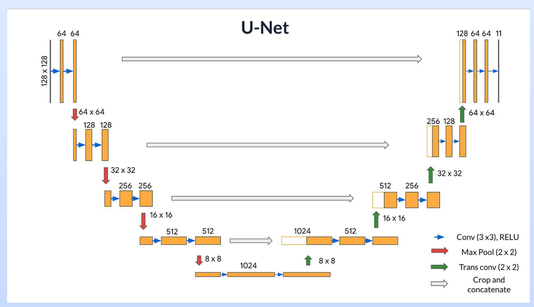
Dental implantation requires precise identification of the mandibular nerve canal. Using CBCT scans is labor-intensive and costly. Collaborating with the Dental Faculty of Peradeniya, we aim to develop a cost-effective, automated method. By leveraging annotated images, we'll create an algorithm to enhance the efficiency and accuracy of dental implants.

01. Choosing the Best Architecture

Using existing **chest X-ray** and **brain tumor** datasets, segmentation was performed with various neural networks.



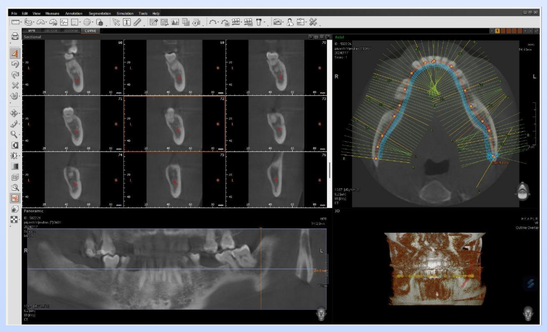
Inferior Alveolar Nerve



U-Net Architecture

U-Net architecture was selected as the it performed well for most of medical image segmentation.

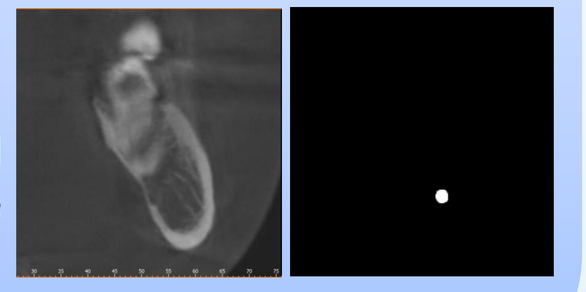
02. Collecting Data and Preparing Masks



Sliced View CBCT Images

CBCT images from **15 patients** (7 male, 8 female) were collected, with 50 images per patient. Masks were created for each image.

U-Net was used for training. For greater accuracy, **filtered** and **clustered** images (by male and female) were used.

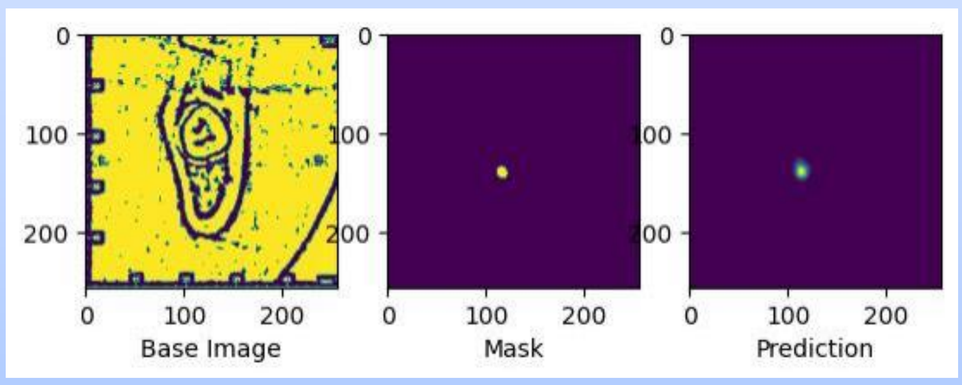


Original Image

New Mask

03. Training and Improvement of the Model

- Training and improvement of the model were carried out using this dataset. The **U-Net++** architecture was used as an improvement.
- Accuracy was tested with different loss functions and filtered data, using the **Dice coefficient** as the measurement.

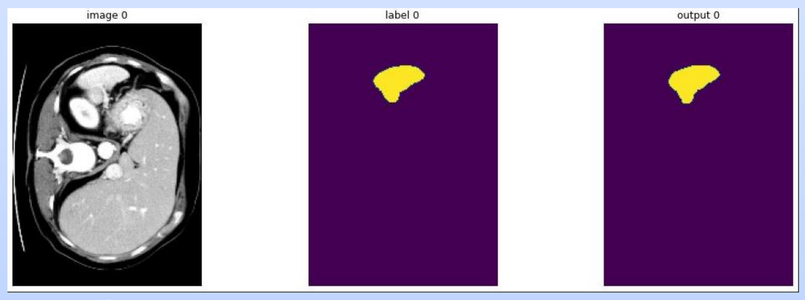


Original Image Original Mask Predicted Mask

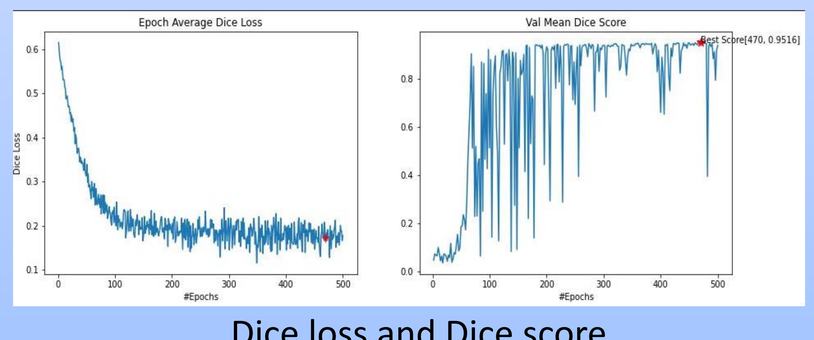
- A coefficient of **0.89,** indicating **89%** accuracy, was achieved with **U-Net++.**

04. Training with 3D U-Net

Testing 3D U-Net: Using a pancreatic cancer dataset, the 3D U-Net was tested to determine if accuracy increased. As it requires 3D images, it provided more accurate results for the tested dataset.



Original Image Mask Predicted Mask



Dice loss and Dice score

05. Future Expansion and Procedures

To utilize 3D U-Net for the dental image dataset, initial efforts involved building a **voxel dataset** using **JPEG images.** Despite successfully creating the image set, unresolved overhead issues persisted, hindering further progress. Consequently, the current focus has shifted to using **DICOM images**, specifically **raw CBCT images, directly** to construct a **3D voxel dataset**. This approach aims to bypass the previous overhead issues and leverage the higher quality and detailed information contained in the DICOM images.

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