

Metrics

Link: [MICCAI Challenge](#)

I/ Basic Information:

- **Task:** teeth and pulp root canal segmentation
- **Dataset:** Training set: 30 labeled CBCT images, 300 unlabeled CBCT images; Validation set: 40 labeled CBCT images
- **Evaluation:** segmentation accuracy (Dice, NSD, mIoU, IA) and segmentation efficiency (GPU consumption, running time)

II/ Dice Score

Definition: Measure how well the output overlaps with the groundtruth.

Formula:

$$\text{Dice} = \frac{2|A \cap B|}{|A| + |B|}$$

where A is the predicted segmentation and B is the ground truth.

Range: 0 - 1

Challenges: Sensitive to class imbalance; small errors in tiny regions (e.g., pulp) can drastically lower the score.

II/ Normalized Surface Distance (NSD):

Definition: Measures the distance between the surfaces (boundaries) of predicted and ground truth segmentations.

Formula: For a tolerance τ , NSD is the proportion of points on the predicted surface whose distance to the ground truth surface is $\leq \tau$, and vice versa.

Range: 0 - 1

Challenges: Requires accurate surface extraction => Đo hình dáng / boundary

III/ Mean Intersection over Union (mIoU):

Definition: Measure how well the output overlaps with the groundtruth.

Formula:

$$\text{IoU} = \frac{|A \cap B|}{|A \cup B|}$$

Range: 0 - 1

Challenges: Similar to Dice, sensitive to small structures and class imbalance

IV/ Identity Accuracy (IA):

Formula: $IA = \frac{TP}{\text{Number of unique classes (excluding background)}}$, where:

- TP (True Positives) is the number of correctly classified voxels for all instances (e.g., individual teeth or pulp regions).
- The denominator is the number of unique classes or instances in the ground truth (*gt*) and predicted segmentation (*seg*), excluding the background (class 0). This is computed as $\text{len}(\text{list}(\text{set}(\text{np.unique}(gt)) \cup \text{set}(\text{np.unique}(seg)))) - 1$.