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SliceLift: Slice-to-Volume Feature Lifting for Volumetric Pancreatic Cyst MRI Segmentation

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A Slice Selection Strategies

Given a 3D volume $X \in \mathbb{R}^{D\times H\times W}$, we select a subset of 2D slices along the depth dimension to guide the hybrid 2D-3D feature fusion. Let K denote the number of selected slices and z denote a slice index.

A.1 Uniform Selection

Uniform selection samples K slices evenly across the depth axis. The selected indices are computed by linearly spacing the interval $[0, D-1]$:

$$s_k = \text{round}\left(\frac{k(D-1)}{K-1}\right), \quad k = 0, \ldots, K-1. \tag{1}$$

This strategy provides global coverage of the volume without relying on image content.

A.2 Group-wise Representative Selection

The volume is divided into G non-overlapping groups along the depth dimension. From each group, we select the slice that is most representative of the group. Specifically, for a slice x_z in group g, we compute its mean absolute deviation from the group mean:

$$s(z) = \frac{1}{HW}\left\|x_z - \bar{x}_g\right\|_1, \tag{2}$$

where $\bar{x}_g$ is the average slice of group g. The slice with the largest score is selected from each group. This strategy preserves spatial coverage while favoring representative slices.

A.3 Middle Slice Selection

The middle selection uses the central slice of the volume:

$$s = \left\lfloor \frac{D}{2} \right\rfloor . \tag{3}$$

This simple baseline assumes that the central region contains the most informative anatomical context.

A.4 Random Selection

Random selection samples K slice indices from the depth dimension. When $K \leq D$, slices are sampled without replacement; otherwise, they are sampled with replacement. The selected indices are sorted before being used. This strategy serves as a stochastic baseline for comparison.