**Deep Vision Showdown - Procom ‘25**  
**Team: ADPM**

**Introduction:**

The challenge focuses on improving pain management following surgery by identifying anatomical structures in sonography images. The goal is to create a model that segments these structures to optimize treatment and recovery while minimizing the need for heavy medication.

**Objective:**

The objective was to develop a segmentation model that identifies specific anatomical structures in medical sonography images. The dataset consists of annotated images where structures of interest have been manually identified by experts.

**Methodology:**

The model was trained using a dataset of sonography images with ground truth annotations, utilizing deep learning techniques for segmentation. The dataset included images both with and without the structures of interest, requiring a robust model capable of distinguishing between relevant and irrelevant areas.

**Data Processing:**

* The dataset was preprocessed by resizing all images to (448, 608) dimensions for consistency.
* Image augmentations were applied, including flipping and contrast adjustments, to improve model generalization.
* Ground truth masks were stored using Run-Length Encoding (RLE) to reduce file size and facilitate efficient storage.

**Model Training:**

* A deep learning-based segmentation model was trained over **100 epochs**.
* The **Dice coefficient** was used as the primary evaluation metric.
* **Binary cross-entropy loss combined with Dice loss** was employed for optimization.
* The Adam optimizer was used to adjust model weights effectively.
* The model’s performance improved consistently, with loss decreasing over epochs.

**Performance:**

The model underwent rigorous training, with the following results:

* **Initial Dice score:** 0.0302
* **Final Dice score:** 0.8682
* **Best Dice score:** 0.8807 on the 96th epoch
* **Training Loss Trend:** from 0.6052 to 0.3177 and best is 0.3169 on 99th epoch

**Evaluation Metrics:**

To further assess performance, classification metrics were computed using the ground truth and predicted masks:

* **Precision and Recall:** Indicating model reliability in detecting structures.
* **Confusion Matrix:** Demonstrating classification performance between background and lesion regions.
* **Accuracy Score:** Providing an overall measure of segmentation effectiveness.
* **Classification Report:** Summarizing the precision, recall, and F1-score for different categories.

**Results:**

* The model achieved steady progress in loss reduction and Dice coefficient improvement, demonstrating its effectiveness in segmenting anatomical structures in sonography images.
* The segmentation quality improved significantly over training, reaching a **Dice score of 0.8682** by epoch 100.
* The classification metrics validated the model’s strong performance in distinguishing between anatomical structures and background.

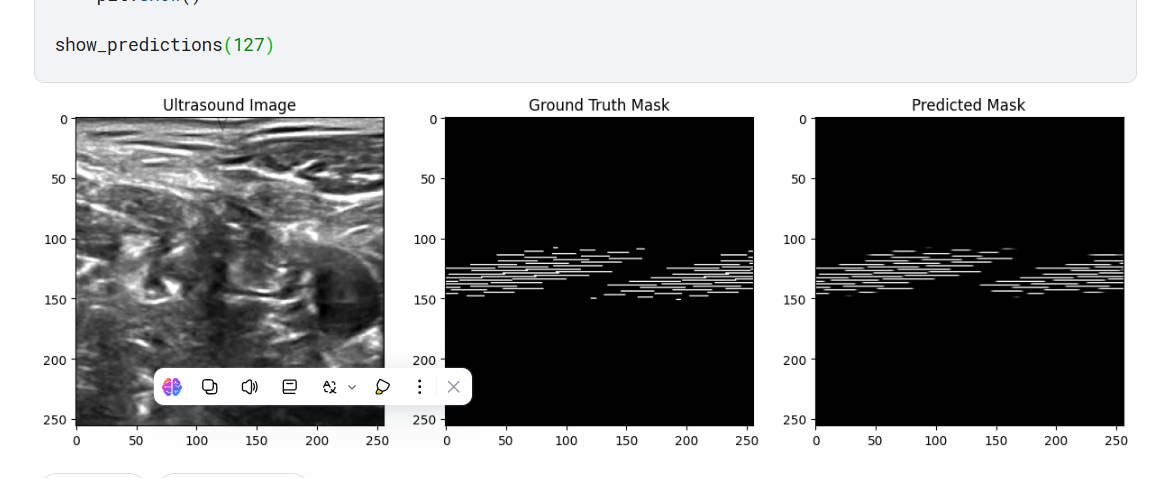
**Conclusion:**

The segmentation model successfully enhanced the identification of anatomical structures in sonography images. The training process demonstrated consistent improvement, with significant gains in Dice score and loss reduction. Future improvements could include fine-tuning hyperparameters, experimenting with advanced architectures, and integrating post-processing techniques to refine segmentation results further.

**Future Work:**

* Implementing **U-Net++** or **DeepLabV3+** for enhanced segmentation.
* Exploring **attention mechanisms** to improve feature extraction.
* Increasing dataset diversity to enhance generalizability.
* Optimizing model inference time for real-time applications in clinical settings.

**Some results:**



A screenshot of a computer

AI-generated content may be incorrect.

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