AI- MedX

MODEL ACCURACY REPORT

TEAM NAME : localhost

### **Model Accuracy Report: AI-Based Brain Metastases Segmentation**

The performance of three deep learning models—**U-Net, Attention U-Net, and ResU-Net**—was evaluated for brain metastases segmentation using multi-modal MRI scans. The models were assessed based on **training accuracy, validation accuracy, and key architectural strengths**.

#### **1. U-Net Performance**

* **Train Accuracy:** **95.41%**
* **Validation Accuracy:** **94.08%**
* **Analysis:**
  + U-Net demonstrates strong training performance, indicating effective learning from the dataset.
  + However, the validation accuracy is slightly lower than the training accuracy, suggesting minor **overfitting**.
  + The lack of attention mechanisms could contribute to its struggle in focusing on the most crucial tumor regions, leading to reduced generalization.

#### **2. Attention U-Net Performance**

* **Train Accuracy:** **96.97%**
* **Validation Accuracy:** **97.54%**
* **Analysis:**
  + Attention U-Net outperforms standard U-Net in both training and validation accuracy.
  + The introduction of **attention mechanisms** allows the model to focus on the most relevant tumor regions, leading to better segmentation.
  + The **higher validation accuracy** indicates superior generalization to unseen MRI scans, reducing overfitting.

#### **3. ResU-Net Performance**

* **Train Accuracy:** **96%**
* **Validation Accuracy:** **97%**
* **Analysis:**
  + ResU-Net achieves high accuracy due to its **residual connections**, which enable deeper network training without vanishing gradients.
  + It maintains strong validation accuracy, showcasing its effectiveness in real-world clinical applications.
  + The use of residual learning enhances model robustness and improves feature extraction, leading to superior segmentation performance.

### **Comparison & Conclusion**

* **Attention U-Net achieved the highest validation accuracy (97.54%)**, making it the most effective model for generalization.
* **ResU-Net also performed well (97% validation accuracy)**, benefiting from residual connections for deep feature learning.
* **U-Net showed strong training performance but slightly lower validation accuracy (94.08%)**, indicating room for improvement in generalization.

Overall, **Attention U-Net is the best choice for precise segmentation of brain metastases**, followed closely by ResU-Net. U-Net, while effective, may require additional techniques like fine-tuning or regularization to enhance validation performance.