# Final Project: Brain Tumor Segmentation

**1. Guide:**

**作业说明：**

1. The final project is a group project. Each group has 4-5 students.
   这次作业是一次小组项目，4-5 人一组
2. Each group will be assigned with three 3D brain tumor MRI scans with labels.
   将给每个组提供 3 个带有 label 的三维脑肿瘤 MRI 数据，可自选其中两个进行分割
3. All the images are saved as NIfTI files (.nii.gz). ITK-SNAP is recommended to view these images.
   所有数据均为 nii 格式，可安装 ITK-SANAP 查看

**2. Tasks:**

**任务：**

a) To segment the brain tumor in each image.
   分割所选数据中的脑肿瘤

b) Use any methods you want.
   方法任选

c) Evaluate the experiment results.
   对实验结果进行分析评价

**3. Requirements:**

**要求：**

Three files in one folder are required for your final project:
最终报告中需包含三个文件：

a) Source code (Relative PATH only)
   可执行代码（数据读入请使用相对路径）

b) Project report (PDF file):
   报告（PDF 形式）：

   1) Group member and number, as well as the selected data.
      组别与小组成员，以及所选的数据

   2) Describe the algorithm you used with details.
      所采用方法的细节

3) Evaluate your segmentation results in terms of dice score, sensitivity, specificity, precision, accuracy, etc.
分析并评价分割结果，其中定量的评价指标包括但不限于(详见附件):
dice score, sensitivity, specificity, precision, accuracy 等

4) List the contribution of each team member towards the project.
列出组内成员在本项目中的贡献

c) Segmentation Results: Saved as NIFTI files (.nii or .nii.gz).
分割结果（保存为 nii 形式）

A presentation from each group (10 min) is required in week 16.
每个小组在第 16 周课堂中将进行大作业的 10 分钟汇报。

**P.S.** For those who may use the deep learning method, additional public datasets are allowed to train your neural network
另外，采用深度学习实现本次作业的同学可以用其他的公开数据集用于训练网络，测试数据仍从所给三个数据中选择两个。

附:

## Evaluation Metrics

**True Positives (TP):** pixels correctly segmented as foreground.
**False Positives (FP):** pixels falsely segmented as foreground.
**True Negatives (TN):** pixels correctly segmented as background.
**False Negatives (FN):** pixels falsely segmented as background.

**Dice Score:**
Dice score is the most commonly used metric in evaluating medical image segmentations. Dice score is used to calculate the pairwise overlap of the repeated segmentations.

$$Dice = \frac{2TP}{2TP + FP + FN}$$

**Sensitivity:**
Sensitivity measures the portion of foreground in the ground truth that is also identified as foreground by the segmentation being evaluated.

$$Sensitivity = \frac{TP}{TP + FN}$$

**Specificity:**
Specificity measures the portion of background in the ground truth that is also identified as background by the segmentation being evaluated.

$$Specificity = \frac{TN}{TN + FP}$$

**Precision:**
Precision measures the purity of foreground predictions relative to the segmented foreground.

$$Precision = \frac{TP}{TP + FP}$$

**Accuracy:**
Accuracy is defined as the percent of pixels in the image which were correctly classified.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$