Accurate segmentation of breast lesions in DCE-MRI is an essential step for subsequent analysis, especially for computer aided diagnosis systems. In this work we propose an automated breast lesion segmentation method using a 3D patch-based U-Net framework in which we perform a ROI restricted, balanced patch extraction in order to address both the class imbalance and confounding regions problems. Moreover, different aspects have been investigated, such as the optimizers, loss functions and patch sizes. We also compare the proposed U-Net framework with other state-of-the-art approach used for this task and report better segmentation accuracy with the proposed framework on the dataset we used.

### Dataset

- **TCGA-BRCA (Public dataset).**
- **46 cases, all of them contained lesions.**
- **Each case consists of one pre- and four post-contrast volumes.**
- **Ground Truth (GT) of only the primary lesion was provided.**

### Pre-processing

1. ROI masks generation in order to exclude confounding regions.
2. Zero padding with padding width equal to half of the patch size.
4. Balanced patch extraction in order to tackle the class imbalance problem.

### Segmentation algorithm

1. 3D patch-based U-Net architecture.
2. 5-fold cross-validation across the 46 cases, 20 epochs per fold.
3. In each fold 9-10 cases for testing and the remaining were divided into 80% for training and 20% for evaluation.

### Experiments and Results

1. Two DSC values for evaluation, due to provide GT being incomplete.
2. **DSC1** is the normal dice (without post-processing) and **DSC2** is the dice of main lesions only.

### Conclusions

- Fully automatic method with better obtained results on the dataset we used compared to other method proposed in a recent study.
- 3D segmentation was performed instead of 2D as in most existing works.
- Improved segmentation of small lesions, irregular lesions and lesions with lower enhancement.
- Further improvements could be achieved by:
  1. incorporating larger dataset with a complete annotation.
  2. Utilizing information from more temporal volumes.
  3. Deployment of other architectures such as a deeper or modified architecture.