Coursework

Vassily Baranov

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Ischemic Stroke Lesion Segmentation in CT Perfusion Scans using Pyramid Pooling and Focal Loss (2018) by S. Mazdak Abulnaga and Jonathan Rubin

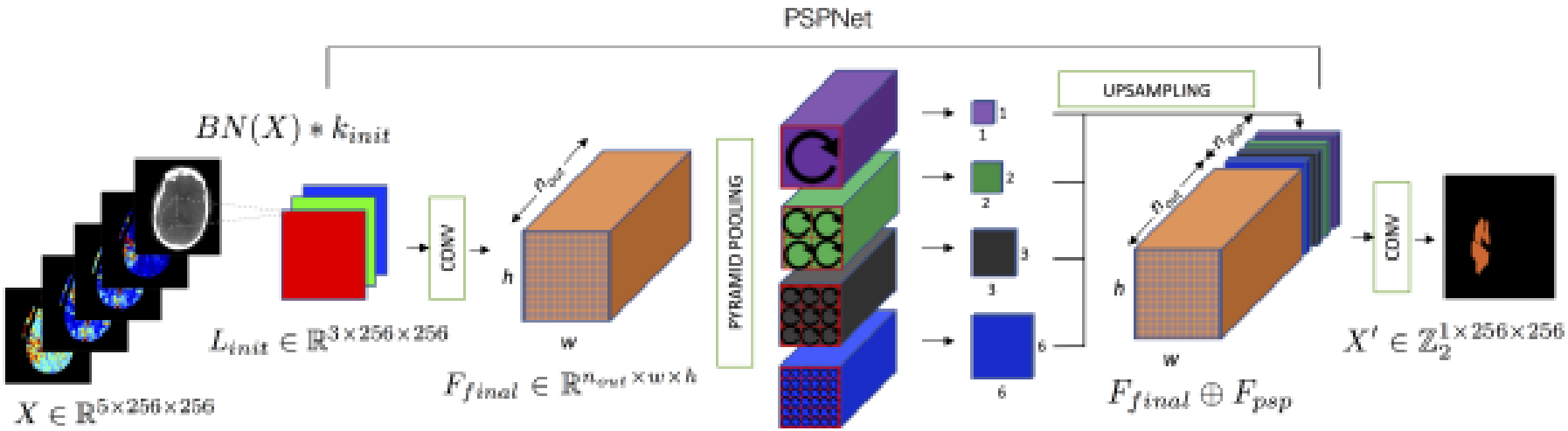
- Data and Augmentation
- Pyramid Scene Parsing Network
- Implementation details
- Cross Validation Results
- Results

Data and Augmentation

- Dataset: ISLES challenge data. Images were acquired within 8 hours of stroke onset. The scans had varying depth in the axial dimension, ranging from 2 to 22 slices. Each slice was a 256x256 image.
  Training set: 63 subjects and 94 scans.
  Test set: 40 subjects with 62 scans.

- Data Augmentation: randomly rotate the images by [-10°, 10°], translate by [-10%, 10%] of the image size, flip, and scale by a factor of [0.9, 1.1].

Pyramid Scene Parsing Network



Implementation details

- Loss function: cross entropy or focal loss functions

$$CE(p, y) = -y \log(p) - (1 - y) \log(1 - p)$$

$$\mathcal{L}_{CE} = \frac{1}{N} \sum_{i=1}^{N} CE\left(p_i, y_i\right)$$

$$FL(p, y) = -y(1 - p)^{\gamma} \log(p) - (1 - y)p^{\gamma} \log(1 - p)$$

- Optimizer: RMSProp
- Metric: Dice Similarity Coefficient

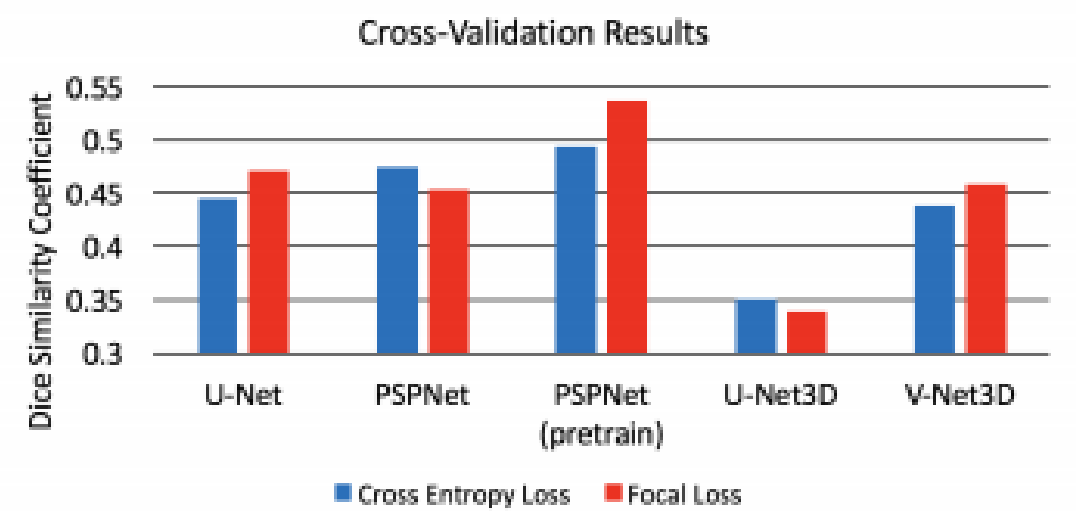
$$\mathrm{DSC}(X, Y) = 2\frac{|X \cap Y|}{|X| + |Y|}$$

- Scheduler: if no improvement was observed for 20 epochs, the learning rate was reduced by a factor of 10.
- Early stopping after 50 epochs

Cross Validation Results

- Cross validation: group 5 fold

Fold	Focal Loss	Cross Entropy Loss
1	0.64	0.64
2	0.42	0.37
3	0.48	0.50
4	0.55	0.54
5	0.58	0.41
Total	$\mathbf{0.54 \pm 0.09}$	$\mathbf{0.49 \pm 0.11}$



Results

- Results of the proposed model compared to the top scores from the ISLES leaderboard, accessed October 2018. Arrows in the header indicate whether lower or higher values are better.

	DSC ↑	Hausdorff Distance ↓	ASSD ↓	Precision ↑	Recall ↑	AVD ↓
Ours	0.44	1.62^{*}	1.62^{*}	0.59	0.43	10.18
Best	0.51	0.97^{*}	0.97^{*}	0.62	0.58	10.08
Place	$\mathbf{6^{th}/38}$	$\mathbf{6^{th}/38}$	$\mathbf{6^{th}/38}$	$\mathbf{3^{rd}/38}$	$\mathbf{18^{th}/38}$	$\mathbf{2^{nd}/38}$

The End