# Slicer 2.6 – EMSegmenter Tutorial using Non-Human Primate Data

## 1 Sample Case

#### 1.1 Sample Case Files

- Subject Files:
  - PrimateSubj001\_T1 T1 image (256  $\times$  256 in plane resolution, 124 slices, 0.496  $\times$  0.496  $\times$  0.5  $mm^3$  voxels )
  - PrimateSubj001\_T1 Subject T2 registered to T1 image
- Atlas Files (registered to T1):
  - PrimateSubj001\_CSF probabilistic atlas of CSF
  - PrimateSubj001\_GM probabilistic atlas of GM
  - PrimateSubj001\_WM probabilistic atlas of WM
- Label Maps (registered to T1):
  - PrimateSubj001\_ECC probabilistic atlas of CSF
- XML Files:
  - PrimateSubj001\_scene01\_images.xml scene containing all the images
  - PrimateSubj001\_scene01.xml scene file with all the images and settings for GM, WM, and CSF segmentation
- Results:
  - PrimateSubj001\_scene01\_Seg

#### 1.2 Atlas

The probabilistic atlas for this tutorial was created from an average of 15 subjects that were segmented using EMSegmenter in Slicer 2.6.

#### 1.3 ECC

The ECC label map was generated by inverting the ICC label map. The ICC was automatically generated from the subjects T2 image and then manually corrected by an expert user.

## 2 Gray Matter, White Matter and CSF Segmentation

#### 2.1 Files Used

- Subject Files:
  - PrimateSubj001\_T1 T1 image

- PrimateSubj001\_T1 Subject T2 registered to T1 image
- Atlas Files:
  - PrimateSubj001\_CSF
  - PrimateSubj001\_GM
  - PrimateSubj001\_WM
- Label Maps:
  - PrimateSubj001\_ECC probabilistic atlas of CSF

### 2.2 Loading Subject and Atlas Images

The input channels and the atlas is input into Slicer. The images can be loaded automatically by loading the scene PrimateSubj001\_scene01\_images.xml or the images can be loaded manually (as described earlier).



Figure 1: Contents of the Current Scene window after loading the images

#### 2.3 Setting the EMSegment Parameters

#### 2.3.1 Adding Input Channels (EM -; Step1 Tab)

Step1	Step2	Step3	Run
Step 1:	Select ori to be segn	ginal greyso nented	ales
Volume Li	st	Input Cr	
		input on	eyscau
template4Tut		template.	_T1_:
template4Tut template_ECC template_GM,		template	_T1_:

Figure 2: Adding T1 and T2 as input channels.

## 2.4 Setting Up the Class Hierarchy (Class Tab)

#### 2.4.1 ECC Class

For ECC class, set the following parameters

Mean: 3.8296, 2.3139

Covariance: 0.4753, 0.1581 0.1581, 0.1682 Prob: 0.4 Prob Atlas: PrimateSubj001\_ECC Color/Label: Black=0 Prob Data Weight: 1 Input Channel Weight: 0.01, 0.01 Note: The first channel (channel 0) is the T1, the second (channel 1) is the T2.

Note: To exclude (set to label 0) all of the ECC, we want to put maximum weight on the ECC label map and little weight on the input channels (0 weight will give an error, thus we set it to 0.01).

Help EM Class CIM
Super Class Sub Class of Head
Use Sample
Mean: 0.4786 0.5503
Covariance: 2.7485 3.1605
3.1605 3.6345
Prob.: 0.4 te_ECC_S( Color/Label:
Prob Data Weight: 1 Input Channel Weights: 1.0 1.0
Print Parameters:
UVeight PCA Quality None
Class Distribution
Class Overview

Figure 3: Parameters for the ECC Subclass

#### 2.4.2 GM Subclass

For GM class, set the following parameters

Mean: 3.8296, 2.3139 Covariance: 0.4753, 0.1581 0.1581, 0.1682 Prob: 0.4 Prob Atlas: PrimateSubj001\_GM Color/Label: Red=4 Prob Data Weight: 0.7 Input Channel Weight: 1.0, 1.0

#### 2.4.3 WM Subclass

For WM class, set the following parameters

Mean: 3.8296, 2.3139 Covariance: 0.4753, 0.1581 0.1581, 0.1682

Help EM Class CIM				
4 Super Class of ICC				
🔲 Use Sample				
Mean: 5.718 6.3328				
Covariance: 0.8224 0.7221				
0.7221 0.9035				
Prob.: 0.4 ste_GM_SE Color/Label: 4 Prob Data Weight: 0.7 Input Channel Weights: 1.0 0.1				
Print Parameters:				
Weight PCA Quality None				
Class Distribution				
Class Overview				

Figure 4: Parameters for the GM Subclass

Prob: 0.4 Prob Atlas: PrimateSubj001\_WM Color/Label: Green=5 Prob Data Weight: 0.7 Input Channel Weight: 1.0, 1.0

Help	EM	Clas	13	CIM
Super Class	3	5 Suk	) Class	of ICC
🔲 Use Samp	ole			
Mean:	6.3488	6.2287		
Covariance:	0.0967	-0.030		
	-0.030	0.0487		
Prob.: 0.3 ste_WM_SE Color/Label: 5 Prob Data Weight: 0.7 Input Channel Weights: 1.0 0.1				
Print Paramete	rs:			
🔲 Weight 🗉	PCA .	🔟 Quality	No	ine
	Class Dis	stribution		
	Class O	verview	1	

Figure 5: Parameters for the WM Subclass

#### 2.4.4 CSF Subclass

For CSF class, set the following parameters

Mean: 3.8296, 2.3139

Covariance: 0.4753, 0.1581 0.1581, 0.1682 Prob: 0.4 Prob Atlas: PrimateSubj001\_CSF Color/Label: Blue=6 Prob Data Weight: 0.7 Input Channel Weight: 1.0, 0.1

Help EM Class CIM				
6 Super Class of ICC				
Use Sample				
Mean: 5.4421 7.1171				
Covariance: 0.1301 0.0032				
0.0032 0.0474				
Prob.: 0.3 <u>tte_CSF_S1</u> Color/Label: 6 Prob Data Weight: 0.9 Input Channel Weights: 1.0 1.0				
Print Parameters:				
🗆 Weight 💷 PCA 🖃 Quality None				
Class Distribution				
Class Overview				

Figure 6: Parameters for the CSF Subclass

- 2.4.5 Subclass Probabilities
- 2.4.6 Class Distributions



Figure 7: Class Overview window for the ICC super class.

Display Class Overview						
Display Class Overview						
Name	Label	Global Prob.	Prob. Map			
3	4	0.4	ate_GM_SE			
4	5	0.3	te_WM_SE			
5	6	0.3	de_CSF_SI			
	Total Summe	1.00				

Figure 8: Class Distributions for the Sample Case.