

Spatial STAPLE Documentation

A. Downloading

- Go to the website: http://www.nitrc.org/frs/?group_id=462
- Download “masi-fusion-v1.1”

B. Installing/Setup Instructions

- Create the directory where you want the source code to be (e.g. “masi-fusion”).
- Unzip masi-fusion.zip into the created directory.
- The code is written in a combination of MATLAB (frontend) and java (backend) code. Due to the backend being written in java, you have to allocate memory to java. To do this:
 - a. Create an empty text file called “java.opts” in the “masi-fusion” directory.
 - b. Edit this file to contain the line “-Xmx15000m” (without the quotes).
 - c. This will set the maximum memory used by java to 15GB.
 - i. Java will not use this much memory unless it is actually needed.
 - ii. Obviously, you can change this amount by modifying the text file.
- Finally, from the “masi-fusion” directory, start MATLAB and set the PATH by running the “setup_labeling.m” script.
 - a. The output of the script should indicate that there is 15GB (or whatever you set it as) of memory available for java.

C. Running SpatialSTAPLE

- For generic information, type “help SpatialSTAPLE” to get basic information on how to run the algorithm.
- I will describe a typical technique to run the algorithm. There are several ways to call Spatial STAPLE, but consider the one that we most commonly use:

```
[estimate W theta] = SpatialSTAPLE(obs, epsilon, sv_prior, init_flag, ...  
                                interp_type, num_up, win_dims, ...  
                                bias, bias_theta);
```

- **Inputs**

- *obs* -> the observation struct
 - This is a structure that we have created to hold the label observations from the raters (or registered atlases).
 - For information on how to construct this see “help create_obs”, “help add_obs”, and the example scripts in the “scripts” directory.
 - For an example
 - Let “data” be an X x Y x Z x R, 4D matrix that holds the observations for all R raters, where each observation is a volume of size X x Y x Z.
 - Code to create the observation struct would be:

```
obs = create_obs('volume', [X Y Z]);  
for i = 1:R  
    obs = add_obs(obs, data(:, :, :, i));  
end
```

- *epsilon* -> the convergence factor
 - We usually use 1e-5 for Spatial STAPLE
- *sv_prior* -> an explicit spatially varying prior
 - *sv_prior* should be an X x Y x Z x L, 4D matrix, where X, Y, and Z are the dimensions of the volumes, and L is the number of labels.
 - We usually use a majority vote or locally weighted vote estimate to initialize the spatially varying prior.
- *init_flag* -> the initialization type
 - We usually use *init_flag* = 0, which indicates that the EM algorithm starts with an initial estimate of “W”, instead of “theta”
- *interp_type* -> the interpolation type for the local theta estimates
 - *interp_type* = 0, indicates nearest neighbor interpolation
 - *interp_type* = 1, indicates linear interpolation (recommended)

- *num_up* → a 3 element array indicating the number of times theta is calculated in the X, Y and Z directions.
 - The points where theta is calculated is rectilinearly distributed throughout the volume.
 - This is dependent upon the size of the volume.
 - We usually construct this so that there as at least 50% overlap between windows. (which depends upon “win_dims”).
- *win_dims* → a 3 element array indicating the size of the windows (regions) for each theta estimate
 - Again, this is dependent upon the size and resolution of the volume.
 - For a standard isotropic brain volume, we usually use something like [10 10 10].
- *bias* → the amount of bias applied to the prior estimate of theta (the linkage structure between global and local performance)
 - We usually use N_w / L , where N_w is the number of elements in each window and L is the number of labels.
- *bias_theta* → the prior estimate of theta
 - We usually use either a prior theta from majority vote or STAPLE. Obviously, theta should be $L \times L \times R$, where L is the number of labels and R is the number of raters.
 - Each column should be normalized to 1.

- **Outputs**

- estimate – the $X \times Y \times Z$ estimated segmented volume
- W – the $X \times Y \times Z \times L$ estimated label probabilities
- theta – the regional performance level parameters.