The Napoli-Copenhagen software package

Pvelab: a framework for correcting PET and SPECT data for Partial Volume Effects

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EU's 5th framework program, PVEOut, finished in June 2004

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Purpose of pvelab


- The software is able to:
  - automate the process
  - control the performance of each step in the image processing pipeline
  - visualize results from each step in the process
  - log results for later inspection
  - possible (very easy) to include own methods for each step in the PVE correction process
pvelab: Main interface

```plaintext
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pvelab: Implemented methods

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pvelab:
• software for control and logging of the image processing pipeline (NRU)

Fileload:
• Software for loading and converting analyze and dicom image files

Registration (MR and PET):
• Interactive Image Overlay (IIO, NRU)
• Interactive Point Selection (IPS, NRU)
• Interface to SPM co-registration (Statistical Parametric Mapping)
• Interface to AIR registration (Automatic Image Registration)
• Load AIR file (registration done otherwise)

Segmentation (MR):
• QMCI segmentation (Naples, uses 3 MR images T1, T2, and PD)
• Interface to SPM segmentation (Statistical Parametric Mapping)
• Interface to BrainSeg segmentation (Canterbury)
• Load segmentation volume (segmentation done otherwise)
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pvelab: Implemented methods

Reslice (MR to PET):
- Interface to ResliceWarp (using Brain Warp, Kjems, DTU)
- Interface to AIR reslicing (Automatic Image Registration)
- Reslice (pure matlab)

Atlas (defines VOI’s (volumes of interest)):
- Talairach based (Naples, 16 VOI’s)
- MNI based (Naples, requires T1, T2 and PD images)
- applyrois (NRU, 37 VOI’s)

PVE correction:
- PVE correction (Naples), including Rousset, Meltzer, and Müeller-Gartner methods

Further:
- Programs for visualization of images (NRU)
- Programs for correction of analyze files (headers)
- Other tools for correcting images

pvelab: Other possibilities

- pvelab: controls and logs the steps of the PVE correction process and makes it possible afterwards to review what has been done to the image data

- For each step it is really easy to incorporate an interface for your own favorite method or load results from your own method (alignment, segmentation, ROI definition)

- and the framework can be used for setting up a pipeline for other image processing tasks
Possible methods:
- Interactive Image Overlay (IIO)
- Interactive Point Selection (IPS)
- SPM (co-registration)
- AIR (alignlinear)

Inspecting Results:

Controlling registration more carefully using pvelab -> View -> Inspect
pvelab: Segmentation

Parameters for each of the implemented methods can be changed by selecting options.

E.g. SPM2 segmentation:

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pvelab: Atlas – VOI definition - applyrois

Svarer et al, MR-based automatic delineation of volumes of interest in human brain PET images using probability maps, Neuroimage, Feb. 2005

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New subject MR with own VOIs and three examples of transformed template VOIs

- Upper panel: Probability map for cerebellum
- Lower panel: Probability map for sensory motor cortex and parietal cortex
- As expected voxels in the middle of the VOI’s have the highest probability while more exterior voxels have lower probabilities
Learning curve, how many VOI sets shall be used for generating common VOI set

- 20 VOI sets available, randomly split into two groups of 10 VOI sets (training and test set)
- From the 10 VOI sets in training set is randomly chosen from 2 to 10 of the VOI sets and a common VOI set is generated
- From the 10 VOI sets in the test set a common VOI set is generated
- The voxel overlap between the two generated VOI sets is calculated

- Voxel overlap for the VOIs is not perfect (86%) even for 10 VOI sets in the training set, but though significantly higher than for 2 VOI sets in the training set (75%)
- Transferring only 1 VOI sets an overlap of only 62% is achieved

Brain volumes of interest
MNI space
pvelab: PVE correction

Correction for PVE using one or all of the following methods:
• Rousset (VOI)
• Meltzer (image)
• Müller-Gartner (image)
• Alfano (image)

pvelab

• A possibility for setting up a PET processing pipeline including automatic definition of regions and correction for partial volume effects, without having to program yourself

• Have already been downloaded by about 90 different sites

• Can be downloaded from the internet:
  – Send an email to pvelab@nru.dk and we will send instructions for download and installation
  – remember also to download: mriwarp-1.03.tar.gz
  – and Matlab 6.5/7.2, Automatic Image Registration (AIR 5), and Statistical Parametric Mapping (spm2) are required.
• And now questions and demo