

## Analisis Data Pengimejan Resonans Magnet Kefungsian: Pra Pemrosesan Ruang Menggunakan Kaedah Pemetaan Statistik Berparameter

AHMAD NAZLIM YUSOFF, MOHD HARITH HASHIM,  
MOHD MAHADIR AYOB & ISKANDAR KASSIM

### ABSTRAK

*Kajian garis pangkal pengimejan resonans magnet kefungsian (fMRI) telah dijalankan ke atas 2 orang subjek lelaki sihat (kidal dan tidak kidal) masing-masing berumur 22 dan 25 tahun. Imbasan fMRI dijalankan menggunakan sistem pengimejan resonans magnet (MRI) 1.5 T di Jabatan Radiologi, Hospital Universiti Kebangsaan Malaysia. Kajian ini menggunakan gerakan jari tangan kanan dan kiri untuk merangsang aktiviti neuron di dalam korteks serebrum. Paradigma 5 kitar aktif-rehat digunakan dengan setiap kitar mengandungi satu blok aktif dan satu blok rehat yang masing-masing mengandungi 10 siri pengukuran. Imej fMRI dianalisis menggunakan pekej perisian MatLab dan pemetaan statistik berparameter 2 (SPM2). Proses pendaftaran jasad tegar menggunakan penjelmaan afin 6 parameter dilakukan ke atas kesemua imej kefungsian berwajaran T2\*. Keputusan menunjukkan bahawa pergerakan subjek adalah minimum sama ada dalam arah translasi ( $< 1$  mm) atau putaran ( $< 1^\circ$ ). Kesemua imej dinormalkan melalui proses peledingan tak linear menggunakan penjelmaan afin 12 parameter dan didapati sepadan dengan pencontoh yang telahpun mematuhi ruang anatomi piawai. Walau bagaimanapun, bentuk, resolusi dan kontras imej kefungsian telah berubah sedikit berbanding dengan imej asal. Pelicinan imej menggunakan kernel Gaussian isotropik 6 mm menyebabkan data imej lebih bersifat parametrik dengan kehilangan yang ketara dalam resolusi dan kontras. Pengasingan struktur yang dilakukan ke atas imej berwajaran T1 mengklaskan tisu otak kepada jirim kelabu, jirim putih dan bendalir serebrospina. Pasca pemrosesan ruang bagi imej kefungsian dan struktur menjadikan data imej bersifat parametrik dengan taburan jenis Gaussian dan sedia untuk dianalisis menggunakan model linear am dan teori medan rawak Gaussian.*

*Kata kunci: Pengimejan resonans magnet kefungsian (fMRI), penjajaran semula, penormalan, pelicinan, pensegmenan.*

### ABSTRACT

*Baseline functional magnetic resonance imaging (fMRI) study has been carried out on 2 healthy male subjects (left and right handed), aged 22 and 25 years old, respectively. The fMRI scans were performed using a 1.5 T magnetic resonance imaging (MRI) system at the Department of Radiology, Universiti Kebangsaan Malaysia Hospital. The study used the movement of the right- and left-hand fingers to stimulate neuronal activity in the cerebral cortices. A five-cycle active-rest paradigm was used with each cycle consisted of 1 active block and 1 rest block which individually consisted of 10 series of measurements. The fMRI images were analysed using MatLab and statistical parametric mapping 2 (SPM2) software packages. A rigid body registration using 6-parameter affine transformation was performed on all T2\*-weighted functional images. The results showed that the subject's movement was minimum in either translational ( $< 1$  mm) or rotational ( $< 1^\circ$ ) direction. All images were normalized via a nonlinear warping using a 12-parameter affine transformation and were found to match a template that already conform to a standard anatomical space. However, the shape, resolution and contrast of the functional images were slightly altered as compared to the originals. Image smoothing using an isotropic 6 mm Gaussian kernel rendered the image data parametric with a considerable loss in resolution and contrast. Structural segmentation performed on T1-weighted images classified brain tissues into grey matter, white matter and cerebrospinal fluid. The spatial preprocessing of the functional and structural images rendered the data parametric with Gaussian type of distribution, ready to be analysed using the general linear model and Gaussian random field theory.*

*Key words: Functional magnetic resonance imaging (fMRI), realignment, normalisation, smoothing, segmentation.*