

1.

[4 점] 신경과학자 David Van Essen 은 MRI 를 일컬어 'a workhorse technology because of the diversity of information attainable using the same scanner to acquire images'라고 했습니다. 이 표현이 함축하는 바를 설명하시오.

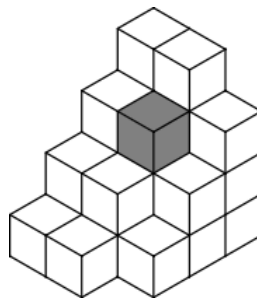
[4 points] Neuroscientist David Van Essen referred to MRI as "a workhorse technology because of the diversity of information attainable using the same scanner to acquire images." Explain the implications of this expression.



2.

[4 점] 3 차원 부피 데이터인 MRI 데이터를 구성하는 최소 단위로서 흔히 수 mm^3 정도의 크기를 갖는 Voxel(Volume Element 또는 Volumetric Pixel)의 값이 나타내는 바를 설명하시오.

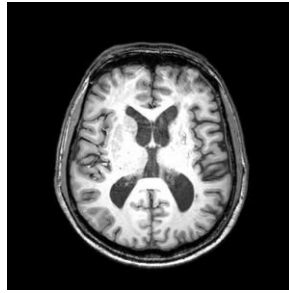
[4 points] Explain what is represented by the value of a voxel (Volume Element or Volumetric Pixel), which is the smallest unit that composes MRI data as a three-dimensional volume data and commonly has a size of several cubic millimeters.



3.

[5 점] Structural MRI(sMRI)의 T1-weighted Contrast 를 이용하여 뇌의 해부학적 구조(Structure)를 가시화할 수 있는 원리를 설명하시오.

[5 points] Explain the principle by which the anatomical structure of the brain can be visualized using the T1-weighted contrast of structural MRI (sMRI).



4.

[3 점] Structural MRI(sMRI) 데이터의 전처리(Preprocessing) 과정에서 Segmentation 을 통해 얻은, 아래와 같은 Grey Matter Map 에서 각 Voxel 별 값은 무엇을 나타내는지 기술하시오.

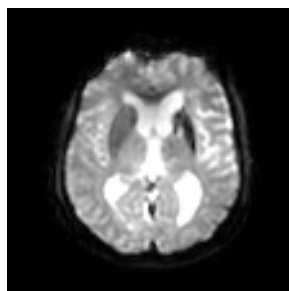
[3 points] In the preprocessing of structural MRI (sMRI) data, describe what the values of each voxel represent in the following grey matter map obtained through segmentation.



5.

[5 점] Functional MRI(fMRI)는 뇌 기능과 관련된 신경세포의 활성화(Activity)을 간접적으로 측정할 수 있는 방법입니다. fMRI 의 BOLD(Blood-Oxygen-Level-Dependent) Contrast 를 이용하여 신경세포의 활성화의 측정이 가능한 원리를 설명하시오.

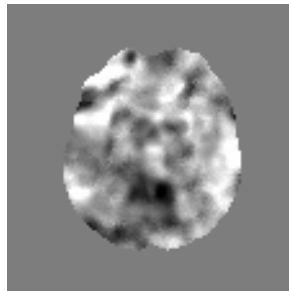
[5 points] Functional MRI (fMRI) is a method that can indirectly measure the activity of neurons related to brain functions. Explain the principle by which the activity of neurons can be measured using the BOLD (Blood-Oxygen-Level-Dependent) contrast of fMRI.



6.

[3 점] 특정한 과제나 자극 중에 얻은 Task-based Functional MRI(fMRI) 데이터의 전처리(Preprocessing) 후 Segregation 관점에서의 뇌 기능 분석을 통해 얻은, 아래와 같은 뇌 활성화(Activity) Map 에서 Voxel 별 값은 무엇을 나타내는지 기술하시오.

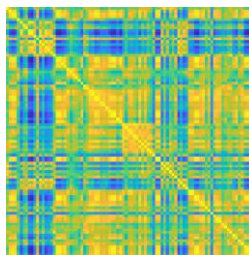
[3 points] In task-based functional MRI (fMRI) data acquired during specific tasks or stimuli, describe what the values of each voxel represent in the following brain activity map obtained by functional segregation analysis following preprocessing.



7.

[3 점] 특정한 과제나 자극 없이 얻은 Resting State Functional MRI(fMRI) 데이터의 전처리(Preprocessing) 후 Integration 관점에서의 뇌 기능 분석을 통해 얻은, 아래와 같은 Functional Network Map 에서 Element 별 값은 무엇을 나타내는지 기술하시오.

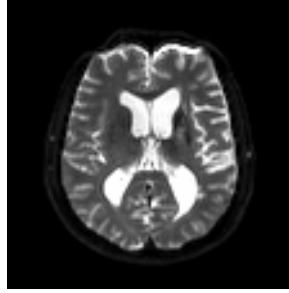
[3 points] In resting state functional MRI (fMRI) data acquired without specific tasks or stimuli, describe what the values of each element represent in the following functional network map obtained by functional integration analysis following preprocessing.



8.

[5 점] Diffusion-weighted MRI(dMRI)는 흔히 'White Matter Imaging'이라고 불립니다. dMRI 의 Diffusion-weighted Contrast 를 이용하여 White Matter 의 구조적 특성을 측정할 수 있는 원리를 설명하시오.

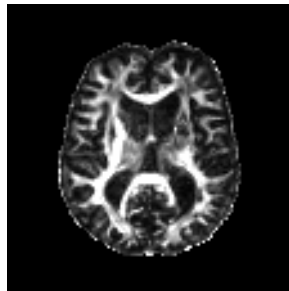
[5 points] Diffusion-weighted MRI (dMRI) is commonly referred to as "white matter imaging." Explain the principle by which the structural properties of white matter can be measured using the diffusion-weighted contrast of dMRI.



9.

[3 점] Diffusion-weighted MRI(dMRI) 데이터의 전처리(Preprocessing) 후 Diffusion Tensor Model 을 이용하여 얻은, 아래와 같은 Fractional Anisotropy Map 에서 각 Voxel 별 값은 무엇을 나타내는지 기술하시오.

[3 points] In diffusion-weighted MRI (dMRI) data, describe what the values of each voxel represent in the following fractional anisotropy map obtained by diffusion tensor modelling following preprocessing.



10.

[5 점] Diffusion-weighted MRI(dMRI)는 White Matter Fibre Tract 의 경로(Trajectory)를 간접적으로 관찰할 수 있는 방법입니다. dMRI 데이터를 이용하여 White Matter Fibre Tract 의 재구성이 가능한 원리를 설명하시오.

[5 points] Diffusion-weighted MRI (dMRI) is a method that allows for the indirect observation of the trajectory of white matter fibre tracts. Explain the principle by which the reconstruction of white matter fibre tracts is feasible using dMRI data.

