Medical Image analysis
## Week 1: Assignment Questions

# Answer all Questions.

1. What is the estimated market of medical image analysis in year 2020
   - (a) \$3.5 Billion
   - (b) \$3.5 Million
   - (c) \$6 Billion
   - (d) \$6 Million

2. Anaconda platform is used for which language
   - (a) Lua
   - (b) C
   - (c) C++
   - (d) Python

3. Which is the specialist Literature for Medical image analysis
   - (a) IEEE J. Biomedical and Health Informatics
   - (b) IEEE Trans. Biomedical Engineering
   - (c) ACM Trans. Graphics
   - (d) None of these

4. What among the following is a journal on ML
   - (a) ICML
   - (b) ACML
   - (c) CVPR
   - (d) None of these

5. What is the kinetic energy of an electron with mass 9.31×10^{-31} Kg moving with the velocity of light
   - (a) 41 fJ
   - (b) 39.25 fJ
   - (c) 40.95 fJ
   - (d) 39.5 fJ

6. What is the kinetic energy of a particle having wavelength of 2 pm. Plank's constant 6.6×10^{-34} J-sec
   - (a) 99 pJ
   - (b) 98 pJ

(c) 99 fJ

(d) None of these

7. In figure shown below the μ_1, μ_2, μ_3 are the attenuation coefficient of the 3 different materials given. The materials are of length L_1, L_2, L_3 respectively. Calculate the value of N_2
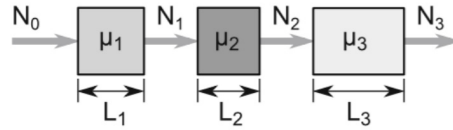

(a) $N_0 e^{(-\mu_1 L_1 - \mu_2 L_2 - \mu_3 L_3)}$

(b) $N_0 e^{(-\mu_1 L_1 - \mu_2 L_2)}$

(c) $N_0 e^{(-\mu_1 L_1) + N_1}$

(d) None of these

8. What is the Hounsfield unit of brain where attenuation coefficient of brain and water is 0.237 and 0.214 respectively.

(a) 23

(b) 97.05

(c) 107.48

(d) None of these

9. Identify the imaging modality

A   B   C   D
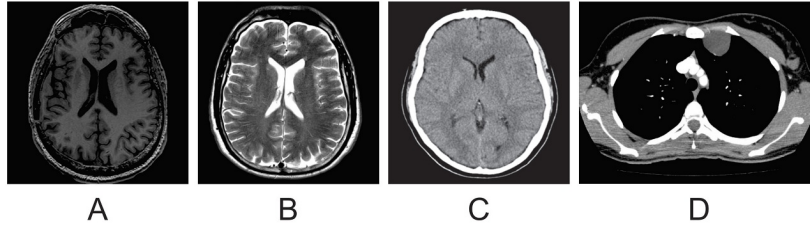
(a) A - CT, B - T1 weighted MRI, D- T2 weighted MRI, D - T1 weighted MRI

(b) A - T2 weighted MRI, B - CT, C- T1 weighted MRI, D - X ray

(c) A - T1 weighted MRI, B- T2 weighted MRI, C - CT D - CT

(d) A - T2 weighted MRI, B - CT, C - T1 weighted MRI, D - CT

10. Calculate the Larmor frequency of a molecule subjected to a magnetic field of 1.5 T

    (a) 63.87 MHz
    (b) 401.11 MHz
    (c) 100.28 MHz
    (d) 28.39 MHz

11. Choose the correct statement

    (a) T1 relaxation time in MRI is longer than T2 relaxation time
    (b) T2 relaxation time in MRI is longer than T1 relaxation time
    (c) T1 and T2 relaxation time in MRI are equal
    (d) T1 relaxation time in MRI can be longer or shorter than T2 relaxation time

12. Consider a 1.5 T MRI scanner with a slice encoding gradient of 10 mT/m. What should be the step size in scanning frequency to achieve a slice resolution of 10 mm?

    (a) 42.58 MHz
    (b) 4.258 MHz
    (c) 4258 Hz
    (d) 4258 MHz

13. Consider the scheme shown in the following figure for ultrasound imaging of soft tissue. For the point P shown in the figure, find the propagation time for the jth transducer for beamforming in ultrasound scanning. Assume point O to be the origin of the coordinate system and length of each transducer 1 mm. Given, $R_{fp} = 10$ $cm, \theta = 15°$, speed of sound in soft tissue $= 1540$.
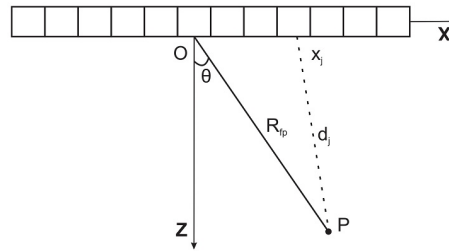
    (a) 64.46 μs
    (b) 6.28 ms
    (c) 1.93 μs
    (d) 6.49 ms

14. From the following list of ultrasound frequencies, choose the best one for imaging heart.

    (a) 20 MHz

    (b) 3 MHz

    (c) 10 MHz

    (d) 100 MHz

15. Let P_1 and P_2 be the pressure of the echo pulse received corresponding to frequencies f_1 and f_2 in ultrasound imaging. If $f_1 > f_2$, what is the relation between P_1 and P_2?

    (a) $P_1 < P_2$

    (b) $P_1 > P_2$

    (c) $P_1 = P_2$

    (d) There is no relation between pressure of echo pulse and frequency.

16. Arrange the following materials in increasing order of acoustic impedance.
    A - Adipose tissue, B - Brain tissue, C - Compact bone, D - Liver

    (a) A<D<B<C

    (b) C<D<B<A

    (c) C<B<D<A

    (d) A<B<D<C

17. Calculate the angular aperture for a lens having numerical aperture 0.5. Consider air as the medium.

    (a) 15°

    (b) 60°

    (c) 30°

    (d) 64.4°

18. In optical microscopy, what kind of artifact is observed in relation with high numerical aperture?

    (a) Blurring

    (b) Saturation

    (c) Airy disk effect

    (d) None of these

19. What is the relation between depth of focus and numerical aperture in optical microscopy?

    (a) No relation

    (b) Depth of focus increases with increase in numerical aperture

    (c) Depth of focus decreases with increase in numerical aperture

20. What kind of microscope is used for fluorescence imaging?

    (a) Transmission light microscope

    (b) Reflected light microscope

    (c) Both transmission and reflected light microscope

    (d) None of these

End