Day: M T W T F S S

Name * Guldai Zahid
ID # * 15175
Paper * CR & DR
Submitted to * Mam. Maheen Gul.

Question: 1

Features of Pre processing:

→ Preprocessing of digital images is largely automatic.

→ Preprocessing is designed to produce artifact-free digital images.

→ Preprocessing provides electronic calibration to reduce row-to-row column-to-column and pixel-to-pixel response difference.

→ The process of pixel interpolation, lag correction and noise correction are automatically applied with most systems.

Day: M T W T F S S

→ Gain image are generated every few months, and offset images are generated many times.

→ Offset images and gain images are automatic calibration images designed to make the response of image receptor uniform.

→ The preprocessing calibration technique is flatfielding. Digital image receptors and display devices have milions of pixels.

→ Digital image generators an electronic latent image that may to not be made visible completly.

→ Some voltage variation may be seen along the buses that drive each pixel, the defect is called line noise which cause linear artifacts to appear on final image.

Date:

Day: M T W T F S S

Feautures of Postprocessing Image:

- Postproccessing is where digital imaging shines.
- Postprocessing requires intervention by technologist.
- Postprocessing refers to anything that can be done to a digital radiographic image after i is acquired.
- Postprocessing image perform to optimize the appearence of image for Purpose of
- better detecting pathology. Annotation is the adding text on image.
- Dynamic range of images up to 16-bit, 65-536 grey.
- The larger matrix size digital display devices have beter spatial resolution b/c of small pixels.
- Multiple digital images must be flipped horizontal or verticaly.

→ Pixel shift can be corrected by reregistering the image through techniques.
→ Edge enhancement is effective for fractures and small, high contrast tissues.
→ Highlighting can be effective.

Question: 2

	Spatial Resolution	Contrast Resolution
(1)	Ability of imaging system to resolve and render on the image a small, high-contrast image.	Ability to distinguish b/w and to image similar tissues.
(2)	Spatial resolution described by the quantity "Spatial frequency"	The principal descriptor for contrast resolution is grey scale called & dynamic range.

Date:

Day: M T W T F S S

(3) Spatial Frequency is relates to the number of line pairs in a given length usualy cm , mm.

(4) With higher spatial frequency has better spatial resolution.

(5) At low spatial frequencies , MTF for radiographs should be higher

(5) Dynamic range is the number of grey shades that an imaging system can reproduce.

Image noise limits contrast resolution

high contrast objects is said to be limited by the MTF. of imaging system.

Date:

Day: M T W T F S S

Question: 3

Characteristics which results in low patient dose:

→ patient dose reduction should be possible beacuse of the manner in which digital image receptor responds to x-rays and because of properties of DQE.

Image receptor response:

- Digital image receptor is linearly related to radiation dose but image contrast resolution does not change with dose.
- One cannot overexpose or underexpose a digital image receptor.
- Therefore a digital image should never requires repeated because of exposure factors, which results range approximately

Date:
Day: M T W T F S S

5 a/b.

- Radiographic techinque for screen-film imaging requires;
  (i) that an appropriate KVp be selected on the basis of anatomy that is being examed.
  (ii) that the proper mAs be selected to produce proper OD.

- Digital imaging techniques must be approched differently.
- Instead of "dose creep" "technique creep" is used. This will results in low patient dose.
- When examination to be conducted, KVp should start to increase, and reduction in mAs should be noted with successive examination. This results with adequte contrast resolution,

constant spatial resolution and reduced patient radiation dose.

Detective Quantum Efficiency:

- The discriptor used for medical imaging is DQE.
- DQE related to the absorption of coefficiant and to the spatial frequency of the imaging forming x-ray beam.
- Patient dose in DR should be low because of high DQE of ~~high~~ image receptor.
- Note that DQE for DR is higher than for CR. and CR is slightly higher DQE than Screen-film.
- Relative value of DQE for various image receptor means that fewer x-rays are required by higher DQE

Date:
Day: M T W T F S S

receptor to produce an image, results in low pt dose.

⇒ Thes above analysis of image receptor response and DQE shows - that both characteristics of digital image receptors suggest - that patient dose should be less.

Question: 4

Active-matrix liquid-crystal display: (AMLCD)

⇒.. The concept of AMLCD is was proposed by Berned. J. Lechner at the RCA Laborales in 1968.

⇒.. The first function of AMLCD with thin-film transistors.

⇒.. AMLCD is a type of flat-panel display the only viable technology for

Date:
Day: M T W T F S S

→ TV, computers, table computers and smartphones with an LCD screen due to low weight, very good quality, wide colour and response time.

→ The most common type of AMLCD contains, beside the polarizing sheets and cells of liquid crysts, a matrix of thin-film transistors to make thin-film transistor liquid crystal display.

→ LCDs are superior to CT displays.

→ It has high ~~qua~~ property of highly ordered molecular structure, a crystal and the property of viscocity of fluid.

→ liquid crystal are linear organic molecules that are electrically charged forming a natural molecular dipole.

Date:
Day: M T W T F S S

→ The liquid crystals can be aligned through the action of external electric field.

→ AMLD has very intense white backlight that illuminate each pixel.

→ Eeach pixel contains light polarizing filters and films. Color AMLD have red-green-blue filters.

→ Spatial resolution improves with higher megapixel display devices.

→ Flat panal digital display devices are identified by number of pixels in AMLCD.

→ **Image luminance:**

* Aperture ratio is a measure of image luminance of LCDs.
* Apperture ration is to a display device as "fill factor"

is to digital radiographic detector.

* Aperture ratios of 50 % to 80 % are characteristic of medical LCDs.

Ambient light:

* Liquid crystal displays are designed to better reduce the influence of ambient light on image contrast.

This characteristic of flat panal digital display devices has led to considered ergonomic design of digital work station.

Date:

Day: M T W T F S S

13

Question: 5

Picture achiving and Communication System :- (PACS):-

➡ Radiology has adopted digital imaging very rapidly.

➡ When PACS fully implement its not allow not only the acquistion but also storage of each medical image in degital form.

➡ PACS improves image processing viewing, storage, recall and interpretation.

➡ Four principle components of PACS are;

- display sytem
- Storage system
- Network
- acquisition system

Date:
Day: M T W T F S S

PACS Network:

→ It is effective and quick & also easy to use.

→ Computer scientists use the term network to describe the manner in whic computer can be connected to interact with one another.

→ Network are used for medical data in some countries.
Any hospital at any time can enter the unique identifier and acess the medical records for patient.

→ In Radiology network may consist of various types of devices that allow storage, retrieval, and viewing of image. PACs remote etc.

Teleradiology:

→ It is the process of remote transmission and viewing of image.

Date:

Day: M T W T F S S

NEMA has produced a standerd imaging format called "DICOM".

At any time images are transffered to clients within or outside the hospital through PACs.

PACS System storage:

Image storage requirement are determines by the no. of images and images of data file size.

Image file size = matrix size x greyscal bit depth.

Backup images storage is accomodated offsit at a digital data storage vendor.

By using PACS the workflow chart is greatly reduced leads to improved efficiency.

te:_____

y: M T W T F S S

11

Question : 6

What is artifacts:

definition:

→ An Artifacts are any false visual feature on medical image.

→ It interfare with diagnosis and must be avoided.

→ It can be controable when causes of artifacts are understood.

Types of artifacts:

Three digital radiographic image artifacts are;

(i) Image receptor artifacts
(ii) Software artifacts
(iii) Objects artifacts.

(i) Image receptor artifacts:

: It occurs due to rough handling, dust and scratches.

: Pixel malfunction

Date:
Day: M T W T F S S

- Ghost images:

The appearance of Ghost images occurs b/c of incomplete erase of previous image.

Avoidance:

- Artifact produce by dust can be corrected easily with proper cleaning. ~~Unless~~
- Scratches or pixel malfunction requires replacement of image receptor.
- Ghost artifacts can be avoided by additonal signal erasure technique. IP should be erased again before use.

(2) Software Artifacts:

- The artifacts produce during development of software.

Date:
Day: M T W T F S S

10

- In software development life cycle artifacts usually refers to (things) that are produced by people involved in process.

Examples:

- → Document design
- → data modles
- → workflow → test matrices
- → setup → script → plans.
- → architecture of software.

- Processing artifacts also occur due to dead pixels & row/column of pixels.

Avoidance:

- Before [redacted] a image is prepared "for processing" several manipulation of output of an image receptor may be necessary for correctness of artifacts.
- Anti-virus to software also done.

Date:
Day: M T W T F S S

(3) Object Artifacts:

- These artifacts are arises due to technologist's error in patient posining, x-ray collimation and also due to histogram selection.
- Backscatter also can be troublesome b/c Back Scatter produce phantom images.

How to avoid:

- Technologist should be experienced.
- Back side of Image receptor should be sheilded to reduce backscattering x-ray.
- Accurate patient possition.
- Accurate x-ray colimation.

Date:
Day: M T W T F S S

20

Question : 7

Basis for data Compression :

* Compression is the act of flattening soft tissue to improve optical density.

* Transmiting and achiving the amount of data is techinically difficult therefore compression are used.

* Data compression take advantages of redundancy of data as occurs with exposure to raw x-ray beam.

* Up to 50MB per image on a 24- x30-cm IP, a four-view digital mammogramphy study can generate 200 MB.

Date:

Day: M T W T F S S

Loseless Compression:

* An image file that is Compressed in lossess mode can be reconstructed same as original.
* It reduce data file to 10 % (10:1) to 50 % (2:1) of original file.
* It is not satisfactory for large image files because of unacceptable transmition and manipulation time.
* It up to 3:1 generaly considerd acceptable and helpful in digital radio-graphic image mangment.

Lossy Compression:

* It provide compression factor up to 100:1 ..
* Lossy compression is that which is something

greater than an order of magnitude less than 10:1, such level supports teleradiology.

* Lossy compresion is not acceptable for archiving mammography images.

* It can cause CAD system to miss lesion b/c of compression artifacts.

Question: 19

→ If x-ray feild is not properly collimated, sized, positioned then errors may occurs.

Improper collimation:

Collimation is projected x-ray beam area for patient radiation dose.

Date:
Day: M T W T F S S

Due to

- Improper collimation, the histogram can be improperly analyzed which results in artifacts.
- The use of three collimated margins usually works but few than three are used than artifact will results.
- If images are not collimated and centered than image exposure will not be accurate and cannot used for image quality evaluation.

Partitioning:

- If multiple field is projected onto a single IP each must have clear, collimated edges and margins b/w each field this process is called **Partiting.**
- The exposure field recognition algorithm is unable to match image histogram

Date:
Day: M T W T F S S

If the feilds are not clear.

- This algorith is based edge detection or eare detection.

Alignment:

- Alignment of exposure feild on the IP is important in the same way as collimation.

- If it is not oriented with size and dimension of the IP, image artifacts can appear.

Date:
Day: M T W T F S S

Question :8

For Processing and For presentation of an image:

* For processing images are manipulated for presentation images that radiologic technologist can use for ~~OR~~ QC and for interpretation by radiologist.
* Before an image is prepared for processing several manipulation of the output of an image receptor may be necessary to correct for potential artifacts.
* Such artifacts can ~~cause~~ occurs because of dead pixels, rows and colowms.

Date:
Day: M T W T F S S

* Preproccessing manipulation known as flat feilding is performed in a uniform resulting response to uniform x-ray beam.

Note *

* For processing image is obtain from raw data set of digital radiographic image.

* The image which is obtain by manipulating of "for processing" know as for-presentation image.