SAM Questions – Sunday, April 15

Sunday, April 15th 8:00am-8:45am – Mark Michalski, MD

SAM - Deep Learning – Artificial Intelligence in our Future

1. What is "deep learning"?

a. A family of computational approaches which allow learning representations of data at various layers of abstraction by using layers of "neurons" arranged into a network
b. A broad range of computational techniques which rely on computers to improve and learn without being explicitly programmed
c. An interdisciplinary field of algorithms, computational processes and methods for gleaning insights from both structured and unstructured data
d. An educational principle for medical students, residents and fellows to help them understand the core elements of data science

Answer: A

Rationale: A family of computational approaches which allow learning representations of data at various layers of abstraction by using layers of "neurons" arranged into a network

Remediation: *Machine learning* is a broad range of computational techniques which rely on computers to improve and learn without being explicitly programmed. *Data Science* is an interdisciplinary field of algorithms, computational processes and methods for gleaning insights from both structured and unstructured data.

Reference(s): LeCun, Y, Bengio Y, Hinton G. Deep learning. *Nature.* 2015 May 28;521(7553):436-44. doi: 10.1038/nature14539

2. What is one of the primary properties of neural networks vs traditional computer vision classifiers?

a. As compared to traditional classifiers, neural networks typically require less labeled data
b. As compared to traditional classifiers, neural networks typically take more programmers and time to code
c. As compared to traditional classifiers, neural networks have recently demonstrated higher accuracy for many image classification tasks
d. As compared to traditional classifiers, neural networks can only be used for a narrow set of classification tasks in radiology

Answer: C

Rationale: As compared to traditional classifiers, neural networks have recently demonstrated higher accuracy for many image classification tasks

Remediation: As compared to traditional computer vision classifiers, neural networks generally require more labeled data, but take less task-specific coding and can be used for a very broad heterogeneous set of data

Reference(s): LeCun, Y, Bengio Y, Hinton G. Deep learning. *Nature.* 2015 May 28;521(7553):436-44. doi: 10.1038/nature14539

3. In general, competitions like the "DREAM Challenge" accelerate development in the space of machine learning through what mechanisms?

a. Encouraging large numbers of medical centers to contribute labeled data to a database for building deep learning models
b. Extending the invitation to compete to only the best machine learning practitioners
c. Guarantee that models will be translated into a clinical environment for further testing
d. Provide prizes, including cash rewards, for the top performing teams

Answer: D

Rationale: Provide prizes, including cash rewards, for the top performing teams

Remediation: Data science competitions typically provide some reward, often a cash prize, for the highest performing teams. While competitions may encourage multiple academic centers to provide data, generally data comes from only a single (or a few) sites. While models sometimes translate to clinical usage, this is not guaranteed.

Reference(s): https://www.synapse.org/#!Synapse:syn4224222/wiki/401743

4. What is the general state of the application of deep learning in breast imaging today?

a. Its application is predominately limited to extending the accuracy and reducing recall rates in digital mammography
b. It is implemented in nearly every CAD system today
c. There are potential applications in ultrasound and MRI in the research phase
d. Regulatory considerations mean that these technologies probably won't reach practical usage for at least 5 more years

Answer: C

Rationale: There are potential applications in ultrasound and MRI in the research phase

Remediation: Deep learning is being evaluated in nearly every modality used in radiology, but implementation in practice is just beginning. Regulatory considerations, while sometimes challenging, are not likely to prevent implementation, with several deep learning radiology products already FDA.

Sunday, April 15th 8:45am-9:15am – Elizabeth A. Morris, MD

SAM - Radiomics - Useful Information Hiding in Plain Site

1. Radiomics refers to:

A. The combined data from an individual patient

B. SEER Data base
C. Evaluation of data contained within radiology images
D. Evaluation of economics of radiology

Answer: C

Rationale: Radiomics refers to analysis of radiographic image data contained within images.

Reference: Radiomics: Images Are More than Pictures, They Are Data Radiology. 2016 Feb;278(2):563-77.

2. The type of information contained within images includes:

A. Entropy
B. Karma
C. Skewness
D. Both A and C
E. None of the above

Answer: D

Rationale: Entropy and Skewness are Texture Features that can be analyzed in images. Karma bringing upon oneself inevitable results, good or bad.

Reference: Cancer imaging phenomics toolkit: quantitative imaging analytics for precision diagnostics and predictive modeling of clinical outcome. J Med Imaging 2018 Jan;5(1):011018

3. Choose the correct statement about the field of Radiogenomics:

A. Relationship between imaging and genomics, resulting in potential prediction and prognostic biomarkers
B. Analysis of tumor DNA only is performed
C. Image data generated will tell what gene abnormality is present
D. It has little capacity to impact how we take care of patients
E. Radiogenomics can only be performed in the breast currently

Answer: A

Rationale: Radiogenomics can be performed with a myriad of genetic data – not just DNA.

Reference: Behind the Numbers: Decoding Molecular Phenotypes with Radiogenomics—Guiding Principles and Technical Considerations. Radiology 2014

Sunday, April 15th 9:15am-9:45am - Maxine S. Jochelson, MD

SAM - Contrast Enhanced Mammography - Putting the Theory into Practice

1. Contrast Enhanced Mammography should not be used for:
   A. Further evaluation after abnormal screening mammogram
   B. Determination of what to do with suspicious calcifications

C. Assessing response after neoadjuvant chemotherapy
D. Preoperative staging for new breast cancer

Answer: B

Rationale: Even though one may get additional information from CEDM, lack of uptake does not exclude cancer- just as with MRI.

Reference: Cheung et al Eur Radiology July 2015.

2. Contrast Enhanced Mammography compares favorably to MRI in which of the following ways:
   A. Patient preference
   B. Cost
   C. Likelihood of allergic reaction
   D. Not requiring an injection

Answer: A

Rationale: Patients prefer contrast mammography.

Reference: Hobbs et al Journal of Medical Imaging and Radiation Oncology 2015.

3. In using Contrast Enhanced Mammography for preoperative staging
   A. No biopsy is required to confirm malignancy
   B. Patients with abnormal renal function can be imaged
   C. Tumor size is better predicted with contrast mammography
   D. Specificity is better with MRI

Answer: C

Rationale: Contrast mammography is the most accurate depiction of tumor size

Reference: Lobbes et al Journal of Cancer 2015