Translational Research: Priorities for Enabling Computer-Based Medical Systems Knowledge Representation and Analysis.

Imaging Informatics in Medicine

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Imaging Informatics is a subspecialty of Biomedical Informatics that aims to improve the efficiency, accuracy, usability and reliability of medical imaging services within the healthcare enterprise.

Branstetter, B (2007). "Basics of Imaging Informatics". Radiology 243 (3): 656–67

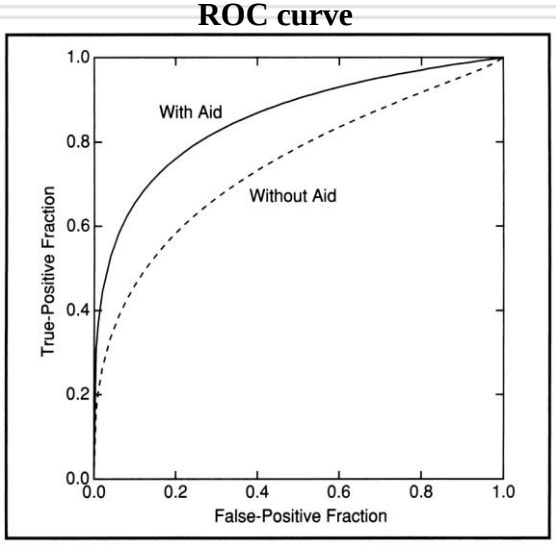
Computer-aided Diagnosis (CAD)

Definition:

A diagnosis made by a radiologist using the output of a computerized scheme for automated image analysis as a diagnostic aid (second opinion).

K. Doi - Computerized Medical Imaging and Graphics 31 (2007) 198–211

With CAD, the performance by computers does not have to be comparable to or better than that by physicians, but needs to be complementary to that by physicians (synergy).



Nishikawa RM - Applied Radiology, Suplement November 2001:14-16

Content-Based Image Retrieval

CBIR

Definition:

Content-based image retrieval (CBIR), also known as query by image content (QBIC) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for similar images in large databases.

Content-based means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, and/or descriptions associated with the image.

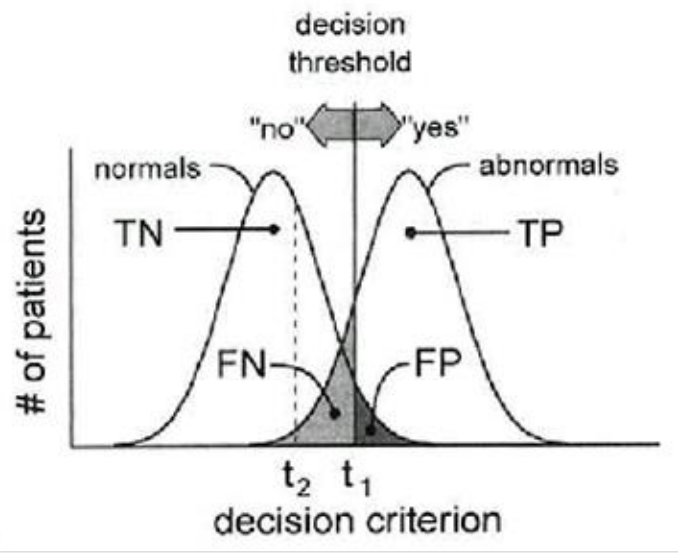
Müller H. et al. International Journal of Medical Informatics (2004) 73, 1—23

$$\text{precision} = \frac{\text{number of relevant items retrieved}}{\text{number of items retrieved}}$$

$$\text{recall} = \frac{\text{number of relevant items retrieved}}{\text{number of relevant items}}$$

DIAGNOSIS

Signal Detection Theory – Decision Matrix



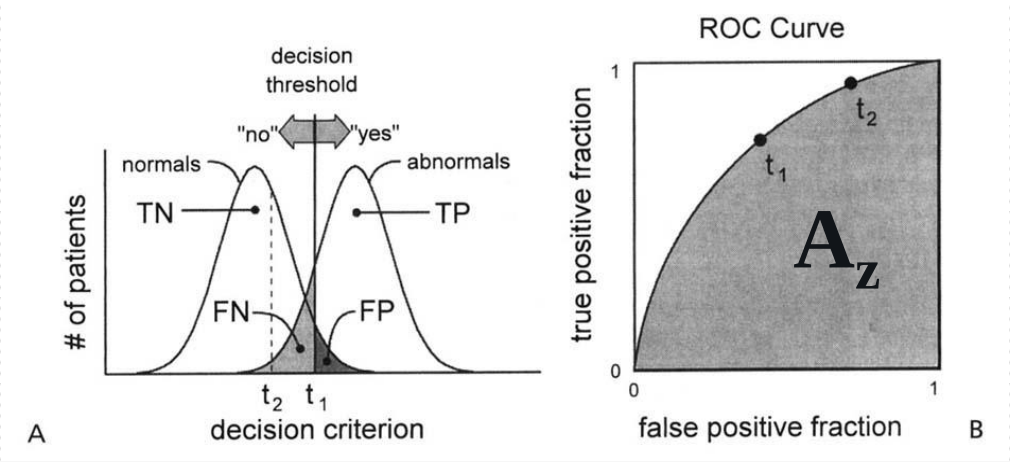
	Confirmed Abnormal	Confirmed Normal
Diagnosed as Abnormal	True Positive (TP)	False Positive (FP)
Diagnosed as Normal	False Negative (FN)	True Negative (TN)

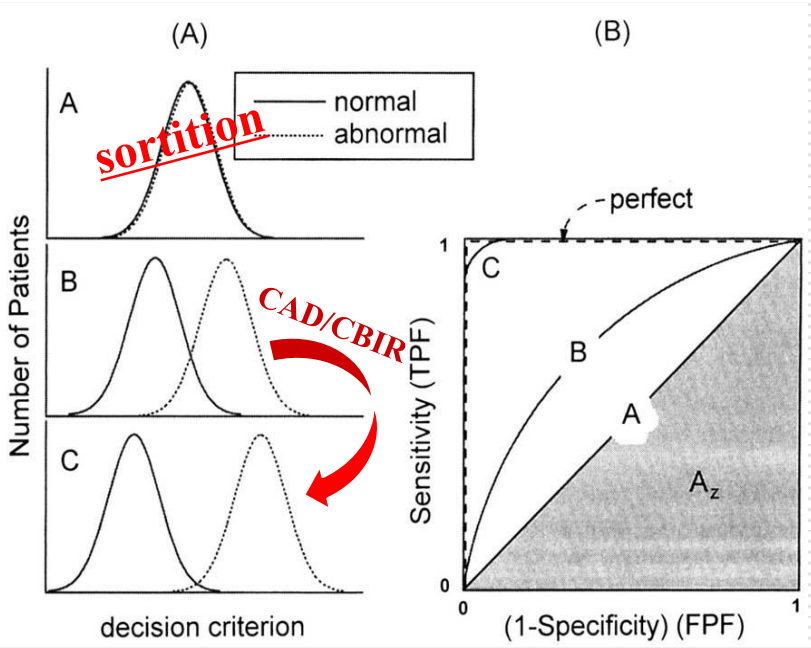
The Essential Physics Of Medical Imaging. Bushberg JT, Seibert JA, Leidholdt Jr. EM, Boone JM. Lippincott Williams ε Wilkins, Philadelphia, USA, 2002.

DIAGNOSIS

PERFORMANCE MEASUREMENTS

ROC curve (receiver operating characteristic)

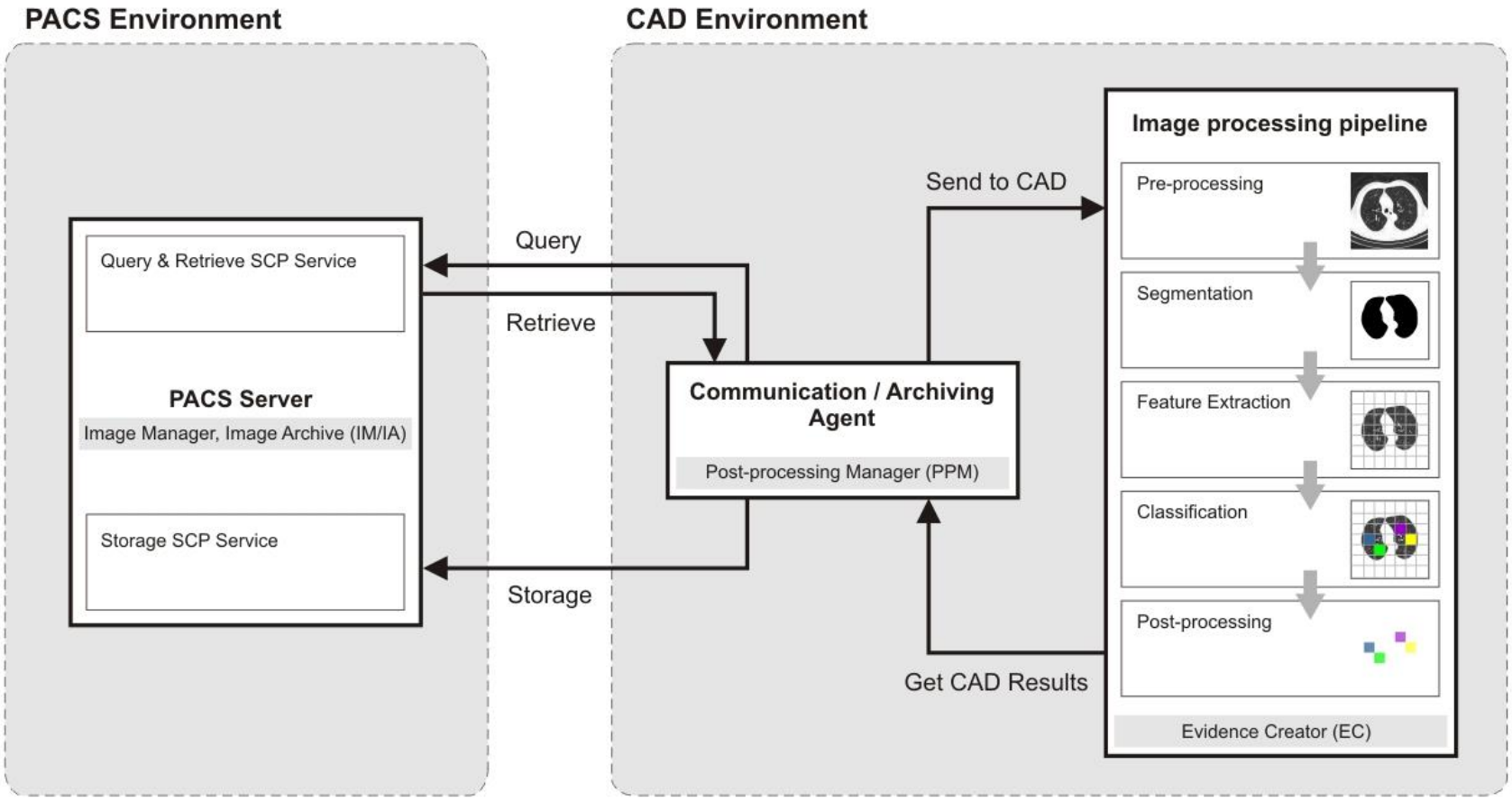




The Essential Physics of Medical Imaging. Bushberg JT, Seibert JA, Leidholdt Jr. EM, Boone JM. Lippincott Williams ε Wilkins, Philadelphia, USA, 2002.

Example of CAD/PACS integration framework:

- Communication services (DICOM functionalities)
- Image-processing pipeline (CAD-CBIR server)



Azevedo Marques PM et. al. Int. Journal of Computer Assisted Radiology and Surgery. 2009, v. 4. p. S180-S181.

It is not just about imaging, image processing, pattern recognition, information systems...

It is mainly about interoperability, radiology workflow, radiology environment, radiologists needs and so on...

Definition:

Biomedical informatics (BMI) is the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving, and decision making, driven by efforts to improve human health.

Kulikowski CA, Shortliffe EH, et al. AMIA Board white paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline, J Am Med Inform Assoc. 2012;19:931–938.

BMI is more than simply the biomedical application of computer science. It is a new discipline!

Shortliffe EH, Cimino, JE (Editors): Biomedical Informatics: Computer Applications in Health Care and Biomedicine, Fourth Edition, Springer, 2014..

THANK YOU!

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