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The Use of CAD in the Detection of Lung Nodules on Digital Chest Radiographs:

Early Detection Key to Survival

Author

Thomas Rohse

International Product

Manager General X-ray

Digital Radiography IO/

Medical IT

Philips Medical Systems

DMC GmbH

Hamburg, Germany

Computer Assisted Detection (CAD) helps radiologists analysing images to detect cancers and diseases of the breast, lung and colon. Using CAD, suspicious regions can automatically be highlighted and marked. This steers the radiologist to review or confirm a specific area that may require further analysis after the initial assessment.

The most common x-ray examination is a plain x-ray chest image. Approximately 50 percent of all x-ray examinations are standard chest x-rays that are carried out for a range of different purposes, from pre-operative planning to routine check-ups.

Latest Stats Highlight Deadliness of Lung Cancer

At the same time, lung cancer is the leading cause of cancer deaths among both men and women worldwide, claiming almost as many lives each year as liver and colon cancer combined. Patients with lung cancer often die within one year after the onset of clinical symptoms, so screening and early detection can play a crucial role in saving a patient's life.

For example, Cancer Research UK reports that the one-year survival rate for lung cancer in England and Wales is around 25 percent, falling to seven percent after five years. Also, the American Cancer Society found that if lung cancer is found and treated while it is localised, survival rates increase from 15 percent to 47 percent five years after diagnosis. Currently, only 16 percent of lung cancers are found in the early, more treatable stages.

The motivation of this large body of evidence demonstrating the positive impact of early detection of lung cancer has led to a remarkable increase in the number of diagnostic tools available. With the increased volume of information from a range of modalities, the complexity of data available to clinicians has also grown, and there is now a substantial demand for decision support tools to help interpret this complex information.

Controversy Surrounding CAD

The clinical application of CAD started during the last decade with screening mammography. Controversy exists as to whether CAD has a positive impact as a diagnostic tool. One recent study has suggested that the use of CAD in helping practitioners detect breast cancer at an early, curable stage may be harmful because falsepositive results could lead to more call-backs and follow ups (e.g. a biopsy to validate breast cancer). Other studies, both prospectively and retrospectively, demonstrated the value of CAD in improving the detection of early stage cancers when utilised in conjunction with screening mammography.

CAD has been put forward during the last few years as a combined viewing and reporting tool which can help interpret the growing amount of information generated by constantly evolving imaging modalities. In the application of lung nodule detection, there have been a number of studies suggesting that digital radiography in combination with CAD could be a valuable adjunct to CT diagnosis and has the potential to become a firstline screening tool.

Studies Provide Interesting Data

A multi-centre study carried out by the Beijing Union Medical College and Beijing Friendship Hospital revealed a significant difference in physician's detection rates and inter-observer variation between reading results carried out with and without the use of CAD (by EDDA Technology). The group gathered chest DR screening studies from a total of more than 500 patient studies and tested the diagnostic performance of CAD software on the DR images.

According to preliminary results, the individual radiologists' detection rate without CAD averaged 50 percent. But the collective detection rate for small actionable nodules confirmed as true positives averaged 40 percent, underscoring an important inter-observer variation. With xLNA (x-ray Lung Nodule Assessment) – Philips' CAD system for the lung – the individual and collective detection rates recorded were about 85 percent. In addition, the inter-observer variation decreased significantly.

These results suggest that CAD technology not only significantly increases the chances of small nodule detection but that it also helps decrease the occurrence of inter-observer variation. In addition, it implies that an individual practitioner, aided by CAD technology, will put forward a similar level of diagnosis as one carried out by a collective of practitioners, which is typically considered to be more accurate and reliable.

Chest x-ray CAD can be incorporated into routine clinical workload, and should be particularly beneficial for solitary practitioners. Over time, as it assists the practitioner to obtain accurate diagnostics, it helps increase their confidence, thereby providing the patient with better, faster and more accurate treatments.

xLNA 2.0 (based on EDDA Technology's IQQA-Chest product) supports clinicians in the identification, quantification, evaluation and reporting of pulmonary nodules at an early stage. As the first real-time interactive diagnostic analysis system, it integrates advanced computer analysis technology into the diagnostic process. In clinical environments, it has been shown to increase the discovery rates of small nodules (between 5 - 15 mm) to 85 percent.

Advantages of Lung CAD

Recognised as a high-quality diagnostic tool, CAD enables hospitals to provide a consistent level of healthcare. The software is resistant to fatigue and attention distracters that physicians often have to deal with and consistently checks areas of interest in every single image for physicians. At the same time, less experienced users or residents can make use of CAD as a training tool and therefore reach a high level of expertise with the support of a CAD system.

By providing high-quality fully integrated workflow solutions, CAD can potentially make positive impact on not only accuracy but efficiency. As a result, practitioners working with CAD can focus on their patients' needs, reducing the amount of time spent researching complex information to reach the correct diagnosis. This enables clinics to expand their client-facing services and provide patients with a faster and more personalised service, resulting in better quality of care for patients and improved outcomes in treating life-threatening diseases such as lung cancer.

How Does Lung CAD Work?

The CAD software marks locations that may be suspicious of solitary pulmonary nodules and presents a report list that can be easily reviewed and extended by the radiologist. The digital x-ray data is processed by the CAD package to provide accurate automatic segmentation and quantification tools for the detected nodules, which is crucial for follow-up examinations to observe growth rates and decide on the likely presence of malignancies.

It is essential to have the CAD functionality embedded directly in the reading process. Because of that, xLNA can be integrated into virtually any existing PACS environment. Neither code-level integration nor the installation of additional software at the PACS workstation is required. The application can be launched at the PACS workstation by simply selecting the relevant case from the PACS worklist. A report including user-confirmed findings, measurements, statistics and free text can be stored in the PACS in DICOM format.

CAD a Complimentary Tool for Chest Exams

The ease with which CAD can be incorporated into the average practitioner's workflow demonstrates that radiologists should not view CAD functions as a potentially threatening tool which might make their positions obsolete, but rather to view it as a complimentary tool which aids them in reading chest x-rays and hence supplements their skills. It functions as 'a second pair of eyes', which can assist radiologists in providing a better quality of care for their patients. Using CAD helps bridge the gap between the clinician's interpretation based upon patient-specific knowledge and computer analysis of the information captured by the x-ray.

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