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# ***Standard Digital Image Database: Chest Lung Nodules and Non-Nodules***

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the Japanese Society of Radiological Technology (JSRT)  
In cooperation with  
the Japanese Radiological Society (JRS)  
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## 1. Summary

The standard digital image database for lung nodules and non-nodules was created by the Standard Digital Image Database Project Team of the Scientific Committee of the Japanese Society of Radiological Technology from April 1995 to March 1997.

The database can be used in various areas of research for digital imaging, including image processing, image enhancement, image compression, image display, image evaluation, picture archiving and communication system (PACS), computer-aided diagnosis (CAD) and ROC study.

## 2. Specifications of the Standard Digital Image Database

### Film digitizer

- Konica LD 4500 and LD 5500

### Image parameters

- Matrix size: 2048 x 2048
- Pixel size: 0.175 mm
- Number of gray levels: 4096 (12bits)
- Optical density range: 0.0-3.5 (high density corresponds to a high pixel value, and low density to a low pixel value)

### Image format

- 2048 x 2048 matrix of image data recorded in 2 byte units from the beginning of a file

## 3. Clinical Information

All images used in the database (lung nodules and non-nodules) have been examined by CT images to confirm the presence (or absence) of a nodule. A nodule image was classified as malignant from the results of its histologic and cytologic examination, and as benign from its histology, the definitive isolation of a pathogenic organism, or shrinkage and disappearance with the use of antibiotics, or if no change was seen during a follow-up period of two years.

The images in the database were graded with the consensus of three chest radiologists according to the degree of subtlety of the abnormality present.

The degrees of subtlety in detecting an abnormality were defined as follows:

- 1) Extremely subtle: The abnormality is very indistinct, or very small, and extremely difficult to detect.
- 2) Very subtle: The abnormality is very difficult to detect.
- 3) Subtle: Detection is difficult.

- 4) Relatively obvious: Detection is relatively easy.
- 5) Obvious: Detection is very easy.

For further details, please refer to our article as shown below;

Shiraishi J, Katsuragawa S, Ikezoe J, et al. "Development of a digital image database for chest radiographs with and without a lung nodule: Receiver operating characteristic analysis of radiologists' detection of pulmonary nodules," AMERICAN JOURNAL OF ROENTGENOLOGY 174 (1): 71-74 JAN 2000

#### 4. Contents of Image Data

Number of images: 154 lung nodules (100 malignant cases, 54 benign cases), and 93 non-nodules.

Image sequence: The sequence of lung nodule images is arranged according to the degree of subtlety from 5 (obvious) to 1 (extremely subtle). non-nodule images are arranged randomly.

Headers: Images have file names only. No headers are used.

File names: JPCLN\*\*\*.IMG for chest lung nodule images, and JPCNN\*\*\*.IMG for non-nodule images.

#### 5. Additional Information

Clinical data and information on the location of nodules contained in this database are recorded in the directory of "CLINICAL".

Information is recorded as;

**CLNDAT\_E.TXT [text file]:** Clinical data and information on lung nodule images (JPCLN\*\*\*.IMG) are arranged in the order of image filename, nodule size [mm], degree of subtlety, x and y coordinates of the nodule location, age, sex, malignant or benign, anatomic location, and diagnosis.

[examples]

JPCLN010.IMG 525 60 female624 598 malignantr.upper lobe(S2) lung cancer

JPCLN011.IMG 520 68 male664 386 benign r.upper lobe(S1) tuberculoma

#Note: The coordinates of the upper left of the image are (0,0).

**CNNDAT\_E.TXT [text file]:** Clinical data on non-nodule images (JPCNN\*\*\*.IMG) are arranged in the order of image filename, age, gender, diagnosis.

#### 6. Image Viewer

If you want to see images included in this database, you may use "Image J"

software, which was developed by NIH (National Institution of Health, U.S.A.) and has been publicly available for researchers [<http://rsb.info.nih.gov/ij>]. In order to open the image in this database by Image J, you need to open the file with "File menu > import > Raw", select one of the image file, and open with the following parameter settings for the window of import;

Image type: 16-bit Unsigned  
Width: 2048 pixels  
Height: 2048 pixels  
Offset to First Image: 0 bytes  
Number of Images: 1  
Gap Between Images: 0 bytes  
Check "White is Zero" only

\*Note: You need to adjust Window/Level for optimizing a grayscale of the image because the original number of gray levels is 4096 (12bits) which corresponding to optical density range between 0.0 and 3.5.

## 7. Artifact

Some images contained in this database may cause an interference artifact due to the effect of grid lines on the original image, when the images are displayed on a CRT monitor or printed by a laser printer.

## 8. Conversion of image parameters

For display of images appropriately, it may be necessary to convert the image matrix size and the number of gray levels. For example, for conversion of a 2048 x 2048 to a 1024 x 1024 image matrix, it is common to use one of the following techniques:

- 1) Sub-sampling: Every second pixel is selected both horizontally and vertically.
- 2) Averaging: The average of 2 x 2 (i.e., 4) pixels is used as 1 pixel. Thus, sub-sampling is much faster, but degrades the image quality due to increased noise. If the number of gray levels is converted to 8 bits from 12 bits, the pixel value for each pixel will be shifted by 4 bits to the right. Alternatively, dividing the pixel value of each pixel by 16 will give the same result.

## 9. Warnings

All of the images contained in the database were actually used for making clinical

diagnoses. To ensure the utmost protection of patient privacy, information that might allow the identity of a patient to be known has been eliminated, and to minimize any risk of breach of privacy further, the use of this database is restricted to individuals or organizations that obtain the database directly from the Japanese Society of Radiological Technology.

The data included in this database are to be used only for research purposes, and copying, distribution, or unauthorized commercial use is prohibited. Any researchers reporting results with use of this database are required to acknowledge the use of this database.

### **Acknowledgment**

We would like to express our deepest appreciation to the 14 institutions listed (alphabetically) below for their kind cooperation in providing clinical images for the creation of this database on chest lung nodules and non-nodules.

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We also thank to all of the users who purchased this image database in the last 10 years. Please refer to the following articles in which this database was used and/or cited between 2000 and 2007.

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