

APPLICATION OF COMPUTED RADIOGRAPHY FOR THE DIAGNOSIS OF PNEUOCONIOSES

TOKURO NOBECHI • Yukio Tateno • Hisao Shida • Yutaka Hosoda
• Junichirō Toriwaki • Hidefumi Kobatake • Takeshi Iinuma
• Kenjiro Fukuhisa • Toru Matsumoto • Masao Takano
• Hisatoyo Kato • Masatomo Tachi • Yasuyuki Chiba

Research Group for the Quantification of the Radiographs of the Pneumoconioses
Japan Industrial Safety and Health Association, Tokyo, Japan

In 1982, Research Group for the Utilization of Image Processing for the Diagnosis of Pneumoconioses was organized in the Japan Industrial Safety and Health Association and by the three years' survey, image processing is found very useful for the diagnosis of pneumoconioses with small sized output films of Fuji Computed Radiography (FCR).¹ FCR is a computed radiographic system utilizing imaging plate of laser stimulated luminescence² and has linear response to the X-ray dose, resulting extraordinary wide latitude for the exposure. However the output film of this system is 1/2 size in length of the ordinary radiographic film, such as the ILO standard film of pneumoconioses.

The authors carried out five steps of experiments as shown in Figure 1 since 1982, although in 1985 the name of the research group was changed to the "Research Group for the Quantification of the Radiographs of the Pneumoconioses."

For the experiments 2 and 3 shown in Figure 1, the ILO standard films and test films selected from training films of pneumoconioses in U.S.A. were digitized by using a drum scanner. Digitized images were processed with the several contrast and spacial frequency characteristics which were similar to those employed in FCR system, and finally written optically onto X-ray film in reduced size using a drum scanner. From these experiments gamma 0.85 is found quite satisfactory for this reduced size of the picture, so at the latter stage of the experiments, only 0.85 of gamma curve was used.

For the experiment 5 shown in Figure 1, FCR films of pneumoconioses patients were used with the fixed contrast of 0.85 gamma with several spacial frequency characteristics of E, F, G and H shown in Figure 2. Image processing factors of F, G, and H are almost equally good as shown in Figure 3, but the best is probably G., i.e., slight enhancement at 0.17 cycles/mm.³

Magnetic tapes of the digitized images of ILO standard film and test films aforementioned and FCR were used for the study of the automatic determination of the size and profusion of small rounded opacities. Two methods were utilized for this purpose, one is direct detection method using difference linear filtering and the other is texture analysis method, details of these studies are reported respectively by

J. Toriwaki and H. Kobatake in this International Conference, so I will not discuss these matters.

It seems rather easy to determine the size, p, q and r, while the automatic categorization of the profusion is not so easy

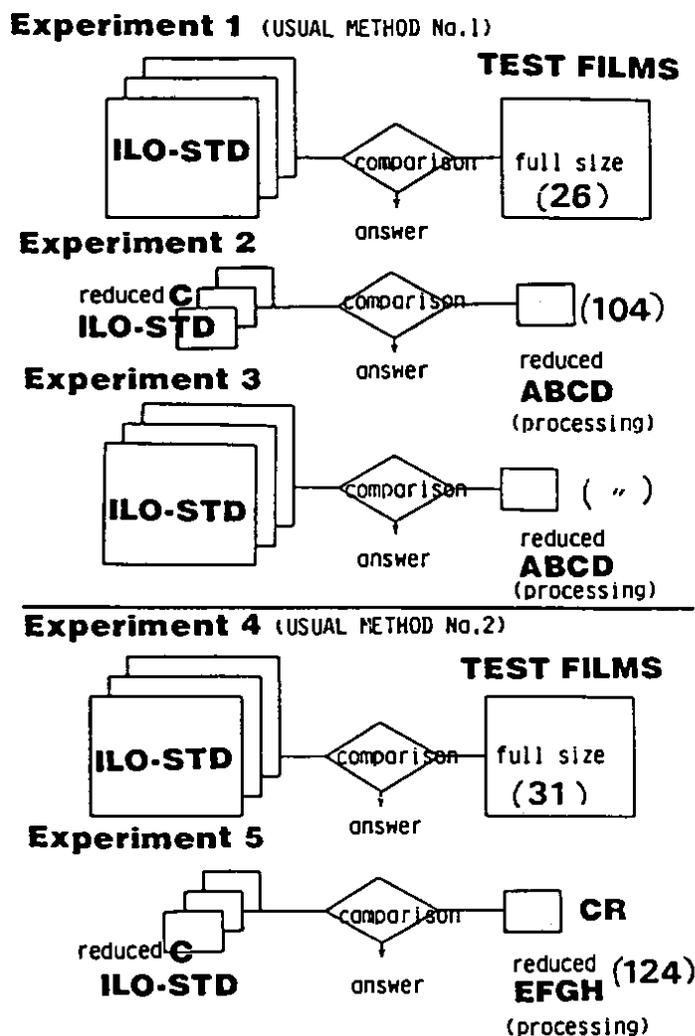


Figure 1. Reading experiments and their sequences.

FREQUENCY PROCESSING

PROCESSING	γ	RANK	BE	FRQ(cycle/mm)
A	0.85	-	-	-
B	0.85	4	0.50	(0.35)
C	0.85	2	0.25	(0.17)
D	0.85	4	0.30	(0.35)
E	0.85	-	-	-
F	0.85	0	0.30	(0.085)
G(≈C)	0.85	2	0.30	(0.17)
H(≈D)	0.85	4	0.30	(0.35)

↑
GRADATION PROCESSING

BE : THE DEGREE OF SPATIAL
FREQUENCY ENHANCEMENT

FRQ: THE CENTER OF ENHANCEMENT

Figure 2. Image processing factors.

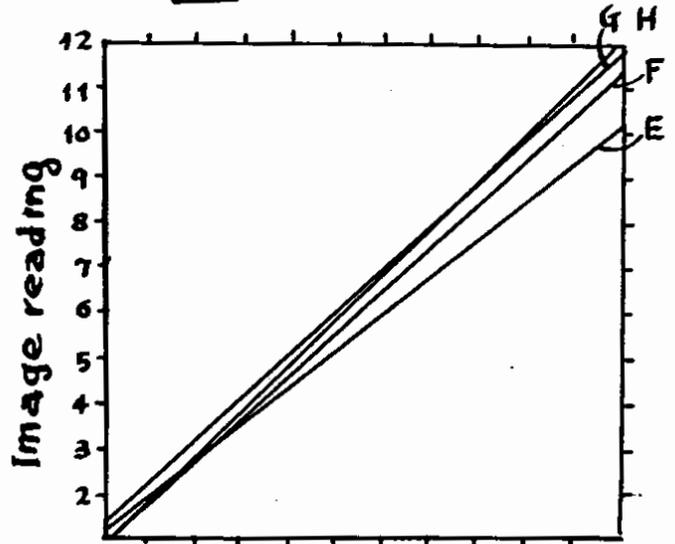
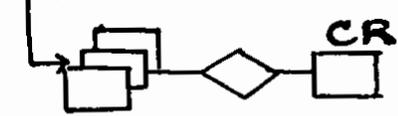
for the low profusion groups, although various methods disclosed the accuracy of 45 to 71%, if majority rule is applied 82% was obtained by texture analysis. The result of the investigation is very promising for the future application of computer technique for the automatic diagnosis of pneumoconioses.

At present the authors are collecting more cases with FCR, for the preparation of excellent standard films of our country, and for the creation of better program of automatic diagnosis by computer.

REFERENCES

1. Fukuhisa, K., T.A., Matsumoto, T., Tateno, Y., Nobechi, T., Shida, H. and Hosoda, Y.: Effect of Digital Image Processing on Radiographic Interpretation of Pneumoconioses. *Nippon Acta Radiologica* 46:614-626, 1986.
2. Sonoda, M., Takano, M., Miyahara, J. and Kato, H.: Computed Radiography Utilizing Scanning Laser Stimulated Luminescence. *Radiology* 148: 833-838, 1983.

Digitized by drum scanner



Confirmed

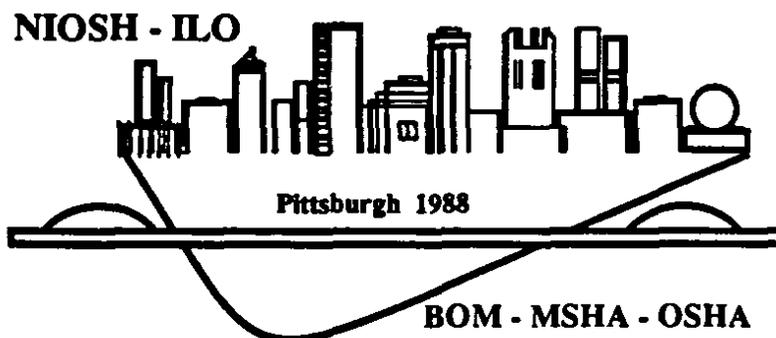
Figure 3. Accuracy of image reading.

3. Annual Report 1987, Research Group for the Quantification of the Radiographs of the Pneumoconioses. Japan Industrial Safety and Health Association Tokyo. (1988) (Japanese).

This work was supported by Ministry of Labor and Japan Industrial Safety and Health Association.

Proceedings of the VIIth International Pneumoconioses Conference
Transactions de la VIIe Conférence Internationale sur les Pneumoconioses
Transacciones de la VIIa Conferencia Internacional sobre las Neumoconiosis

Part **I**
Tome
Parte



Pittsburgh, Pennsylvania, USA—August 23–26, 1988
Pittsburgh, Pennsylvanie, Etats-Unis—23–26 août 1988
Pittsburgh, Pennsylvania EE. UU—23–26 de agosto de 1988



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health



Sponsors

International Labour Office (ILO)
National Institute for Occupational Safety and Health (NIOSH)
Mine Safety and Health Administration (MSHA)
Occupational Safety and Health Administration (OSHA)
Bureau of Mines (BOM)

September 1990

DISCLAIMER

Sponsorship of this conference and these proceedings by the sponsoring organizations does not constitute endorsement of the views expressed or recommendation for the use of any commercial product, commodity, or service mentioned.

The opinions and conclusions expressed herein are those of the authors and not the sponsoring organizations.

DHHS (NIOSH) Publication No. 90-108 Part I