THOMOSYNTHESIS PARAMETERS TUNE-UP

S.Miroshnychenko[2], O.Motolyha[1], A.Nevgasymyi[2], S.Senchurov[1,*],Y.Zabashta[1]
[1]*Physics Faculty, Taras Shevchenko National University of Kyiv,*
64/13, Volodymyrska str., Kyiv, Ukraine,;
[2]*Teleoptic PRC, 58 Dmytrivska str., office 4, Kyiv, Ukraine;*
*E-mail: motor.sasha@gmail.com

Digital tomosynthesis is the procedure of digital reconstruction of object internal structure from the set of X-ray projection images [1]. Reconstruction algorithms in tomosynthesis are very similar to algorithms used in CT and include shift-and-add, filtered backprojection, algebraic methods and MLEM. The principal difference between CT and tomosynthesis is that tomosyntesis uses only a limited angular subset of projection images for reconstruction, typically 30°...90°, whereas CT uses projections taken from every side of the imaged object – 180°. Another difference is that to succeed in tomosynthesis technology one needs a high-speed dynamic digital flat x-ray detector. This makes tomosynthesis similar to cone-beam computed tomography. The simplicity of techological implementation allows to introduce it into x-ray laminography equipment, also known as classical tomography. Very promising health technology is mammographic tomosynthesis.

There is a number of trajectories of motion of digital receptor and x-ray tube around the object with various scan sweep angular ranges and number of projections used for reconstruction[2]. Nevertheless very few theoretical models were created until present to relate the reconstructed slice characteristics and scan parameters.

The incompleteness of the projections set decreases patient radiation dose and significantly and extends the area of possible applications, for example, mammography, pulmonary screening or veterinary scanning for big animals.

Purpose of our study is investigation of dependencies between thomosynthesis parameters (sweep angle, step between projections, post-processing filters) and resulting slice quality parameters characteristics (thickness, level of artifacts).

Theoretical model of slice thickness in thomosynthesis was proposed. Experimental measurements of reconstructed slice characteristics, such as thickness, were made with special phantom. Experimental results have good agreement with theoretical estimations.

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[2] Yue-Houng Hu, Bo Zhao, and Wei Zhao, Image artifacts in digital breast tomosynthesis: Investigation of the effects of system geometry and reconstruction parameters using a linear system approach, Medical Physics 35 (12) 2008