

A method of spatial reconstruction of coronary arteries by a small number of angiographic projections

A.O. Korepanov^{1,2}, N.Y. Ilyasova^{1,2}, A.V. Kupriyanov^{1,2}, A.G. Khramov^{1,2}, A.V. Ustinov^{1,2}, A.A. Kovalev^{1,2}

¹ Image Processing Systems Institute of RAS

² Samara State Aerospace University

Abstract

The article discusses computer technology for fully automatic restoration of the spatial structure of coronary arteries based on a small number of angiographic projections. The proposed reconstruction technique consists of four preliminary stages of the analysis of projection images and the stage of the construction of the spatial structure itself. The structure development method is based on the consistent development of the spatial trace of vessels based on the simultaneous analysis of all the available projections. The article discusses in detail the stages of restoration, provides the results of separate stages. As a result, a structure is formed that contains the vector representation of spatial vessels, which is used further for visualization. The article presents the results of restoration of the spatial structure of phantom objects and the left coronary artery.

Keywords: coronary artery, angiographic projection, computer technology, analysis projection image, phantom object.

Citation: Korepanov AO, Ilyasova NY, Kupriyanov AV, Khramov AG, Ustinov AV, Kovalev AA. A method of spatial reconstruction of coronary arteries by a small number of angiographic projections. *Computer Optics* 2004; 26: 90-98.

[Access full text \(in Russian\)](#)

References

- [1] Mourgues F, Devernay F, Malandain G, Coste-Manière E. 3D+t modeling of coronary artery tree from standard non simultaneous angiograms. In Book: Niessen WJ, Viergever MA, eds. *Medical image computing and computer-assisted intervention*. Springer, Utrecht; 2001.
- [2] Messenger JC, Chen SY, Carroll JD, Burchenal JE, Kioussopoulos K, Groves BM. 3D coronary reconstruction from routine single-plane coronary angiograms: clinical validation and quantitative analysis of the right coronary artery in 100 patients. *Int J Card Imaging* 2000; 16(6): 413-427.
- [3] Ding Z, Friedman MH. Quantification of 3-D coronary arterial motion using clinical biplane cineangiograms. *Int J Card Imaging* 2000; 16(5): 331-346.
- [4] Baranov VG, Hramov AG. The discrete fan Radon transformation in the problem of the netlike structures branches emphasizing. *Computer Optics* 2002; 23: 44-47.
- [5] Ilyasova NYu, Ustinov AV, Baranov VG, Kupriyanov AV, Khramov A.G. Estimating the geometrical parameters of branches of 3D treelike and netlike structures exemplified by the cardiovascular image. *Computer Optics* 2002; 23: 48-52.
- [6] Ilyasova NYu, Korepanov AO, Kupriyanov AV, Khramov AG, Baranov VG. The analyze of the hart vascular system structure by the method of the projections images tracing. *Computer Optics* 2002; 23: 53-57.
- [7] Ilyasova NYu, Korepanov AO, Kupriyanov AV, Khramov AG. Fractures elimination on the binary images of the treelike structures. *Computer Optics* 2002; 23: 58-61.
- [8] Ilyasova NYu, Ustinov AV, Baranov VG, Kupriyanov AV, Khramov AG. Estimating the geometrical parameters of branches of 3D treelike and netlike structures exemplified by the cardiovascular image. *Optical Memory & Neural Networks* 2002; 11(1): 65-72.
- [9] Soifer VA, Ilyasova NYu, Baranov VG, Khramov AG. Estimating the geometrical parameters of branches of treelike and netlike structures. *Proc 12th Scandinavian Conference on Image Analysis* 2001: 49-53.