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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Ref: FST/SEM/00099/2015

Quantitative 4D Cardiac PET Image Reconstruction Methods for Image quality Improvement and Quantitative Cardiac Motion Estimation

by

Prof. Benjamin M. W. TSUI
Professor,
Department of Radiology and Radiological Science
Johns Hopkins University, USA

Date : 19 November 2015 (Thursday)
Time : 11:30 – 12:30
Venue : E11-1028

ABSTRACT

Quantitative four-dimensional (4D) image reconstruction methods with respiratory and cardiac motion compensation are an active area of research in ECT imaging, including SPECT and PET. They are extensions of three-dimensional (3D) statistical image reconstruction methods with iterative algorithms that incorporate accurate models of the imaging process, to include additional models of the respiratory and cardiac motion of the patient. We describe respiratory motion estimation and gating methods based on patient PET list-mode data. The estimated respiratory motion is applied to the respiratory gated data to reduce respiratory motion blur. The gated cardiac images derived from the list-model data are used to estimate cardiac motion. They are then used in the cardiac gated images summing the motion-transformed cardiac gated images for significant reduction in the gated images noise. Dual respiratory and cardiac motion compensation is achieved by combining the respiratory and cardiac motion compensation steps. The results are further significant improvements of the 4D gated cardiac PET images. The much improved gated cardiac PET image quality increases the visibility of anatomical details of the heart, which can be explored to provide more accurate estimation of the cardiac motion vector field and cardiac contractility. Results from simulated studies using the 4D XCAT phantom with realistic anatomical structures and respiratory and cardiac motions, and clinical cardiac-gated 18FDG and 13NH3 myocardial perfusion (MP) PET studies demonstrate the effectiveness of the 4D image reconstruction methods.

BIOGRAPHY

Prof. Benjamin M. W. Tsui, A.M., Ph.D. is currently a Professor of Radiology with joint appointments in Electrical and Computer Engineering, Biomedical Engineering and Environment Health Sciences and the Director, Division of Medical Imaging Physics,

Department of Radiology at the Johns Hopkins University. His research interests include medical imaging physics of SPECT, PET and CT, computer generated phantoms, computer simulation techniques, quantitative analytical and statistical 3D and 4D image reconstruction methods, image quality evaluation using model and human observers, cardiac and respiratory motion compensation, multi-modality SPECT/CT, PET/CT, SPECT/MR and PET/MR imaging, and preclinical small animal imaging instrumentation and techniques. He has over 300 publications and is a fellow of the IEEE, IOP and AIMBE and member of AAPM, SNMMI, ASNC, and WMIS

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Ref: FST/SEM/00058/2015

Trend of the Smart Grid Development

by

Prof. Wei Jun LEE
Professor and Director Energy Systems Research Center,
The University of Texas at Arlington, Texas, USA

Date : 18 June 2015 (Thursday)
Time : 10:15 – 10:45
Venue : Library Auditorium, Wu Yee Sun Library

ABSTRACT

The electrical power system in the US has been named as "the supreme engineering achievement of the 20th century" by the National Academy of Sciences. While the power system is a technological marvel, it is also reaching the limit of its ability to meet the nation's electricity needs. In addition, our nation is moving into the digital information age that demands higher reliability from the nation's aging electrical delivery system.

The modernization of the electricity infrastructure leads to the concept of "smart grid". A comprehensive smart grid design should cover both top-down and bottom-up approaches. For the current centralized generation and transmission system, upgrading the power delivery infrastructure, enforcing the system security requirement, and increasing interoperability are well known techniques to improve the reliability and the controllability of the power system. For the bottom-up approach, one of the most important features is its ability to support a more diverse and complex network of energy technologies. Specifically, it will be able to seamlessly integrate an array of locally installed, distributed power sources with smaller CO2 footprint, such as fuel cells, photovoltaic, and wind generation, into the power system.

This presentation discusses the opportunities and challenges for the development of Smart Grid, highlights the smart grid related researches and developments. The presentation concludes with the listing of issues needed to be addressed to ensure successful integration procedures that will eventually create new structures of efficient, modular and environmentally responsive electricity infrastructure that will have an impact nationally as well as globally.

BIOGRAPHY

Wei-Jen Lee received the B.S. and M.S. degrees from National Taiwan University, Taipei, Taiwan, R.O.C., and the Ph.D. degree from the University of Texas, Arlington, in 1978, 1980, and 1985, respectively, all in Electrical Engineering.

In 1985, he joined the University of Texas at Arlington, where he is currently a professor of the Electrical Engineering Department and the director of the Energy Systems Research Center.

He has been involved in the revision of IEEE Std. 141, 339, 551, 739, and dot 3000 series development. He is the Chair of the IEEE/IAS, Industrial & Commercial Power Systems Department (ICPSD), associate editor of IEEE/IAS and guest editor of IEEE Transactions on Smart Grid. He is the project manager of IEEE/NFPA Collaborative Research Project on Arc Flash Phenomena.

Prof. Lee has been involved in research on utility deregulation, renewable energy, smart grid, microgrid, arc flash and electrical safety, load forecasting, power quality, distribution automation and demand side management, power systems analysis, online real time equipment diagnostic and prognostic system, and microcomputer based instrument for power systems monitoring, measurement, control, and protection. He has served as the primary investigator (PI) or Co-PI of over ninety funded research projects. He has published more than three hundred and twenty journal papers and conference proceedings. He has provided on-site training courses for power engineers in Panama, China, Taiwan, Korea, Saudi Arabia, Thailand, and Singapore. He has refereed numerous technical papers for IEEE, IET, and other professional organizations.

Prof. Lee is a Fellow of IEEE and registered Professional Engineer in the State of Texas.

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