

## Preface to Special Issue “Medical Imaging Technologies”

by Mitsuru Umeda

*Research & Development Department, Medical Systems Division,  
Shimadzu Corporation, Kyoto, Japan*

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### 1. Introduction

This year marks the beginning of a new era in Japan, being the first year of the 2020s, the first year of the Reiwa era in the Japanese calendar, the year of the Tokyo Summer Olympics and Paralympics, and the first year of domestic 5G services.

But switching our focus to Japanese society reveals a country approaching a time when one in four citizens is aged 75 years or older (the 2025 problem), and a country that has been enacting a series of so-called “work style reform laws” since April 2019. With its aging and shrinking population, many believe Japan must now adapt to accommodate a range of working arrangements and address the issue of work-life balance. The healthcare industry is not excluded from this appraisal, with improvements to the long working hours of doctors and other changes under discussion.

Also, since an overdose of X-ray CT radiation in 2007 in the U.S. led to an increased focus on managing the total radiation dose from medical equipment, and after the Fukushima nuclear accident in 2011, people share a growing concern about radiation exposure. There is a growing need to manage and reduce the radiation dose received not only by patients during examination and treatment, but also by medical professionals who operate medical equipment on a routine basis.

Within this social context, Shimadzu, with its corporate philosophy of “Contributing to Society through Science and Technology” and its management principle of “Realizing Our Wishes for the Well-being of Mankind and the Earth,” also endeavors through its business activities to address the sustainable development goals (SDGs) shared by the international community.

Shimadzu develops medical equipment and analytical instruments with state-of-the-art technology to aid the diagnosis and treatment of a variety of diseases, but in the course of research and development, also aims to address the aforementioned work style reforms in the medical

workplace and ensure safe and secure medical care.

This special issue of Shimadzu Review reports on recent instrument developments and the results of recent research and development in the field of medicine.

### 2. Developments in New Fields

- Development of Smart BMD AI Assist, Femur Segmentation Using Deep Learning
- Development of Adrenal Venous Sampling Support System for Primary Aldosteronism
- Development of Universal Tomosynthesis System with UT-Station and Positioning Phantom
- Measures for Expanding fNIRS Applications

This year marks 145 years since the founding of Shimadzu and 110 years since Shimadzu created Japan’s first medical X-ray device. In the intervening years, Shimadzu has worked on a wide range of medical diagnostic imaging systems and consistently integrated new technology into these systems, particularly image processing technology. Deep learning is currently a popular area of research, and Shimadzu has implemented deep learning technology in a range of applied fields, with one example presented in this section.

The automatic identification of bones in X-ray images has typically been performed by image segmentation based on histogram analysis. However, this approach has difficulty differentiating thin bones from image noise, requires manual corrections from the user, and in some cases makes bone mineral density analysis a time-consuming process. The implementation of deep learning-based image segmentation has substantially reduced the amount of manual correction required from the user when identifying bones in X-ray images.

Other new applications are also presented in this section, including solutions that assist examinations and treatment by linking medical devices to analytical instruments.

### 3. Reducing the Burden on the Patient

- Development of the SONIALVISION G4 LX edition
- Development of SCORE Chase EVT Support Application for Lower Extremities
- Development of New Functions for the SyncTraX FX4 version Real-Time Tumor Tracking System for Radiation Therapy

Advances in examinations and treatment have improved early disease discovery and therapeutic outcomes, but in some cases have also increased the burden on the patient by lengthening the duration of examinations and treatment and increasing the radiation dose to the patient. This section reports on new products and features that reduce the burden medical care places on the patient.

For angiography systems used in lower extremity endovascular procedures, Shimadzu has developed a feature that automatically generates long-view images post-scanning and a feature that generates vessel road map images without additional contrast imaging.

This section also describes a tumor tracking system for radiotherapy devices, including new features of the system that reduce treatment times by allowing combined use with intensity modulated therapy (IMRT/VMAT) and improving the treatment dose rate.

### 4. Workflow Improvements

- Orthopedics Functionality Extension for SimCLINIC T3 $\alpha$  XLink package
- Development of MobileDaRt Evolution MX8 Version Digital Mobile X-ray System
- Development of the RADspeed Pro style edition General Radiography System
- Development of Trinias unity smart edition Angiography System

This section reports on developments that help improve workflows in medical clinics and hospitals. The user experience (UX) has become a popular area of design, and Shimadzu develops products with regard for the user experience by adopting the user's point of view and offering an attention to detail unique to Japanese business. By automating operations once performed manually and creating a working environment that prioritizes ease of use and accessibility, Shimadzu is developing systems and equipment that minimize the demands on the user and can be easily operated by anyone.

### 5. Conclusions

Although this is the dawn of a new era, the fate of this era remains uncertain as technologies especially in information-related fields develop at an increasingly rapid pace. Despite this uncertainty, the desire for health will never diminish, and Shimadzu is committed to research and development aimed at meeting this need.