

## Progress Report 2021

### Department of Computational Diagnostic Radiology and Preventive Medicine

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#### <Introduction and Organization>

The Department of Computational Diagnostic Radiology and Preventive Medicine (CDRPM) collects latest biomedical data in preventive medicine field, especially massive image data from advanced imaging modalities, develops a detailed database and researches on preventive medicine, image processing and automatic diagnosis algorithms.

Our department conducts a health-screening program over the long term in association with HIMEDIC Co., Ltd. in order to develop a detailed and reliable database. We also promote epidemiological study in preventive medicine field in association with Yamanakako Clinic, which originated the health-screening program using PET. The health-screening program was contracted to University of Tokyo Hospital. Our department was assigned the actual practice of health screening program. It is also the

field work to acquire the data for research on image analysis and epidemiology. The health screening program includes PET/CT (Positron Emission Tomography/Computed tomography), ultra-high field MRI (magnetic resonance imaging), ultrasonography and mammography with the latest technology, in addition to standard screening tests in the Health-screening Center of Computational Diagnostic Radiology and Preventive Medicine on the ninth floor of Central Care 2.

In regard to image processing and image analysis, we cooperate with the Department of Radiology, Graduate School of Medicine, The University of Tokyo, and collaborate with UT Radiology / Image Computing and Analysis Laboratory to develop image processing software. Moreover, we promote collaborative study with other researchers on CAD (computer assisted detection) through Open CAD project.

#### <Research Activities>

##### a) Database development

Our department conducts a comprehensive health-screening program. Examinees periodically undergo the program and are followed up over a long period. Their clinical, laboratory and imaging data are stored in a detailed and reliable database and used for research purposes. Among others, volume data using advanced imaging modalities including FDG-PET, multidetector CT and 3T-MRI are collected to detect subtle early-stage disease throughout the body.

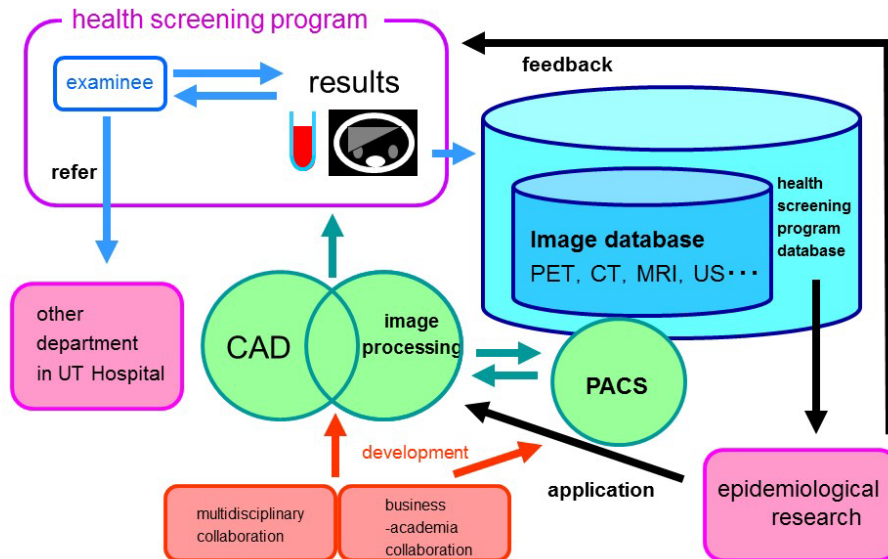
##### b) Big image data processing

We develop basic image processing system to deal multiphase and multimodality images as multidimensional data. And we study algorithms to detect subtle abnormal findings automatically from massive multidimensional data. We develop image processing software in collaboration with UT Radiology / Image Computing and Analysis Laboratory, Department of Radiology, Graduate School of Medicine, The University of Tokyo. We especially focus on development and clinical application of CAD software and work toward practical use of CAD in clinical radiology.

##### c) Cohort study

We analyze various clinical data from health screening program over time. We verify clinical utility of abnormal findings in novel laboratory and imaging examination to predict development and prognosis of diseases.

## Department of Computational Diagnostic Radiology and Preventive Medicine



### <Future work>

#### a) Database development

We have already established research infrastructure for database and CAD. We continue to store detailed and reliable data from health screening program and to improve the database so that various researchers can use the data for research purposes.

#### b) Big image data processing

CAD developing system is in practical use. It supports development of software to detect lung nodules on CT images, to detect skin lesions on PET/CT images and to measure visceral fat volume using PET/CT images. With regard to clinical application, we start to operate clinical CAD server with software to detect cerebral aneurysms on MRA and to detect lung nodules on CT images. Hereafter, we will clinically try out more created software on clinical CAD server, and begin new software development.

#### c) Cohort study

We research on relationship between laboratory data findings, imaging findings and long-term prognosis, because such clinical data has been insufficiently studied. Recently, metabolic syndrome based on visceral obesity has attracted attention. It is suggested that metabolic syndrome occurs in the context of functional abnormality of visceral fat tissue as an organ. Using PET/CT images, we try to evaluate human's fat tissue, which has been difficult to be visualized and quantitated. We will study correlation between

indices from PET/CT images and conventional biomarkers including insulin resistance and serum lipid profile, and demonstrate clinical utility of such indices. Moreover, we will study correlation between function of fat tissue and other clinical biomarkers including biomarkers of atherosclerosis (intima-media thickness, plaque and stenosis of carotid arteries), various adipocytokines, and try to explain the role played by functional abnormality of fat tissue in development of metabolic syndrome in humans. We also plan to conduct a follow-up study to examine prediction of cardiovascular events and effect of intervention including nutritional guidance, weight reduction, exercises and drug therapy.

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