Science and Engineering

Title of Project : Multidisciplinary computational anatomy and its application to highly intelligent diagnosis and therapy

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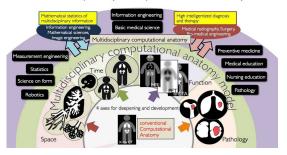
【Purpose of the Research Project】

The purpose of this research project is to establish *multidisciplinary computational anatomy*. Multidisciplinary computational anatomy comprises scientific research on innovative areas based on medical images that have many axes: (1) the spatial axis, from a cell size to an organ size level; (2) the time series axis, from an embryo to postmortem body; (3) the functional axis, such as medical image modality, physiology or metabolism; and (4) the pathological axis, from a healthy physical condition to a diseased condition.

This innovative area achieves mathematical foundation enabling us to deal with not only the static computational anatomy model for handling shape but also dynamic computational anatomy model (multidisciplinary computational anatomy) for handling living human built from useful multidisciplinary information about the human body. This research project is a new scientific area that consists of extensive learning in many fields, such as image engineering, instrumentation technology, data science, materials engineering, applied mathematics, physics, engineering, biomedical engineering and medicine.

【Content of the Research Project】

To define the new scientific research area "multidisciplinary computational anatomy", we establish three key research items: (1) to establish a basic mathematical analysis technology for "a comprehensive and useful understanding of the human body", (2) basic research into mathematical analysis to realize the high intelligent diagnostic treatment system, and (3) development and expansion of multidisciplinary computational anatomy.

Multidisciplinary computational anatomy

The potentiality of multidisciplinary computational anatomy varies from mathematical principles, information science, and engineering to clinical applications. Novel study proposals will be adopted as general invitation research groups different from the regular research groups. Clinical and medical engineering deployment of tumor-diagnosis medical treatment, internal-organ diagnostic medical treatment, intelligent surgical robot realization, etc., are set as concrete research tasks for positively constructing a cooperative organization. The above-mentioned subject setup can give the indicator of systematization of a basic base, and prepares it under domain representation. Moreover, emphasis is set to a theory establishment and base construction of the mathematical study foundation, and to expand the range of the new system, we are planning to work with young investigators and to provide training across discipline boundaries.

【Expected Research Achievements and Scientific Significance】

In the "multidisciplinary computational anatomy", the new mathematical analysis base for "a comprehensive and useful understanding of the human body" is established based on medical image information over various axes. We believe that the results of research in this area also greatly affect related scientific fields, such as informatics, mathematical science, mechanical and biomedical engineering treating multi and huge image information technology.

Furthermore, this innovative area realizes a mathematical method for early detection or a highly intelligent diagnostic treatment method for a disease with difficult medical treatment and the applied system.

【Key Words】

Multidisciplinary computational anatomy, based on the medical image over four axes: space, time, function, and pathology

【Term of Project】   FY2014-2018
【Budget Allocation】 1,048,900 Thousand Yen
【Homepage Address and Other Contact Information】

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