

OSHIMA LAB.



Towards Predictive Medicine: Medical Imaging × Blood Flow Simulation × AI

Department of Mechanical and Biological Systems

Centre for Innovative Simulation Research, Centre for Engineering and Bio-Science Research

Department of Interdisciplinary Information Studies, Graduate School of Interdisciplinary Information Studies

Department of Mechanical Engineering, Graduate School of Engineering

Computational Fluid Dynamics

Science and Technology Interpreter Training Programme, Graduate School of Interdisciplinary Cultural Studies

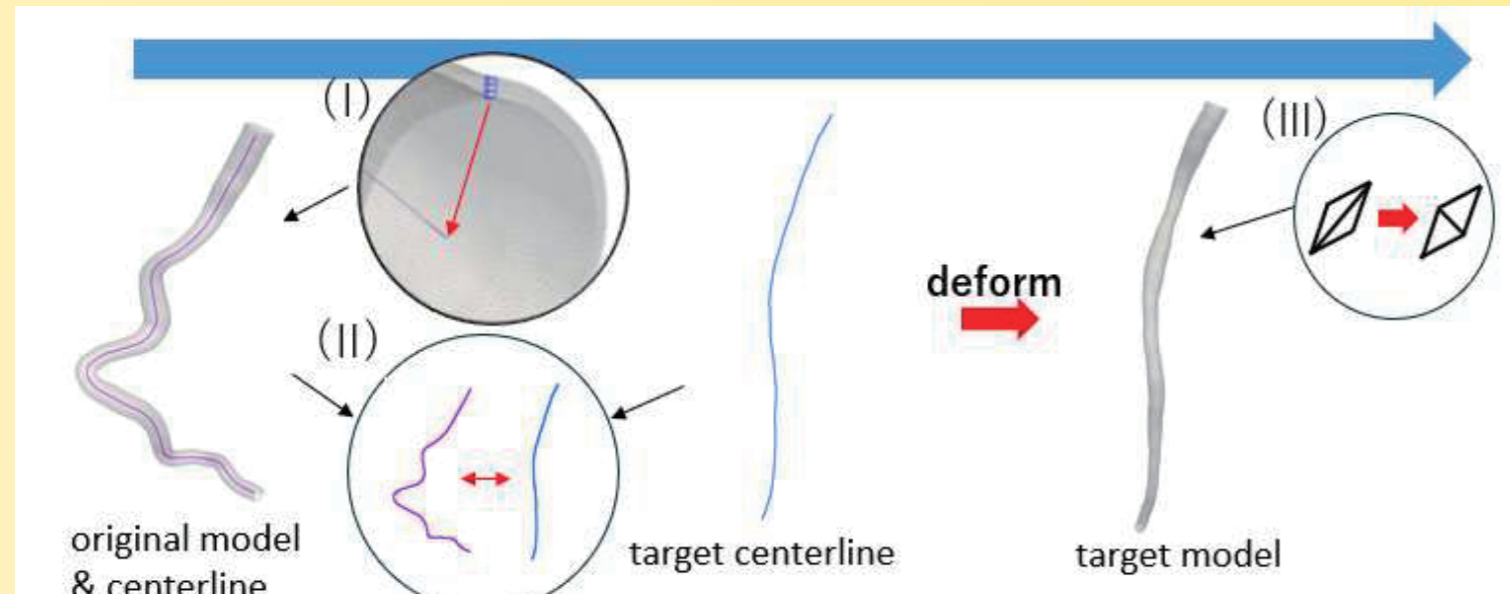
<https://www.oshimalab.iis.u-tokyo.ac.jp/japanese/>

Investigation of Bio/Micro-fluid Mechanics

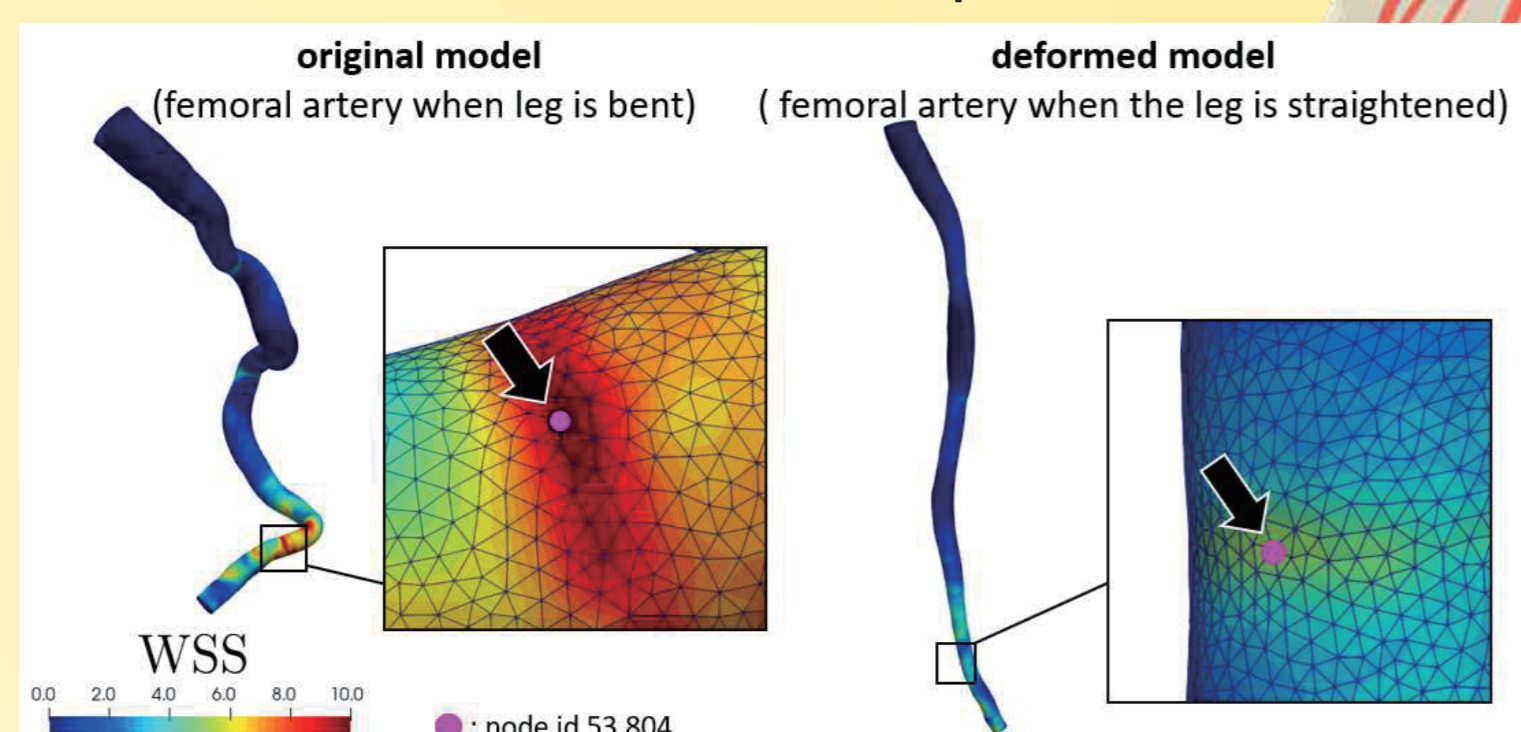
Objectives We aim to develop an integrated, patient-specific framework that combines vascular geometric modeling, blood flow simulations, and AI-based analyses to elucidate cerebral hemodynamics and the mechanisms underlying the initiation and progression of cerebrovascular diseases. Furthermore, we advance research on the clinical application of simulation and AI-based techniques toward predictive medicine.

3D Simulation Evaluation of the effects of vascular morphology on hemodynamics

- Mesh deformation method for 3D fluid simulations

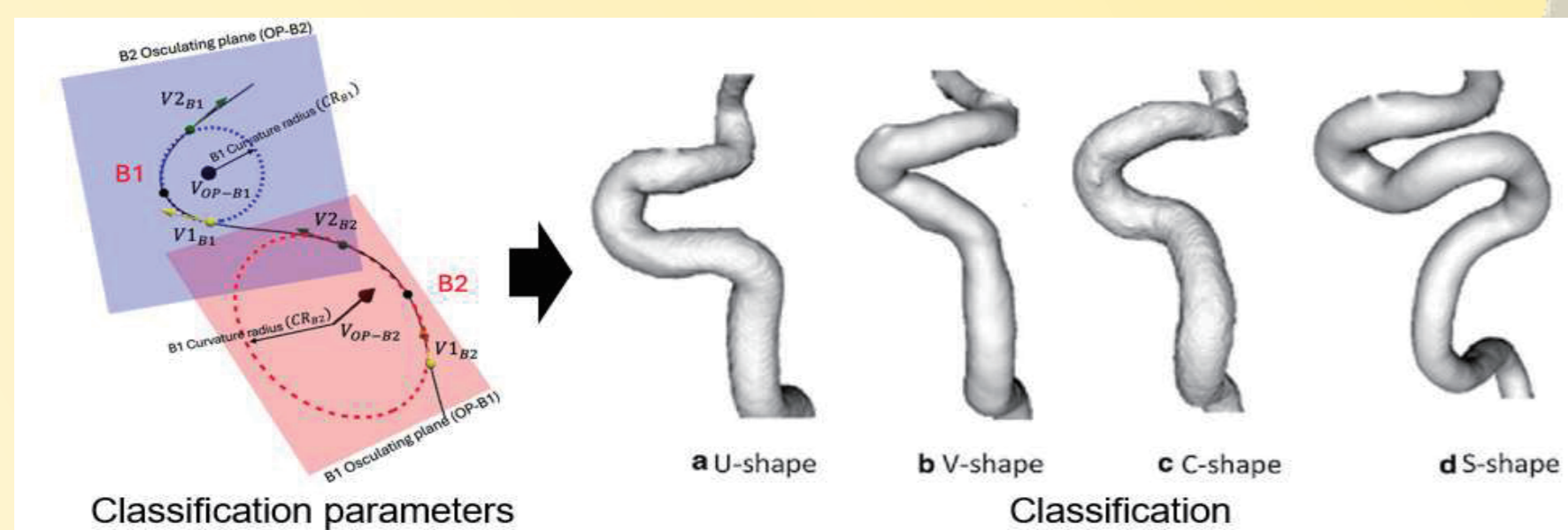


Mesh deformation process

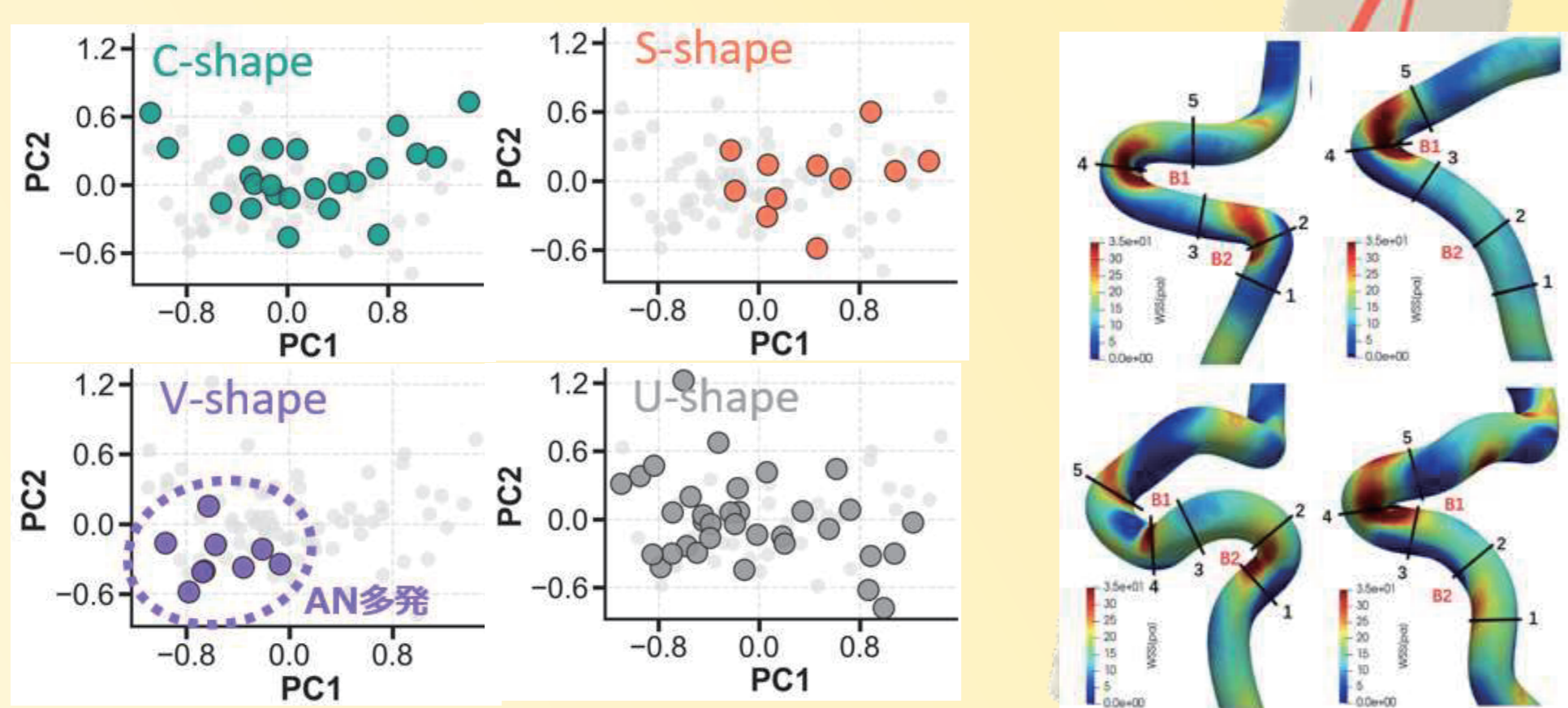


Comparison between before and after deformation

- Quantitative evaluation of the impacts of the ICA siphon geometry on blood flow



Classification of blood vessel morphology

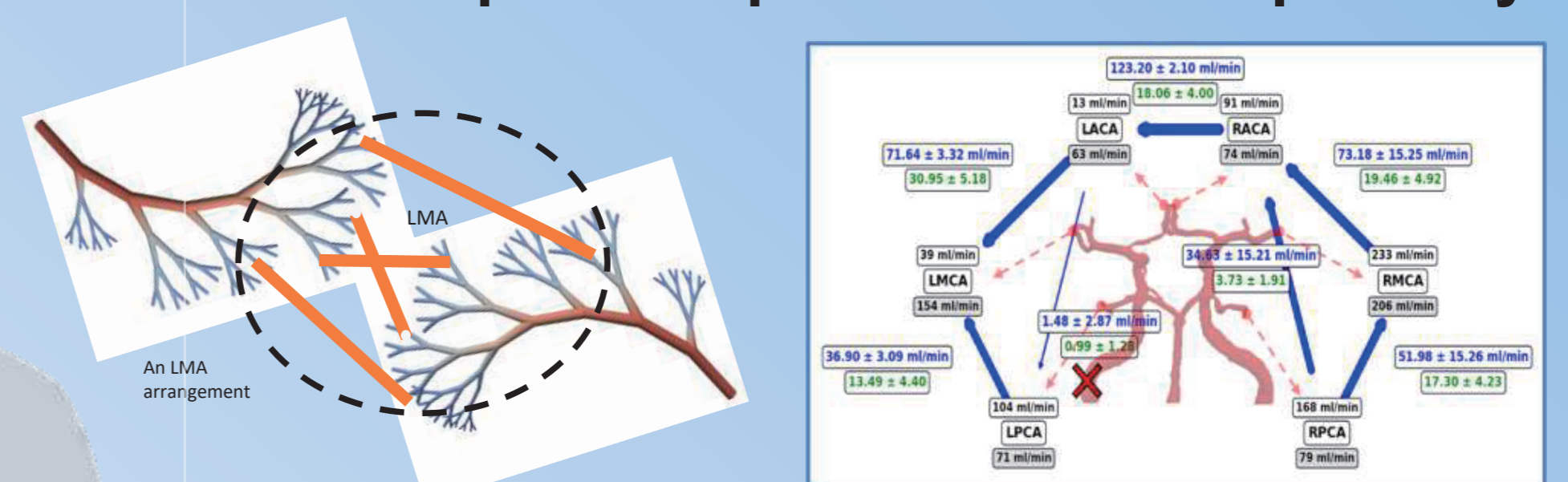


UVCS-type and clustering on the PC1-PC2 plane

WSS distributions

1D-0D Simulation Prediction of patient-specific cerebral circulation with collateral pathways

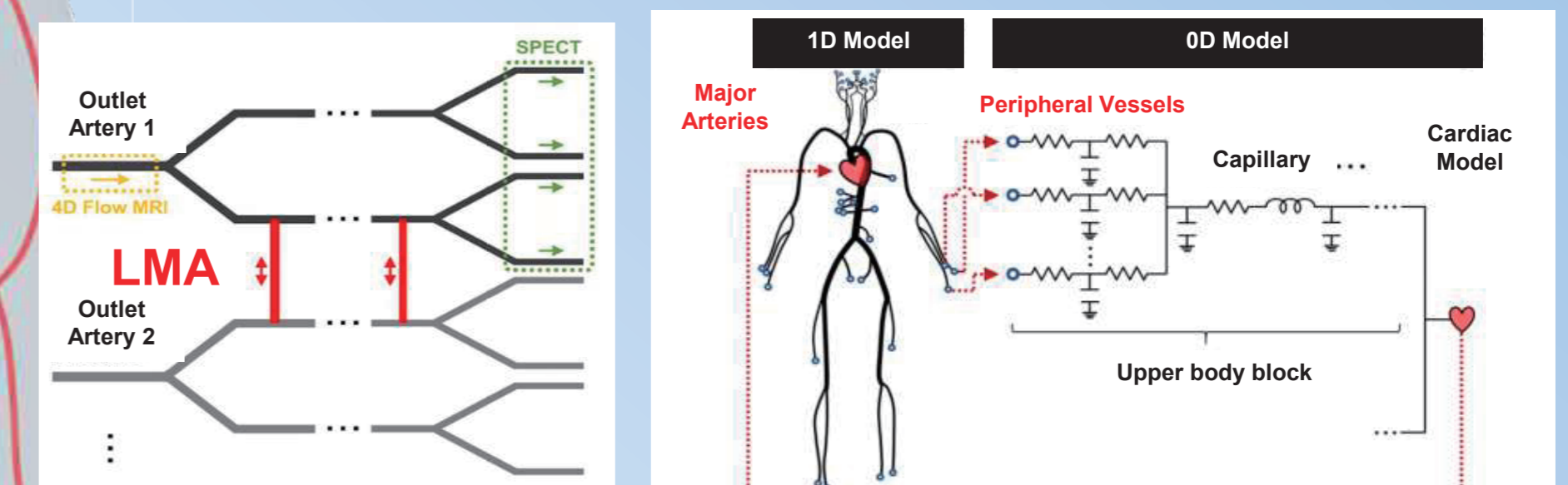
- Assessment of patient-specific collateral pathways



Blood flow redistribution

Simulation Results

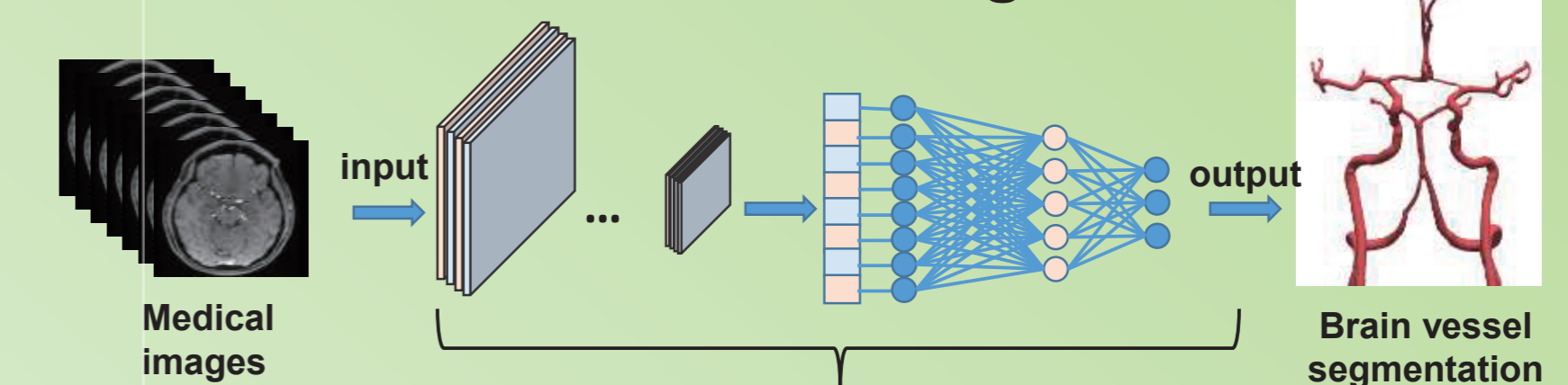
- Development of the entire circulatory system model with peripheral network



1D-0D Simulation

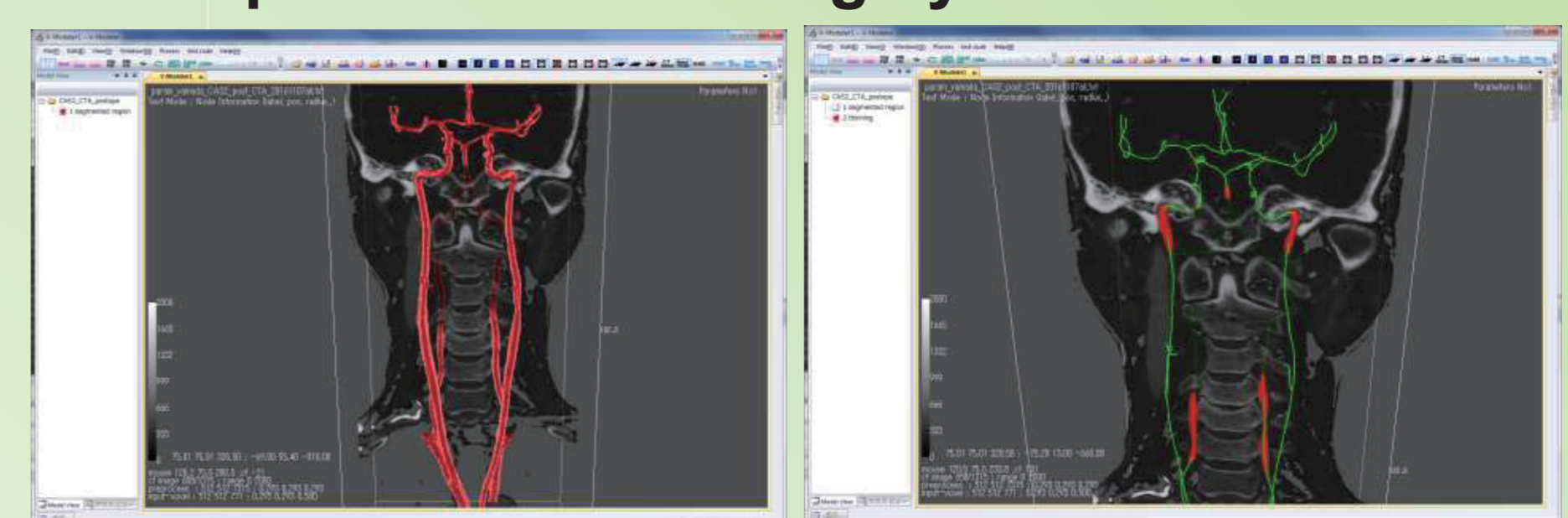
AI-Based Data processing Automatic segmentation and 3D modeling of cerebral vasculature

- Application of deep learning to automatic segmentation of vasculature from medical images



Pipeline of deep learning model

- Development of modelling system V-modeler



Automatic segmentation

Centerline extraction