PURDUE INNOVATES | Office of Technology Commercialization

Automatic Vessel Segmentation for Medical Imaging using the Standardized Difference of Means (SDM) Velocity

MRI-compatible algorithm that segments vessels with ~70% greater accuracy than current approaches.

Researchers at Purdue University have developed an algorithm for segmentation of regions of blood or cerebrospinal fluid flow from medical images. Accurate segmentation is critical for reliably assessing biomarkers of disease like wall shear stress. Existing segmentation methods like pseudo-complex difference (PCD) and high-resolution time-of-flight (TOF) angiography are highly sensitive to error in medical images. The Purdue researchers' standardized difference of means (SDM) segmentation algorithm involves calculating the difference between the time-averaged velocity at each voxel of the image and the mean tissue velocity, relative to the standard error. SDM segmentations are then generated by identifying voxels with significant velocity relative to the mean tissue velocity. The researchers' algorithm then refines the approximation to provide accurate segmentation. The researchers tested their method using a 4D flow MRI image of the cerebral vasculature and compared its performance to PCD and TOF angiography. The researchers' algorithm provided more accurate estimations of the vessel wall location than PCD segmentations across all in vitro phantom scales and in vivo patient measurements. The researchers' algorithm can be integrated with imaging systems to provide the assessment of accurate biomarkers.

Technology Validation: In vitro and in vivo, the SDM segmentations are 49.6% and 71.9% closer to the actual vessel wall than the PCD segmentations as measured by the RMS distance, respectively.

Advantages:

- Automatic

- Can be integrated with imaging systems

Technology ID

2022-VLAC-69831

Category

Digital Health & Medtech/Medical Image Processing

Digital Health & Medtech/AI in Medical Imaging

Authors

Vitaliy Rayz

Sean Michael Rothenberger

Pavlos Vlachos

Further information

Patrick Finnerty

pwfinnerty@prf.org

View online

- Greater sensitivity and balanced accuracy than PCD method

- Generalizable across biological fluid flow types, vascular territories, and imaging methods

Applications:

- Segmentation of regions of blood or cerebrospinal fluid flow

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2022-08-11, United States

Copyright, 2023-03-16, United States

PCT-Gov. Funding, 2023-08-01, WO

NATL-Patent, 2025-02-10, United States

Keywords: Angiography, Biomedical Engineering, Fluid Dynamics, Hemodynamics, Phase Contrast Magnetic Resonance Imaging (PC-MRI), Velocimetry