2026年度共同利用研究報告書

2026年11月05日

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	整理番号	2026a035

1.研究計画題目	Dual-Topological Learning for Structural Integrity Preservation in Image Segmentation			
2.新規・継続	新規			
3.種別	一般研究			
4.種目	短期共同研究			
5.開催方法	対面開催			
6.研究代表者	氏名	KANG MEIYAN		
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7.研究実施期間	2026年08月03日(月曜日)～2027年08月06日(金曜日)			
8.キーワード	Topological Data Analysis (TDA), Persistent Homology, Dual-Topological Learning, Shape-aware Segmentation, Structural Integrity, Deep Learning			
9.参加者人数	7人			

10.本研究で得られた成果の概要

Motivated by connectivity breaks in image segmentation, the initial proposal focused on topological data analysis (TDA)-derived inputs and shape-aware learning. Online discussions and the IMI meeting (August 3-6, 2026) refined the focus toward persistent-homology (PH) loss, semi-supervised learning, and test-time adaptation (TTA). Preliminary VessMAP experiments used one grayscale input channel. On one 20-image validation split, PH loss with TTA increased mean Dice from 0.887 to 0.905 and reduced mean absolute connected-component count error from 28.65 to 23.90. Semi-supervised learning with 50% labels showed trade-offs between overlap and component-count agreement. These initial findings require controlled comparisons and broader validation. We will continue the collaboration, refine the topological loss and target, and examine integration with shape-aware inputs. Publication and dissemination plans will be determined as the research progresses.

報告書は 2030 年 4 月に公開予定