Seminarium Zakładu Teorii Maszyn i Robotów

W piątek 3 stycznia 2025 r. o godz. 10:15 (sala – do ustalenia)

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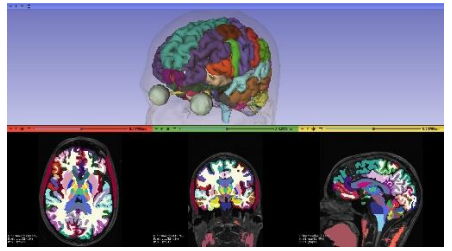

wygłosi wykład na temat

Towards Linking Computational Biomechanics with Brain Anatomy and Function

ABSTRACT

Computational modelling of the brain has matured and is now used with confidence in guiding neurosurgery, localisation of epileptic seizure onset zones, analysis of brain injury mechanisms, engineering design of injury countermeasures (such as helmets, car seats and seat belts, etc.), and as the key enabling technology supporting neuroscience and neurology research. Nevertheless, the effective use of such models requires high level expertise in numerical analysis, often not available to anatomists, neuroscientists and doctors. This limits the extent to which modelling results can be used to advance knowledge and real-world applications. In this seminar, I will propose a paradigm-shifting framework for comprehensive biomechanical and bioelectrical simulations of the brain that will bilaterally link computational models with anatomical and functional digital brain atlases, and allow unrestricted access to these models through Harvard Open Anatomy web-based software infrastructure. Our framework also allows personification of both models and atlases thus enabling patient specific analyses.

Digital brain atlases offer 3D maps that detail the brain anatomy and function. The key realisation behind our approach is that a digital brain atlas (regardless of whether a single-subject or population based) has a voxelised structure consisting of cubes with associated labels that describe the anatomical and functional entities the voxels represent. This structure can be used as a finite element mesh on which to solve equations describing physical processes within the brain. Therefore, atlases medical professionals are familiar with are becoming inputs for sophisticated computer simulations and scenes for displaying the results thus breaking the barriers between computational science and biomedicine.

REFERENCES

[1] M. Halle, V. Demeusy, and R. Kikinis, "The Open Anatomy Browser: A Collaborative Web-Based Viewer for Interoperable Anatomy Atlases," *Front. Neuroinform.*, vol. 11, Mar. 2017, doi: 10.3389/fninf.2017.00022.

[2] Andy Huynh, Benjamin Zwick, Mostafa Jamshidian, Michael Halle, Adam Wittek, Karol Miller. "Hexahedral mesh of anatomical atlas for construction of computational human brain models: Applications to modeling biomechanics and bioelectric field propagation." arXiv:2410.01409 **[cs.CE]** 2024.

Serdecznie zapraszamy studentów i pracowników