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A unified platform for simulating light transport in turbid media and its applications in Optical Diagnostics, Sensing and Computer Graphics

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SPEAKER

This talk considers development of a unified platform for simulating light transport in turbid media and its practical use in a variety of applications including novel Optical Diagnostics, Sensing and Computer Graphics modalities empowered by the Machine Learning (ML) techniques. We present an online browser-based solution and a Monte Carlo model which considers geometrical, spatial, and volumetric variations e.g. surface roughness and subsurface scattering properties of turbid media. The model is accelerated by parallel programming frameworks developed in-house and is being extensively utilized in the ongoing studies of light transport in turbid media. Particular examples include: in situ estimation of certain specific tissue parameters of interest such as distributions of melanin, blood, oxygenation, etc.; simulation of propagation of both spin and the orbital angular momentum of light; biophysically based 3D computer graphics renderings of human skin appearance, etc. The prototypes of lightweight sensing/visualization solutions that could potentially be shrank onto a smartphone/wearable device form-factor will be presented and rigorous validation against experimental data will be discussed.

Biography

Dr Alexander Doronin is an Assistant Professor in Computer Science at Victoria University of Wellington (New Zealand). His research interests are interdisciplinary and lie at the interface between Computer Graphics, Biomedical Optics and most recently Artificial Intelligence focusing on modelling of light transport in turbid media, development of novel optical diagnostics modalities, physically-based rendering, optical measurements/instrumentation, acquisition and building of realistic material models, colour perception, translucency, appearance and biomedical visualization. He has extensive recognized experience in the design of forward and inverse algorithms of light scattering in turbid tissue-like media simulations and created a generalized Monte Carlo model of photon migration which has found a widespread application as an open-access computational tool for the needs of light transport communities in Biophotonics, Biomedical Imaging and Graphics.