

Popular science summary of the PhD thesis

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Title of the PhD thesis	Material Appearance and Perception: Estimating and Generating Properties Across Scales
PhD school/Department	DTU Compute

Science summary

The rapid progress in computational imaging and material appearance modeling has unlocked exciting possibilities for understanding and simulating how light interacts with materials. This Ph.D. research dives deep into these areas, tackling challenges like creating 3D images, estimating material properties, and measuring microscopic material properties.

The first breakthrough is *StereoDiffusion*, a new method for generating high-quality 3D image pairs without needing extensive training. By using existing AI models, this approach makes 3D image creation faster and more reliable. Next, the research introduces *Materialist*, a tool that combines AI and physics-based rendering to predict and edit material properties from a single photo. This allows for realistic material adjustments under different lighting, blending artistic creativity with high accuracy.

The research then zooms in on microscopic material properties, particularly anisotropy—how materials behave differently depending on the direction of light. A new technique, *Noninvasive Material Anisotropy Estimation*, uses simple measurements and machine learning to estimate these properties without damaging the material. Finally, the study presents a method for *Quantitative Measurement of Turbid Medium Anisotropy*, which uses polarized light to accurately measure the properties of translucent materials like frosted glass or certain foods.

Together, these innovations push the boundaries of computational imaging and material modeling. By solving both big-picture and microscopic challenges, this work not only advances scientific understanding but also provides practical tools for industries like virtual reality, gaming, and food science. It sets the stage for future discoveries in these cutting-edge, interdisciplinary fields.

Please email the summary to the PhD secretary at the department