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Abstract

Superresolved Light Microscopy Information on the Structure of the Stained Dental Tissue Section Obtained by Point Divergence Gain Analysis †

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Light microscopy is an unavoidable tool in understanding of the internal structure and chemical composition of materials. It has its limits of resolution [1] which have been analysed mostly from the point of view of the ability of a user of the microscopic instrument to distinguish two objects unambiguously.

We have developed a new variable, point divergence gain (PDG), which enables us to find centroids of the imaging function in any expectable context. In the standard terminology of the light microscopy, irrespectively of the nature of the light-matter interactions, we may create a 3D superresolved map of the interior of a dense semi-transparent material. We have demonstrated this ability on the structure of a living cell [2]. Now we show the ability of PDG-based superlocalisation on a histological sample stained by methods dating back to 1770.

The localization of the elementary centroid of the absorbing object was achieved with the precision of $78 \times 78 \times 5$ nm^3. The comparison of subsequent images shows that these localisations are unique, i.e., do not repeat in consequent images. This indicates that the elementary coloured objects are of macromolecular size. The coloured objects are grouped into structures which may be identified as histologically relevant elements but, in this case, we understand their internal structure.

Besides technical description of the results, we compare the PDG-based results with the standard terms of light microscopy such as resolution and depth of focus and demonstrate their proper definitions based on the theory of information.

References

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